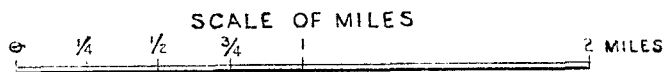


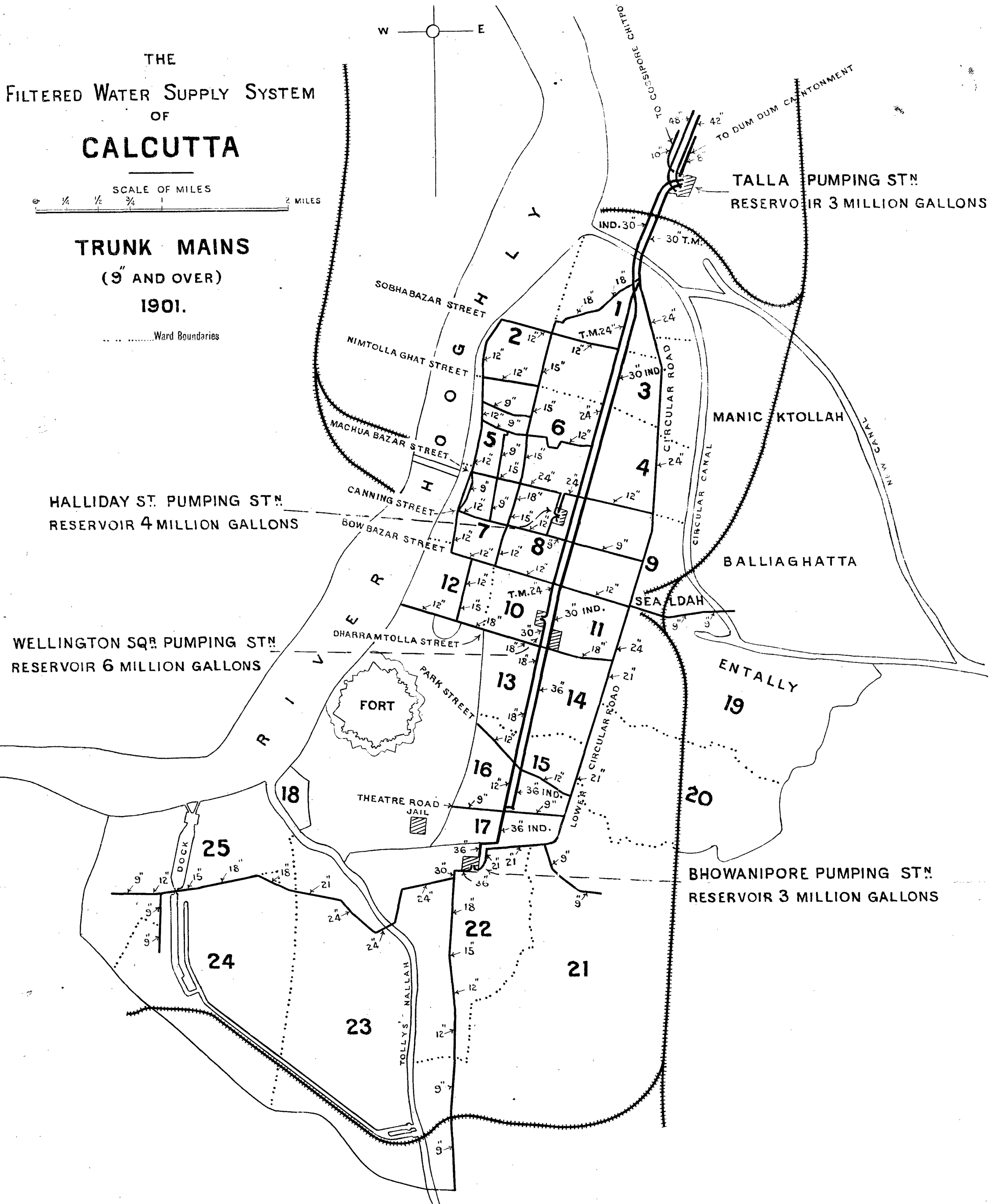


# THE FILTERED WATER SUPPLY SYSTEM OF CALCUTTA



## TRUNK MAINS (9" AND OVER) 1901.

.....Ward Boundaries



# CALCUTTA WATER WORKS.

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## REPORT

ON

### THE INTRODUCTION OF A SYSTEM

OF

### CONTINUOUS SUPPLY.

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BY

Mr. R. B. BUCKLEY, CHIEF ENGINEER

AND

Mr. A. E. SILK, SANITARY ENGINEER.

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*Calcutta, November 1901.*



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# CALCUTTA WATER-WORKS.

## REPORT ON THE INTRODUCTION OF A SYSTEM OF CONTINUOUS SUPPLY.

### PART I.—*Object of this Report.*

We have been deputed, by the Government of Bengal, under section 22 of the Calcutta Municipal Act, to “examine the existing water-supply system of Calcutta with a view to ascertain the best and most economical method of introducing a continuous system of supply.” We have considered the proposals of Mr. Pierce, the Assistant Engineer of the Calcutta Water-Works Department, and the modifications of those proposals which are contained in the “Report on Water-Supply,” dated 17th April 1901, by Mr. Deverell, the Engineer to the Corporation. We have, further, with the ready assistance of various officers of the Municipality, examined the filtered water-supply system in such detail as we consider necessary to enable us to carry out the orders of Government.

### PART II.—*Existing System.*

2. There are two independent systems of water-supply to Calcutta: one supplies filtered water and the other unfiltered water. In the first case the water is drawn from the river at Pulta, some 15 miles above the town, where it is settled and filtered. In the other case the unfiltered water is drawn, at two different points, directly from the river immediately opposite the town. We are only concerned with the filtered supply. But it is well to note, here, that the unfiltered supply, which is capable of development, is used for street-watering, for public and private water closets, for urinals, for flushing sewers, &c., and the filtered supply is supposed to be confined to domestic use, other than water closets. The population of the municipal area as given by the census of 1901 was:—

Town + “fringe” area	...	...	587,572
South “added” area	...	...	220,922
			808,494

The quantity of filtered water, which was supplied to the town and added area in 1900-1901, including some small Suburban areas which are supplied from the town mains, was rather more than 20½ million gallons a day. The quantity of unfiltered water was just over 13 million gallons. This supply, on the basis of the last census, was, approximately:—

		Gallons per head per day.		
Filtered water	{	Town proper + fringe area	...	30
	{	South “added” area	...	12
Unfiltered „	{	Town proper + fringe area	...	21
	{	South “added” area	...	2½

The total amount of water, of both classes, was, then, 51 gallons per head per day in the thickly-populated part of the town: a very liberal allowance. The supply is intermittent. Filtered water is delivered for rather more than four hours in the morning, and for three hours in the evening, and is then supplied at the average rate of rather more than 2,000,000 gallons per hour: but during these hours, the maximum rate is more than the 2,500,000 gallons an hour. In the middle of the day, for about five hours, some 800,000 gallons an hour are given: there is no supply at night. The maximum rate of delivery in the town area proper is about  $3\frac{1}{2}$  gallons per head per hour. The statement in Table II shows the capabilities of the present pumping engines and the manner in which they are worked in order to give the supply.

3. The sketch No. 1 shows, in outline, the present filtered system. The water flows, by gravity, into the reservoir at Tallah: from there it is pumped through an independent main, into the three reservoirs at Halliday Street, Wellington Square, and Bhawanipur. During the day the four pumping-stations deliver the water by direct pumping into the town. The sketch only shows the trunk mains. There is one clear water reservoir at each pumping-station. The capacity in each case is:—

			Million gallons.
Tallah	...	...	3
Halliday Street	...	...	4
Wellington Square	...	...	6
Bhawanipur	...	...	3
Total reservoir capacity in the Town			16 million gallons.

It is usual to have not less than one day's supply of water in a town. Calcutta has less than this, and, in this respect alone it would be a disadvantage to abandon any of the existing reservoirs. As matters stand at present, the supply to the three southern reservoirs (Halliday Street, Wellington Square and Bhawanipur) is pumped, during the night hours only, from Tallah through the independent main. If the supply were given continuously during the 24 hours of the day and night,\* there would be considerable economy in pumping charges at Tallah. The fact, that the whole supply to the southern reservoirs has to be given at night, is due, simply, to the small capacity of the reservoir at Tallah. Independently altogether of the desirability of having a greater reserve of water in the town in case of accidents, the enlargement of the Tallah reservoir would more than repay its cost by economy in coal.

#### PART III.—*The proposed System and the requirements of the Town under it.*

4. Under the Municipal Act of 1899, the Corporation is bound to convert this intermittent system into a continuous one. It is, specially, laid down that the conversion is to be gradual; five years from April 1900 is the period during which the change is to be effected in the town, and seven years is allowed in the "added" area. Under the law the supply to any ratepayer is limited to 4,000 gallons for each rupee of water-rate paid, and the Municipality has authority, whenever there is reason to think that the consumption is in excess of that quantity, to fix meters and charge the ratepayer for any water he may use in excess of that due to him.

5. The total present annual valuation of the Municipality (excluding the Port properties) is Rs. 2,11,45,194: the water-rate on this, at 6 per cent., is Rs. 12,68,712, so that at 4,000 gallons to the rupee, the town is entitled, under the letter of the law, to  $\frac{4,000 \text{ gallons} \times \text{Rs. } 12,68,712}{865}$ , about 14,000,000 gallons a day. There are, however, many considerations which make it impossible to hypothecate the filtered water-supply in accordance with the assessment. In some wards, for instance, the population has a reasonable claim, on account of the large number of the people as compared with the assessment, to more water than the assessment would allow; whereas, in others, where the property is valuable and the population small, the quantity of water permissible, under the assessment,

\* This would necessitate some alterations in the delivery mains in the yard of the Tallah pumping-station.

is greatly in excess of the true requirements. We consider it reasonable that the quantity of filtered water, allowed in any ward, should be that based on the assessment subject to the condition that the total, in any ward, should not be less than 20 gallons, a head on the whole population, or more than 40 gallons, a head in those houses in which the assessment would allow a larger quantity.

6. We have made this the basis of our calculations. There is no doubt		
Ward No. 1 ...	Gallons. 937,700	that the amount of water which is now consumed
" 2 ...	608,600	in many houses of the town is greatly in excess of
" 3 ...	1,001,000	this standard. The provisions of the law were
" 4 ...	839,300	deliberately framed in order to give power to the
" 5 ...	1,031,300	Municipality to check the great waste which is
" 6 ...	1,059,500	now known to occur. These provisions are (1)
" 7 ...	1,263,000	the introduction of continuous supply, coupled with
" 8 ...	1,262,800	a system of blocks provided with meters (section
" 9 ...	1,278,500	267), and (2) by the power of charging for water
" 10 ...	541,000	in excess of a limit (section 271).
" 11 ...	561,200	
" 12 ...	255,200	
" 13 ...	686,700	
" 14 ...	644,800	
" 15 ...	392,900	
" 16 ...	245,200	
" 17 ...	219,400	
" 18 ...	88,900	
Canal ...	10,000	
Jail ...	20,000	
Fort ...	45,000	
Port ...	50,000	
Town ...	13,042,000	
Ward No. 19 ...	772,500	
" 20 ...	564,000	
" 21 ...	564,000	
" 22 ...	544,100	
" 23 ...	992,800	
" 24 ...	354,400	
" 25 ...	432,200	
Total ...	4,418,400	
Cossipore-Chitpur Municipality and Dum-Dum Cantonment ...	458,200	
Maniktalla ...	334,200	
Total ...	792,400	
Garden Reach Municipality	283,300	
South Suburban Municipality	263,700	
Tollygunge Municipality ...	128,200	
Total ...	674,900	
		Gallons per day.
(a) The 18 wards of the original town, (including the "fringe area") together with the Jail, Fort, and the Port, have claim to ...		13,042,000
(b) The wards Nos. 19 to 25 lying to the south of the town are entitled to ...		4,418,400
(c) Under section 278 of the Municipal Act the town of Calcutta has liabilities with reference to certain Suburban Municipalities which have an uncertain claim to ...		674,900
(d) Cossipore-Chitpur, Dum-Dum and Maniktalla ...		792,400
(e) Miscellaneous demands (say) ...		72,300
Total ...		19,000,000

The water which is now supplied to the town exceeds  $20\frac{1}{2}$  million gallons. So, if the waste which now exists could be stopped, there is ample water to provide for all present demands and to allow for a moderate increase in the population or a higher annual valuation. Indeed, it is not at all unreasonable to think that, when the continuous system is fully established, the reduction in the demand may be considerably greater than we have estimated. In several English towns the amount of water saved, by the continuous system, has been considerably more than 25 per cent. of that consumed under the intermittent one, and the service has been much more satisfactory to the people. We have calculated on the total provision of 19,000,000 gallons, but we are much disposed to think that the actual consumption, if the law is well administered, will be considerably less, and that the people will find the new system far more convenient than the present one. It is generally assumed that the maximum hourly demand is about three times the average of the 24 hours: on that basis the maximum demand [excluding items (c) and (e)] would be about 2,300,000 gallons per hour. In towns under continuous supply, in which the waste-water meter system has been introduced, it has been found that the minimum demand, including waste, is at the rate of 5 to 8 gallons a head in the 24 hours. The minimum draught in Calcutta, at the rate of 8 gallons, would be about 330,000 gallons an hour only, but it would, certainly, take the full period allowed by the law to bring the town up to this state of efficiency. Table I, which is attached to this report, shows, in detail, the estimated distribution of supply.

7. The statement in Table II shows the capabilities of the present engines and pumps. If the Tallah reservoir is enlarged, the (A+B) Beam engines\* will be able, even with their present imperfections (which, however, are capable of correction) to supply the three southern reservoirs. They would, ordinarily, work day and night continuously; but, when necessary, one of the small Worthingtons (C+D) or (E+F) could relieve them. The "stand by" of power at this station is ample.

8. Table I shows that the demand, during the period of maximum draught on the mains, under a system of continuous supply, should be—

				Gallons an hour.
		Tallah	sphere	... 828,800
		Halliday Street	"	... 392,700
		Wellington Square	"	... 580,200.
		Bhawanipur	"	... 438,000
		Total maximum demand	...	<u>2,239,700</u>
<i>Probable rate of supply.</i>				
				Gallons per hour.
6-7	A.M.	...	...	800,000
7-8	"	...	...	2,000,000
8-9	"	...	...	2,300,000
9-10	"	...	...	2,000,000
10-11	"	...	...	900,000
11-12	"	...	...	500,000
<i>Midday—</i>				
1	P.M.	...	...	500,000
1-2	"	...	...	400,000
2-3	"	...	...	500,000
3-4	"	...	...	800,000
4-5	"	...	...	2,300,000
5-6	"	...	...	800,000
6-7	"	...	...	500,000
7-8	"	...	...	400,000
8-9	"	...	...	400,000
9-10	"	...	...	400,000
10-11	"	...	...	400,000
11-12	"	...	...	400,000
<i>Midnight—</i>				
1	A.M.	...	...	400,000
1-2	"	...	...	340,000
2-3	"	...	...	330,000
3-4	"	...	...	330,000
4-5	"	...	...	500,000
5-6	"	...	...	800,000
Total		..	..	<u>19,000,000</u>

		Gallons an hour.	Feet above ground.
<i>Tallah—</i>			
The large Worthington and the two small Worthingtons can deliver		... 1,920,000	to 110
<i>Halliday Street—</i>			
The two pair of Beam engines can deliver		... 684,000	to 84
<i>Wellington Square—</i>			
The three Beam engines can deliver		... 722,160	to 95
<i>Bhawanipur—</i>			
The two Worthingtons can deliver		... 751,680	to 84
Total		... <u>4,077,840</u>	

It would, however, never be desirable to work all the three Worthingtons simultaneously at Tallah, as the result would be an excessive velocity and loss of head in the town mains. If any one of those engines be excluded, the maximum pumping capacity of the battery of engines is still considerably in excess of the probable maximum demand.

If one engine at each station is put off work, the capacity of the remainder is—

		Gallons an hour.	Feet above ground.
<i>Tallah—</i>			
Either the big Worthington† or the two small ones working together can deliver at least		... 930,000	to 110
<i>Halliday Street—</i>			
One of the two pairs of Beam engines can deliver		... 342,000	to 84
<i>Wellington Square—</i>			
Two of the three Beam engines can deliver		... 481,440	to 95
<i>Bhawanipur—</i>			
One of the two Worthingtons can deliver		... 375,840	to 84
Total		... <u>2,129,280</u>	

\* The delivery mains in the Tallah yard will need some alterations.

† As a matter of fact, these engines frequently do more than this

These figures show that the existing pumping stations, with one engine off duty at each station, are not fully equal to the probable maximum demand under a system of continuous supply: but they are not very far from equal to it.

It would probably be necessary, then, if continuous supply at the maximum rate which is assumed were given with the existing engines, to run all the engines simultaneously at the three southern stations during about four hours of the day. They do more than that now. During the other eight hours of day time, one pair of engines at each station should be more than equal to the work, and, during the night hours, one engine running slowly at two out of the four stations should more than suffice. But this would only be possible after the whole town was brought under continuous supply: until that is done, the engines in each station must be confined to their own sphere of influence. It is a matter requiring more detailed enquiry whether the "stand-by" in the three southern stations under these circumstances, would be enough. We doubt if it would be, and it is probable that alterations and additions to the engines at Wellington Square and Bhawanipur would shortly be necessary. They are not, in our opinion, immediately required.

9. The whole supply is now given by direct pumping into the Town mains. The sketch No. 1, which faces page 2, shows the trunk mains of 9-inch diameter and over: they were originally laid out from the three centres of Tallah, Wellington Square and Bhawanipur, but they have been modified and increased from time to time: the Halliday Street station was interpolated. The trunk mains are, then, generally suitable for distribution from the four centres; and any project, which entailed new centres of distribution, would be so far disadvantageous that it would necessarily entail more or less alteration in the trunk mains to render them suitable to the new centres. We have investigated the capacity of the present mains with care. We find that some modifications would be necessary, especially in the eastern and southern outlying tracts, but, within the more densely populated parts of the town proper the existing trunk mains are able to distribute, with no excessive loss of head, the maximum draught which would occur under a system of continuous supply, if that draught did not materially exceed three times the average of the 24 hours.

10. We have shown, in the foregoing paragraphs, that the maximum rate of delivery, now, is greater than that which we suggest as necessary, and still greater than that which the Engineer to the Corporation suggested as suitable. We have shown, also, that from 10 A.M. to 3 P.M. the minimum rate of delivery, at present, is far greater than we expect will be required under a system of continuous supply. It may well be asked—How is it possible, then, that the existing engines, pumps and mains will give a pressure of 40 feet all over the town, when, at present, the pressure probably averages considerably less than 20 feet? The reply to this question is more fully given in Part V, paragraph 17 of this report; but, briefly, the answer is this:—There are, we believe, many leaky mains in the town, and there are, we know, thousands of houses where the taps, at a low level, are never closed: the draught from these open taps would easily consume double or treble the maximum delivery of the pumps. The Calcutta engines, in short, are pumping into a sieve. Continuous supply and the waste-water metre system, are, we are convinced, the only cure for what we believe to be an elaborate system of wholesale waste both of water and money.

#### PART IV.—*The Proposal for Raised Reservoirs.*

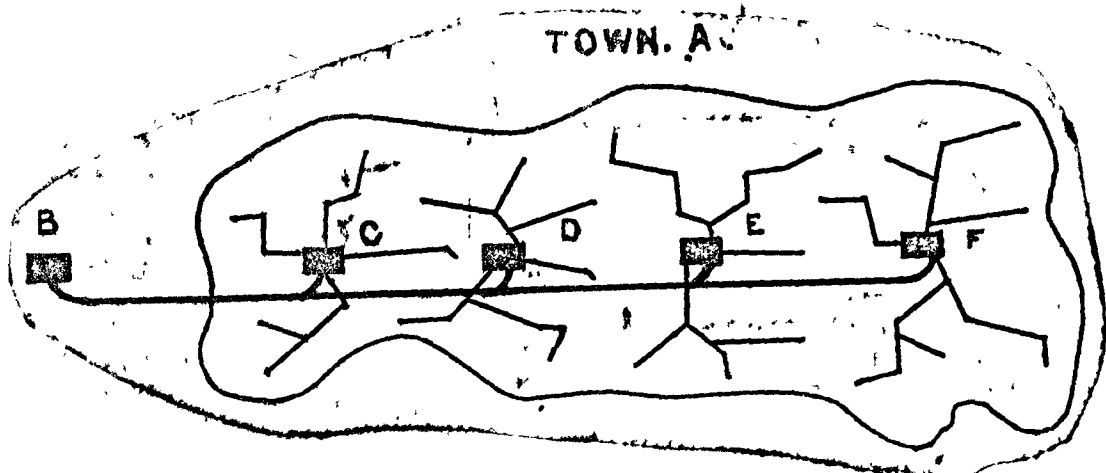
11. Mr. Pierce and Mr. Deverell both propose to introduce continuous supply through the medium of raised reservoirs. This is a radical change in the existing arrangements. Their projects differ in detail: but both Engineers propose to abandon direct pumping into the town mains. It is contemplated that the maximum rate of delivery will be three times the average of the 24 hours. Mr. Pierce proposes to abandon the three pumping stations at Halliday Street, Wellington Square and Bhawanipur; but Mr. Deverell proposes to retain the latter as a station for supplying four raised reservoirs, and to abandon the two former. We find that, excluding the land, the cost to the Municipality of the

reservoirs, buildings, chimneys and other permanent structures at these sites has been, approximately :—

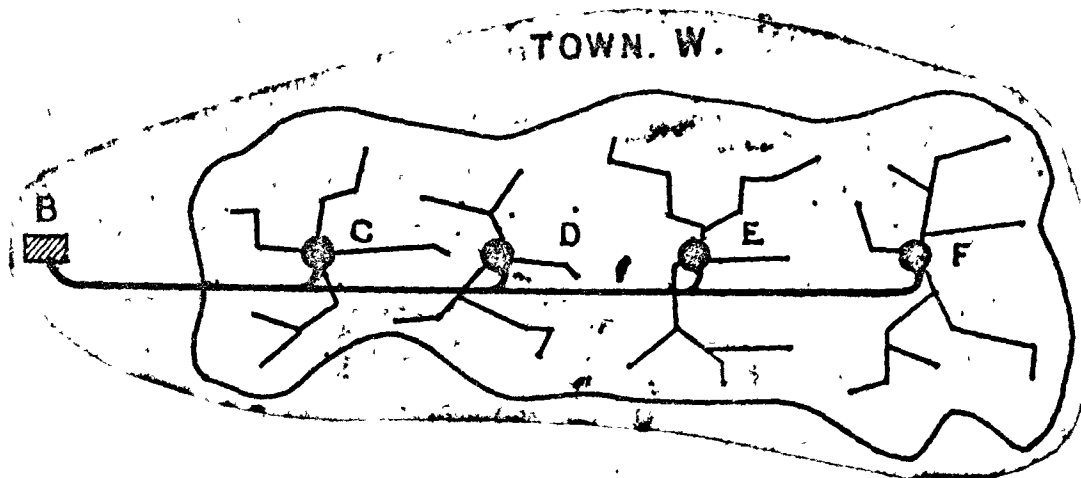
	Rs.	Rs.	Rs.	
Halliday Street ...	5,90,000	} say, 14,00,000	} 18,40,000	} Rs. say, 25,00,000
Wellington Square ...	8,15,000			
Bhawanipur ...	4,40,000			
The cost of engines, boilers and other machinery has been approximately—				
Halliday Street ...	2,78,000	Rs.	Rs.	
Wellington Square ...	2,20,000	} say, 5,00,000	} say, 6,50,000	
Bhawanipur ...	1,55,000			

It is, obviously, necessary to consider, with some care, whether it is desirable to abandon pumping-stations which have cost so much money. The engines and boilers might, perhaps, be used elsewhere,\* but the reservoirs, chimneys, buildings and similar fixtures would be, practically, thrown away. The capacity of the three reservoirs which Mr. Pierce proposes to abandon is 13,000,000 gallons: the two which Mr. Deverell would give up hold 10,000,000 gallons. We have shown in paragraph 3 that the total reservoir capacity of the Town is 16,000,000 gallons.

12. Let us suppose that there are two precisely identical towns, Town A and Town W, on a horizontal plane, as sketched below.



Town A is supplied by direct pumping from pumping-stations at C, D, E and F. At each of these stations there is a suitable clear water reservoir below ground. These clear water reservoirs are supplied, through an independent main, from the pumping-station at B by continuous pumping.



\* We note that Mr. Pierce proposes to use some of them at Tallah, but it is, at least, doubtful whether they would be suitable for that purpose.

Town W is supplied from four raised reservoirs at C, D, E and F. These reservoirs are filled by continuous pumping, from the pumping-station at B; through an independent main: they are of such capacity that they are capable of supplying, during the period of maximum demand, the same quantity of water as can be supplied by the pumps at C, D, E and F in Town A. The distribution mains are identical in both cases.

13. A few moments' thought will show that the pump-horse power exerted, in the 24 hours, in the two cases, is absolutely identical, and that the results to the town are identical. The difference lies in this: in the first case the available horse-power of the engines must be greater than in the second: for, in the first case, the engines have to be equal to the maximum demand, while, in the second case, they have only to be equal to the average demand. If in such a town, the question were whether the one system or the other were to be originally adopted, the main consideration would be whether it were cheaper to build raised reservoirs, or to provide the extra pumping power, taking into consideration the fact that it is cheaper to work concentrated than disseminated power.

14. This example appears to us very pertinent to the case of the town of Calcutta. The system of town A is established and is working in Calcutta. The four existing pumping-stations are now delivering into the town, at the period of maximum discharge, about the same quantity of water as might be required under a system of constant supply, and they are competent to deliver an even larger quantity at a sufficient head to ensure the requisite pressure if the maximum draught is moderate. The reason why they cannot keep up the requisite pressure, is because the condition of the pipes and fittings, and the habits of the people in leaving their taps open, are such that the head given by the pumps is destroyed. Raised reservoirs will have no better effect. If raised reservoirs were erected, to-morrow, at the site of the existing pumping-stations, with the floors of the reservoir at the level to which the engines now pump the water, the result would be no advantage and no disadvantage to the town; but the money spent on the existing stations would be thrown away. If raised reservoirs are erected at other sites, the supply mains to the reservoirs and the distribution pipes of the town itself would have to be modified at considerable cost. The advantage which would be gained by a system of raised reservoirs would be only that due to the concentration of the pumping power.

15. The floors of the raised reservoirs, which are suggested by Mr. Pierce and Mr. Deverell, are to be sixty to eighty feet above ground: the greater height would, we think, be essential: the total height of the structures would not be much less than 100 feet, or about half as high again as the parapet of Writers' Buildings. The reservoirs would require a great spread of foundations on the soil of Calcutta; they would be very costly; and, in the event of their being damaged by an earthquake, might entail a serious catastrophe.

16. After giving the most careful consideration to this important question, we are strongly of opinion that it is not desirable to abandon any of the existing low level reservoirs and pumping-stations in favour of raised reservoirs: It may be desirable, possibly, to adopt small raised reservoirs of less height in the case of the outlying suburban tracts, lying beyond the present municipal area of Calcutta, which have some claim on the town. But, in the town itself, the small financial advantage in the cost of pumping which might be gained by the concentration of the pumping power, is, in our judgment entirely outweighed by the great Capital cost of the change (which we think would be greatly in excess of that given in Mr. Pierce's report), and by the fact that the change would render useless reservoirs, pumping-stations, machinery and plant which have cost a large sum and which can be efficiently used under the continuous system. The change of system, too, would put the inhabitants to considerable inconvenience.

PART V.—*The present pressure in the Town, the waste in connected houses, and the leakage from the Mains.*

17. The existing pressure in the mains varies, of course, greatly, in different parts of the town. It may be said that, when the engines in the

four pumping stations are working, during the hours of maximum supply, in the manner described in Table II, the pressure varies from 10 feet in the worst places, up to the pressure of 50 to 80 feet which is maintained at the pumping stations. It is not possible, as things are, to increase this pressure materially. Any increase in delivery of the pumps only results in larger discharges from the many thousands of taps which are open continuously. In order to satisfy ourselves as to the fact that the taps, in connected houses, are left permanently open, we made two experiments. On the night of the 8th—9th August, without giving any notice at all, we set all the four pumping stations to work for an hour between 2 and 3 A.M., when the whole town was asleep, and no one ought to have been drawing water. The "added area" was excluded, as far as possible, from the influence of the pumps. The result was that the quantity of water delivered was nearly 2,600,000 gallons an hour, which is in excess of the quantity consumed in the hours of maximum demand by the entire town, including the "added area," and the pressures at the pumping stations were not raised to the maximum to which the engines are capable of delivering the water. In other words, the number of taps open, in the dead of the night, was practically the same as are open at the period of maximum demand. On the night of the 20th—21st of August, we repeated the experiment, after giving notice to all house-holders, asking them to close their taps. In the south of the town this had some effect, and the pressure was improved slightly: but, in several quarters, the effect of the notice was exactly the opposite of what was intended; numbers of people got up at 2 A.M. to draw water under a mistaken impression that they would get none the next day! On both these occasions the amount of water drawn off, in the area under the influence of the pumps, was over four gallons per head per hour. In a well-regulated system of water-works in European towns, under continuous supply, the quantity drawn off, including leakage, in the dead hours of the early morning (2 A.M. to 5 A.M. or so) is about one-third of a gallon per head per hour, and even less.

18. We have placed a certain tract, lying to the north of Sham Bazar and Sobha Bazar Streets, under continuous supply since the beginning of September last: it contains a population of 23,446 people. We have placed a small district, lying in this tract, under the observation of the only one of Deacon's Waste Water Meters which the Corporation possess. We trust that this commencement, which has been made, for introducing the new system will be continued, and that, as the new meters, which are being obtained from England, are received, the whole tract will be put under observation. The trial district, which is subjected to the meter, contains 762 houses and 3,846 people; there are 132 connected houses, and they are entitled to 31,351 gallons a day. The entire district is entitled, on the basis of the assessment to 67,000 gallons a day, or to 76,920 gallons at the rate of 20 gallons per head per day. The observations made since the 27th of September give the following results:—

DATE.	TOTAL SUPPLY.		MAXIMUM DRAFT.		MINIMUM DRAFT.	
	Total gallons.	Gallons per head per day.	Gallons per hour.	Gallons per head per day.	Gallons per hour.	Gallons per head per day.
1	2	3	4	5	6	7
27th September ...	148,350	39	10,500	66	7,500	47
7th October ...	125,000	33	8,300	52	5,500	34
17th ,, ...	131,300	34	9,000	56	5,300	33
28th ,, ...	114,800	30	8,800	55	3,500	22
9th November ...	113,600	29	8,200	51	3,800	24



This shows that, in six weeks, the system of continuous supply, without any application of the provisions of the law, has reduced the total supply by 25 per cent.; the maximum draft by 23 per cent.; and the minimum draft by nearly 50 per cent. The total supply of this little trial district is, however, considerably greater than it was before it was placed under continuous supply: it draws 70 per cent. more water than it is entitled to under section 248 of the Act. This will be gradually rectified when the provisions of the law are enforced. In this trial district two houses have been provided with house-meters, but the results, so far, have not shown any great improvement. One occupier is using about the quantity to which he is entitled by law, and the other is using about five times as much as he is entitled to draw.

19. The trial-district has been provided with stop-cocks on all the houses. An experiment, made by closing all these so as to shut off all sources of leakage or draft in the connected houses themselves, showed that the loss by leakage from the mains alone was about 1,800 gallons per hour or about 22 per cent. of the maximum draft. The district contains 9,330 feet of mains of which nearly all are 3-inch and 4-inch pipes. The leakage from the mains alone is, therefore, at about the rate of about 11 gallons per head per day, or about 1,000 gallons per mile per hour. It is most highly probable that the leakage on the larger mains is considerably greater than this, but, even at this rate, the leakage from the 312 miles of town mains would be 312,000 gallons an hour, which is something like 15 per cent. of the maximum draft. Too much weight must not be attached to these figures, which are inconclusive as they apply to so small a district, but we think it by no means improbable that one-fifth of the water which is pumped into the town is wasted by leakage from the town mains before it reaches the consumer at all. It is only possible to ascertain the truth by a water meter system: this localizes and exposes the leaks and enables the authorities to stop them. The Corporation, as soon as the continuous system is introduced, must first make its own mains tight and then attack the waste in the houses. They can commence at once in the trial district in Bag Bazaar.

#### PART VI.—*The Introduction of the System of continuous Supply.*

20. The establishment of a continuous supply of filtered water to Calcutta must, necessarily, proceed slowly. The condition of the mains, and taps and fittings is such that the draught on the mains is insatiable. If there were an unlimited supply of water, it would be possible, with the existing reservoirs and engines, to pump day and night, and the result would be, that householders would soon learn, or would be compelled by action taken under sections 269 and 270 of this Act, to close the taps which are now left constantly open. But there is not an unlimited supply of water: the reservoirs are insufficient, and they would be exhausted in a few hours. It is, therefore, necessary to put the town under continuous supply by gradually advancing steps.

21. Table I which is attached to this report, taken in connection with sketch No. II, explains the outlines of the scheme which we recommend for the introduction of continuous supply. Each pumping-station is assigned its particular sphere of influence, and the work to be done in that sphere is stated in the table. The figures in column 7 of the table show the amount of water required in each ward (or part of a ward) on the hypothesis that:—

- (i) every inhabitant of the town is allowed at least 20 gallons of filtered water a day, and,
- (ii) if the assessment of a house entitles the occupants to more than 20 gallons a head, it is assumed that they will draw the full quantity of water due to the house up to a limit of 40 gallons a head for all the occupants. (It is hardly probable that any house would draw this volume under a system of continuous supply).

The figures in column 8 show the maximum draught on the mains on the usual assumption that the maximum draught per hour is three times the average of the 24 hours. Column 9\* shows the minimum draught; when, after some years, the conditions of supply have been rendered satisfactory by the waste-water meter system.

22. The introduction of the system of continuous supply in Calcutta does not necessitate any radical change in the existing works. No great project is necessary. The existing reservoirs, mains and pumping-stations are generally suitable, and will only need some modifications, and those modifications can be introduced gradually from time to time. Such modifications as are necessary are mainly required in the tract lying to the east of the Lower Circular Road, and in the south "added" area where the trunk mains will need alteration: modifications will in time be required to the pumping engines at Wellington Square and Bhawanipur. It is possible to begin introducing the change from the present system to the continuous one as soon as waste-water meters are provided and some simple arrangements have been made. We have already placed a small area in the north of the town under continuous supply.

23. Sketch No. II shows the present municipal area divided into five spheres: the details of these are given in Table I. The coloured tracts show the spheres of influence of each pumping-station, but Wellington Square pumping-station has two spheres allotted to it, as we propose that the greater parts of Wards Nos. 19 and 20 should have an independent main† from Wellington Square.

24. Each of these spheres will be divided into convenient tracts of moderate size (say, 40,000 to 60,000 inhabitants) according to the arrangement of the mains. The tract in immediate contact with a pumping-station will be first placed under continuous supply. This tract will be divided into blocks, under section 267 of the Act, and each block will be provided with a waste-water meter. Then, when the waste-water meter system has been fully established, and the particular tract had been brought into a good condition, the zone of continuous supply will be extended and a new tract brought under treatment. The zone of continuous supply from each pumping-station would be enlarged, probably at intervals of eight months or a year, and it would take, probably, four or five years to complete the operation within the sphere of influence of each station. It must be remembered that the working of the waste-water meter system, although it produces excellent results and is in the end an economy both in water and money, is very laborious and needs constant attention from a staff of inspectors. We have described in the Appendix how the first tract south of the Tallah might be treated. We recommend that this should be taken in hand at once. It is the tract which it is most easy to treat, and the Tallah pumping-station has by far the greatest facilities for continuous supply.

25. The population of the town proper is hardly likely to increase largely, but there is every probability that the population in Wards Nos. 19 to 25, lying to the east and south, will do so. These wards lie in the "added area," which under section 241, sub-section 2 (a) of the Act have not to be brought under continuous supply for seven years. We propose that Wards Nos. 19 and 20 should be constituted a separate sphere with an independent main from Wellington Square. When the time comes for carrying this out, it will be necessary to make modifications in the Wellington Square Engine-house. In the case of Wards No. 21 to 25, also, it will be necessary, as the population increases, to add to the engine power: indeed we doubt whether it might not be

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\* This is taken at about 8 gallons a head during the 24 hours. The "waste line" in English towns, under the waste water system, is thought to be satisfactory if it shows a discharge at the rate of from 5 to 8 gallons per head in the 24 hours.

† This is a point which will require detailed consideration, after Wellington Square sphere No. 1 has been brought under continuous supply. It is not compulsory to bring Wards Nos. 19 and 20 under the system for some years.

wise now to add a third engine to this station, as we observe that both the engines are at work every day, and there is no spare engine. This point requires further enquiry. The mains in the sphere of influence of this station need to be examined from the point of view of the discharges they have to carry. We think it will be necessary to enlarge them.

26. The Suburban Municipalities of Cossipore-Chitpur and Maniktalla, as well as the Cantonment of Dum-Dum, are now supplied with filtered water by meter from the Calcutta mains. Under section 278 of the Act, the Garden Reach Municipality, the South Suburban Municipality and the Tollygunge Municipality have a certain claim to supply from the Calcutta system. We have no doubt that, when the continuous system of supply is fully established, the amount of filtered water saved will be so large that the Corporation of Calcutta will easily be able to give a supply to these suburban areas. We have included them in our scheme in Table I. We propose that raised reservoirs for each of the last three mentioned Municipalities should be erected at the extremities of the town mains, near the sites indicated on plan No. II and that they should be supplied during the periods of minimum demand in the town.

#### PART VII.—*Summary.*

27. We summarise our conclusions as follows:—

(i) The best and most economical method of introducing a continuous system of supply into Calcutta is to utilize the existing works, and only supplement them where necessary.

(ii) The only work of importance which we recommend is to enlarge the reservoir at Tallah by five million gallons. We consider this necessary in any case, and recommend that it be taken in hand at once.

(iii) We find the pumping power at the different stations to be certainly equal to the immediate introduction of continuous supply over a considerable portion of the town. We think it may be sufficient for the whole town. We do not recommend any immediate alteration, but suggest that some additions may be necessary, shortly, at two stations.

(iv) We find the system of trunk mains is well suited, generally, to continuous supply from the existing centres. Some modifications may be necessary in parts, but they need not be extensive.

(v) We are unable to support the proposal to abolish certain pumping-stations and to institute raised reservoirs. We think the scheme (1) would be less efficient; (2) would be very expensive in initial cost; (3) would necessitate the destruction of works which have cost many lakhs, and (4) would be but little less expensive in working charges.

We recommend that:—

(vi) Arrangements be made, at once, to put stop-cocks, with proper boxes, on all house connections. They should be generally in the footpath and, in any case, readily accessible from the street. A sufficient stock of house meters should be obtained.

(vii) Arrangements be made to isolate, by stand-pipes, convenient tracts near each pumping-station, and that, as soon as that is done, continuous supply be instituted in those tracts.

(viii) That the zone of continuous supply be gradually expanded from each pumping station as a centre, by including new tracts, until the whole town is included.

(ix) That a new sphere of influence be created in Wards Nos. 19 and 20, but that this be not undertaken for another two or three years.

(x) That in the Southern "added" area, Wards Nos. 21 to 25, action be also deferred until more experience is gained.

(xi) That the three Southern Suburban Municipalities be supplied by raised reservoirs, and that they be filled during the hours of small demand in the town.

R. B. BUCKLEY,  
*Chief Engineer, Bengal.*

A. E. SILK,  
*Sanitary Engineer, Bengal.*

CALCUTTA,  
*The 19th November 1901.*

TABLE I.

Statement showing the proposed distribution of the filtered water-supply of Calcutta (on the hypothesis of column 7) to the proposed spheres of influence of the pumping stations.

1	2	3	4	5	6	7	8	9
WARD No.	Latest valuation of the Wards.	Population of Calcutta Municipal areas.	Population outside the Calcutta Municipal area.	WATER DUE TO THE PEOPLE PER DAY.		Water allowed on the assumption that a minimum of 20 gallons a head is given in all cases in the Calcutta Municipal area, and that the assessment would allow more outside the Calcutta area, the quantities per head are different.	Maximum draught on the mains, supposing that the maximum is three times the average of the 24 hours and that the principal areas, outside the Calcutta Municipal area, are supplied during the hours of slack demand in the town.	Minimum draught at night taken at about the rate of 8 gallons per head in 24 hours.
				* If 4,000 gallons are given for each rupee of water rate. Section 248 of Municipal Act.	† If 20 gallons per head are allowed.			
	Rs.	No.	No.	Gallons.	Gallons.	Gallons per day.	Gallons per hour.	Gallons per hour.
Chitপুর and Dum-Dum	...	...	45,823	...	...	458,200	(c) 57,300	...
Ward 1	7,55,812	46,887	...	496,900	937,700	937,700	117,200	...
2	9,25,568	30,155	...	608,600	603,100	608,600	76,100	...
3	8,06,203	50,048	...	530,000	1,001,000	1,001,000	125,100	...
4	6,77,325	41,965	...	445,300	839,300	839,300	104,900	...
5 (Part of)	13,00,000	41,000	...	854,800	820,000	854,800	106,900	...
6 (Part of)	8,50,000	44,000	...	558,900	880,000	880,000	110,000	...
9 (Part of)	9,00,000	52,000	...	591,800	1,040,000	1,040,000	130,000	...
Janicktolla†	...	...	33,417	...	...	334,200	(d) Nil	...
Anal	...	...	4,443	...	10,000†	10,000	1,300	...
Total Tallah Sphere	62,14,908	306,055	83,683	4,086,300	6,131,100	6,963,800	828,800	130,000
Ward 5 (Part of)	2,68,490	8,058	...	176,500	161,100	176,500	22,100	...
6 (Part of)	1,83,984	8,974	...	121,000	179,500	179,500	22,400	...
7	27,19,558	31,574	...	1,788,200	631,500	1,263,000	157,900	...
8	13,44,965	63,139	...	884,300	1,262,800	1,262,800	157,800	...
10 (Part of)	2,70,000	9,000	...	177,500	180,000	180,000	22,500	...
12 (Part of)	7,00,000	2,000	...	460,300	40,000	80,000	10,000	...
Total Halliday Street Sphere	54,86,992	122,745	...	3,607,800	2,454,900	3,141,800	392,700	41,000
Ward 9 (Part of)	2,26,333	11,924	...	148,800	238,500	238,500	29,800	...
10 (Part of)	5,36,358	18,051	...	352,700	361,000	361,000	45,000	...
11	6,31,941	28,060	...	415,500	561,200	561,200	70,200	...
12 (Part of)	13,65,615	4,381	...	897,900	87,600	175,200	21,900	...
13	10,44,362	31,279	...	686,700	625,600	686,700	85,800	...
14	6,53,138	32,238	...	429,400	644,800	644,800	80,600	...
15 (Part of)	5,00,000	14,000	...	328,800	280,000	328,800	41,100	...
16 (Part of)	7,00,000	5,500	...	460,300	110,000	220,000	27,500	...
19 (Part of)	52,710	8,626	...	34,600	172,500	172,500	21,600	...
20 (Part of)	58,499	8,202	...	33,500	164,000	164,000	20,500	...
Port	50,000	...	...	...	20,000†	20,000	2,500	...
Port	...	...	4,588	...	45,000†	45,000	5,600	...
Port of Port	...	...	12,000	...	25,000†	25,000	3,100	...
Total Wellington Square, Sphere No. 1.	58,18,956	182,261	16,588	3,793,200	3,335,200	3,642,700	455,200	60,000
Ward 19 (Part of)	5,00,000	30,000	...	328,800	600,000	600,000	75,000	...
20 (Part of)	2,00,000	20,000	...	131,500	400,000	400,000	50,000	...
Total Wellington Square, Sphere No. 2.	7,00,000	50,000	...	460,300	1,000,000	1,000,000	125,000	17,000
Ward 15 (Part of)	97,439	2,780	...	64,100	55,600	64,100	8,000	...
16 (Part of)	53,299	628	...	35,000	12,600	25,200	3,200	...
17	4,09,815	5,487	...	269,400	109,700	219,400	27,400	...
18	1,19,545	4,444	...	78,600	88,900	88,900	11,100	...
21	4,50,466	27,207	...	296,200	544,100	544,100	68,000	...
22	7,72,139	49,642	...	507,700	992,800	992,800	124,100	...
23	3,95,690	17,719	...	260,200	354,400	354,400	44,300	...
24	1,56,831	21,608	...	109,700	432,200	432,200	54,000	...
25	4,59,114	37,918	...	301,900	758,400	758,400	94,800	...
Port of Port	...	...	13,573	...	25,000†	25,000	3,100	...
Reden Reach Municipality†	...	...	28,305	...	...	283,000	(d) Nil	...
North Suburban Municipality†	...	...	26,374	...	...	263,700	(d) Nil	...
Dygunge Municipality†	...	...	12,821	...	...	128,200	(d) Nil	...
Total Bhawanipur Sphere(b)	29,24,338	167,433	81,073	1,922,800	3,373,700	4,179,400	438,000	83,000
GRAND TOTAL	(a) 2,11,45,194	808,494	181,344	13,870,400	16,294,900	18,927,700	2,239,700	331,000

\* The water-rate is 6 per cent. on the assessment.

† Allowed 10 gallons a head.

‡ These are not calculated at 20 gallons per head, but on independent data.

(a) This does not include the assessment on the Port properties.

(b) It is in this sphere that increase of population is to be expected.

(c) This area takes water by metre direct from Tallah

(d) To be supplied from raised reservoirs taking their supply during the slack hours in the town.

**TABLE II.**  
**CALCUTTA WATER-WORKS. TOWN PUMPING ENGINES.**

**PRESENT ENGINES AND PUMPS AT TALLAH.**

1	2	3	4	5	6	7	8	9	10	11	12	13	14
LETTER OF ENGINE.	Year when erected.	Indicated horse-power as at present worked.	Number of gallons delivered at each stroke.	Length of stroke.	NUMBER OF STROKES PER MINUTE.		GALLONS DELIVERED PER MINUTE.		GALLONS DELIVERED PER HOUR.		HEIGHT ABOVE GROUND LEVEL TO WHICH PUMPS FORCE THE WATER.		REMARKS.
					Ordinary.	Maximum.	Ordinary.	Maximum.	Ordinary.	Maximum.	Ordinary.	Maximum.	
A + B beam engines ...	1888	150	630	Feet. 6	14	15	8,820	9,450	529,200	567,000	Ft. 38	Ft. 64	This engine is weak in several respects, and it is considered unsafe to put more than 50 feet head on the pumps. Gauge in engine-house is about fourteen feet above ground level. The pumps were designed to work against a head of 150 feet, but larger plungers have been put in since erection. Gauge in centre engine-house is about five feet above ground level. Gauge in east engine-house is about four feet above ground level.
C + D Worthington ...	1899	250	330	6	21	25	6,930	8,250	415,800	495,000	65	110	
E + F Worthington ...	1899	250	330	6	21	25	6,930	8,250	415,800	495,000	65	110	
G + H Worthington ...	1895	470	775	10	20	20	15,500	15,500	930,000	930,000	65	105	
Total ...		1,120	.....	.....	...	...	38,180	41,450	2,290,800	2,467,000			

The engines at this station are now worked in this way :-

Monday ... { (G + H) Worthington engines work from 6 A.M. to 10 A.M., pumping into the town.  
(A + B) beam engines work from 10 A.M. to 3 P.M., pumping into the town.  
(G + D) + (E + F) Worthington engines work from 3 P.M. to 8 A.M., the next morning, pumping into town reservoirs.  
Tuesday ... { (G + D) + (E + F) Worthington engines continue working from 8 A.M. to 10 A.M., pumping into the town.  
(A + B) beam engines work from 10 A.M. to 3 P.M., pumping into the town.  
(G + H) Worthington engines work from 3 P.M. to 8 A.M., pumping into town reservoirs.

And so on. (A + B) working every day; the others on alternate days. It seems undesirable to work the beam engines and the Worthingtons at the same time.

**PRESENT ENGINES AND PUMPS AT HALLIDAY STREET.**

A and B linked beam engines.	1888	193	300	Feet. 5	13	19	3,900	5,700	234,000	342,000	Ft. 50	Ft. 84	Gauge outside engine-house is about four feet above ground level.
C and D linked beam engines.	1888	193	300	5	13	19	3,900	5,700	234,000	342,000	50	84	
Total ...	...	386	...	...	...	...	7,800	11,400	468,000	684,000			

Three of these engines were originally erected at Tallah in 1869: they were removed to Halliday Street in 1888, when they had new cylinders and new pumps. With certain renewals and repairs they would be pretty well as good as they ever were and may be fairly expected to work well for years.

The engines at this station are now worked, thus :-

Both pairs of engines are worked from 5-30 A.M. to 10 A.M.  
One pair of engines is worked from 10 A.M. to 3-30 P.M.  
Both pairs of engines are worked from 3-30 P.M. to 6 P.M.

**PRESENT ENGINES AND PUMPS IN WELLINGTON SQUARE.**

A } B } C }	Linked beam engines {	1868	106	236	Feet. 6	14	17	3,304	4,012	198,240	240,720	Ft. 90	Ft. 95	Gauge in engine-house is about fifteen feet above ground level.
		1868	106	236	6	14	17	3,304	4,012	198,240	240,720	90	95	
		1872	113	236	6	14	17	3,304	4,012	198,240	240,720	90	95	
Total ...	...	325	...	.....	...	...	9,912	12,036	594,720	722,160	...	..		

These three engines work with two fly-wheels. They can be disconnected, but it is found that they do not work satisfactorily if even one is disconnected. The engines were originally designed to work to 120 feet head, but the pumps were enlarged some years ago.

The engines at this station are now worked, thus :-

All three engines work from 5-30 A.M. to 10 A.M.  
They stop altogether from 10 A.M. to 3 P.M.  
All three engines work from 3 P.M. to 6 P.M.

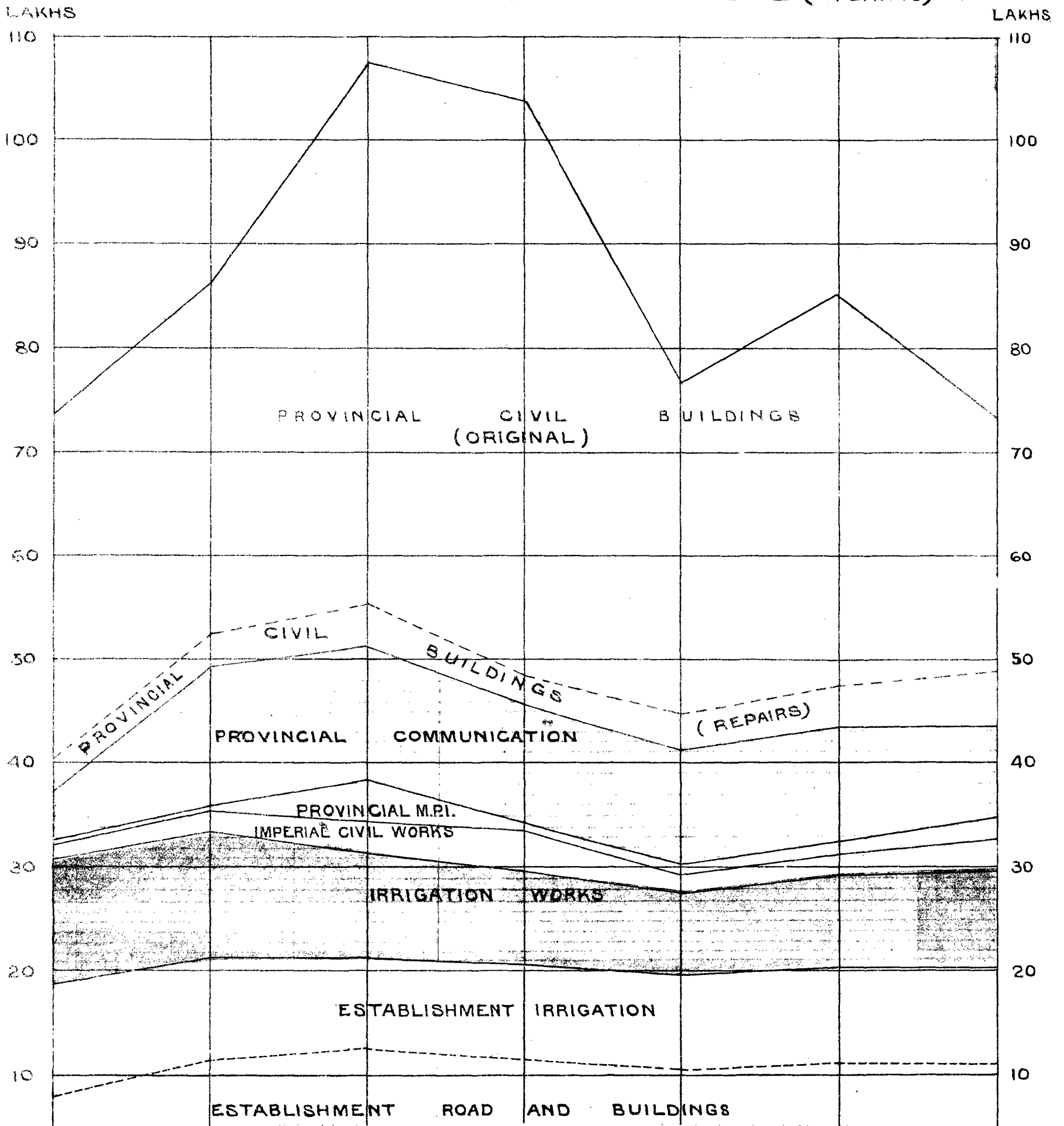
**PRESENT ENGINES AND PUMPS AT BHAWANIPUR.**

A+B linked Worthington engines.	1891	107	174	Feet. 5	26	36	4,524	6,264	271,440	375,840	50	84	These pumps were designed to work against a head of 150 feet, but larger plungers have been put in since erection. Gauge in engine-house is about four feet above ground level.
C+D linked Worthington engines.	1891	101	174	5	26	36	4,524	6,264	271,440	375,840	50	84	
Total ...	...	208	.....	.....	..	...	9,048	12,528	542,880	751,680	...	...	

The engines at this station are now worked, thus :-

One pair of engines works from 5-30 A.M. to 10 A.M.  
The other pair of engines work from 7 A.M. to 10 A.M.  
Both are stopped from 10 A.M. to 3 P.M.  
One pair of engines works from 3 P.M. to 6 P.M.

# DIAGRAM SHOWING YEARLY PUBLIC WORKS EXPENDITURE (IN LAKHS)





## APPENDIX.

THE sketch, No. III on the opposite page, shows the mains in the tract lying north of Sobha Bazar and Grey Street. This tract might conveniently be the first to be put under continuous supply.

2. The annual valuation of the area is about Rs. 12,00,000; the water rate, at 6 per cent. is about Rs. 72,000; the amount of water to which the tract is entitled under the law is  $\frac{72,000 \times 4000}{365} = 788,000$  gallons in the day. But the population is about 62,000, and, on the proposed minimum allowance of 20 gallons a day, the tract might be allowed 1,250,000 gallons a day.

3. The maximum draught allowable to the tract should be 156,000 gallons an hour, and the minimum (at 8 gallons a head per day) should be as little as 21,000 gallons an hour. When this tract has been raised to something like this state of efficiency then the zone of continuous supply can be enlarged.

4. The tract must be put under continuous supply from the Tallah engines. The system we recommend for doing this is indicated in the sketch. At each of the four points shown in red a stand pipe would be erected with its summit 40 feet above ground (it might have another connection with a sluice valve between the two legs at 30 feet). The pipes and sluice valves would be so arranged that the water flowing down the trunk mains could be passed either over the stand-pipes, or through its former course in the mains, at will. The stand-pipe at the junction of Grey Street and Cornwallis Street would be connected, not only with the 24" Town main, but with the 30" independent main also, with suitable sluice valves.

5. The sluice valves on the original mains, in the neighbourhood of the stand pipes, would be kept continuously closed, so that any water, passing south of the line of Sobha Bazar and Grey Street, would be compelled to pass over the stand-pipes. The entire tract, then, north of Grey Street would necessarily have a pressure of 40 feet. At night when no water would be given to the town south of Grey Street, the sluice valves leading to the stand-pipes would be closed, except the one at Cornwallis Street which would remain open. At that point, however, the communication, below the stand-pipe, between it and the 24" Town main would be closed, and the sluice valve leading to the 30" independent main would be opened, so that any water which might pass over that stand-pipe would go into the independent main and not into the town. In the morning the sluice valves, above the stand-pipes, would be opened and the supply to the town, south of the line of stand-pipes, would pass forward through the stand-pipes. It might be found necessary, during the hours of 10 A.M. to 3 P.M., to regulate the discharge over the stand-pipes so as not to give an excessive supply to the town lying south of Grey Street.

6. The tract in question would require about 20 or 25 waste water-meters. The whole pipe system in the tract should be laid down on a map (16 inches = 1 mile), and the sluice valves properly shown. On this map, the "blocks," about twenty to twenty-five in number, which are required under section 267 of the Act, should be demarcated, and, if the existing sluice valves are insufficient, the new ones, which are necessary to control each "block," should be inserted. Every house connection should be fitted with a stop-cock under section 258 of the Act.

7. A statement should be prepared for each "block" showing (1) the number and size of all house connections in it; (2) the volume of water to which each connected house is entitled under section 248 of the Act; (3) the number of street standposts and their probable draught; (4) the approximate population of the "block" and the volume of water they are entitled to at 20 gallons a head. This statement would give the inspector the standard to which he was expected to raise the block by the judicious use of the powers given in the Act.

8. The tract would require the constant attention, especially at night, of two or three competent inspectors, who would work the district under Deacon's waste-water meter system. In England one inspector is, we believe, usually allowed to every group of about 3,000 houses, but, at first, in Calcutta, one inspector could not work so large a district properly. Any intelligent man would quickly learn the system. It would be well to give each inspector an under-study, who would learn the work, and be ready to take up a new tract when the zone of continuous supply was enlarged.

9. There is nothing to prevent steps being taken at once to put this tract, north of Grey Street, under continuous supply. It can be done as soon as the meters are received and the stand-pipes have been erected. The first result will be a great waste of water in the tract: this will be gradually reduced, as the inspectors do their work, and as the law is enforced, until the quantity of water consumed is considerably less than it is now. Then a new tract can be included in the Tallah zone of continuous supply. When two tracts have been successfully treated, the first set of stand-pipes could be removed and used elsewhere.

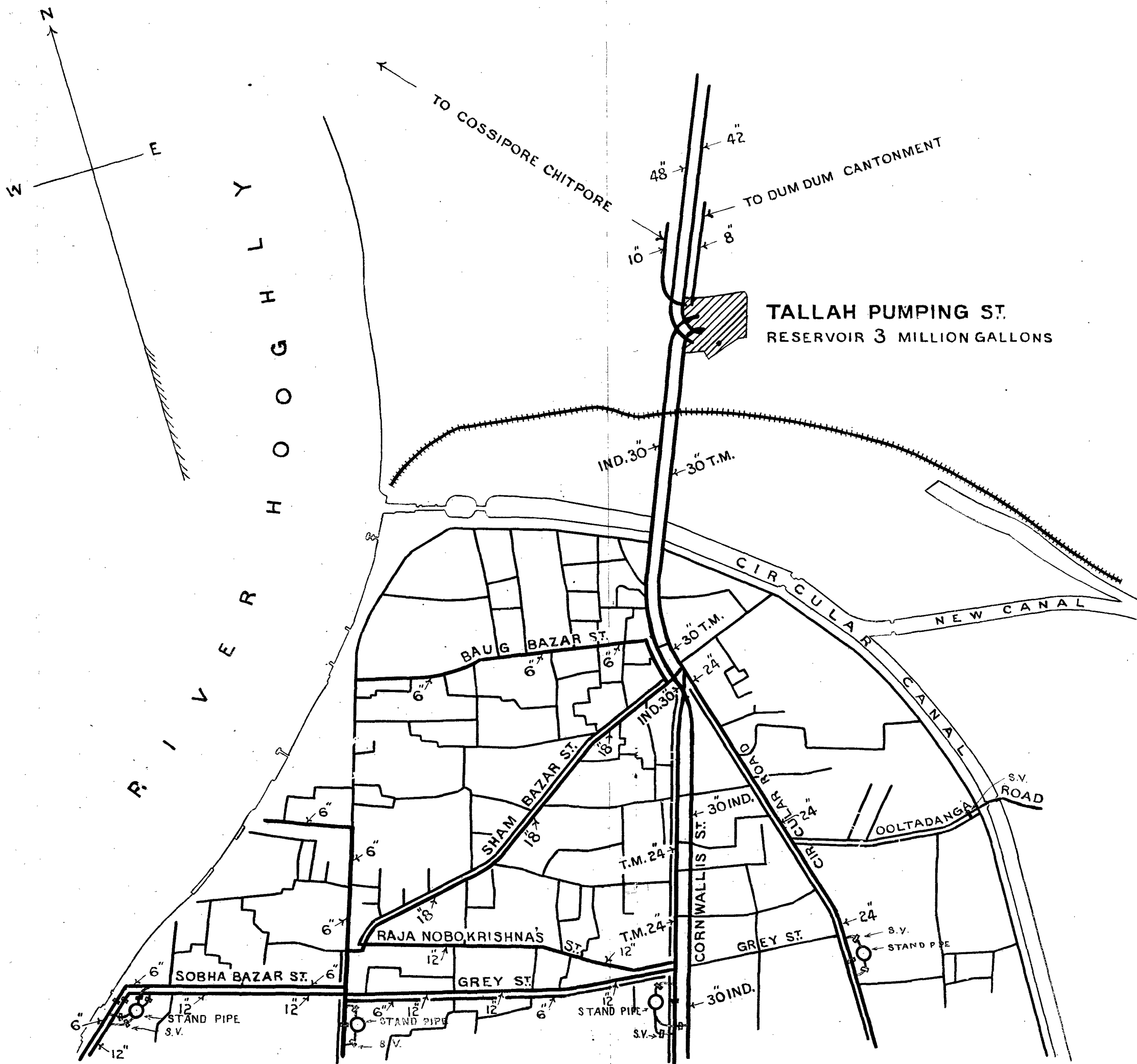
10. As soon as a tract is placed under continuous supply, the provisions of section 246 (and especially sub-section 3) and section 247 should be rigidly enforced. We have reason to think there is great waste of filtered water in privies.

11. The inspectors, who have to work the waste-water meter system, should be subject to frequent supervision by a superior officer. One of the great advantages of the system is that it does not necessitate inquisitorial visits to the houses of the people. Bad fittings and waste in a house can be detected, with certainty, without entering the building. When the system of continuous supply is first introduced into a tract, the mains of the Corporation

should be first examined and made good. There will be many leaks discovered, with ease, which it is not possible to discover now. When the Municipality has set its own house in order in the tract, it will be time enough to begin to require improvements in the houses of the rate-payers. It must be remembered that, at first, the people will be inconvenienced and put to expense. We desire particularly to point out the desirability of effecting improvements in the internal fittings of houses without undue haste, with moderation, and with consideration for the people. The word "gradually" was used in section 241 of the Act mainly with a view to prevent undue haste and harassment. But, at the same time, we desire, even more strongly, to give marked prominence to the fact that it is absolutely essential that the law should be literally and rigidly enforced, and that the present unparalleled draught on the mains should be reduced. Unless the law is enforced, it is practically impossible to introduce the system of continuous supply. Sir Alexander Binnie, in speaking of the waste-water meter system, said: "Again I must warn you that there is no finality in the work we have commenced, but that it will only be by the most careful attention and constant supervision that the districts can be kept in a proper state of efficiency."

# SKETCH SHEWING THE FIRST TRACT TO BE PLACED UNDER CONTINUOUS SUPPLY

SCALE OF MILES



WARD 1. = 46,887 PERSONS

HALF WARD 2. = 15, 115 ABOUT PERSONS

TOTAL POPULATION OF TRACT = 62,000

# REPORT

OF THE

## ENGINEERING COMMITTEE

APPOINTED AUGUST 1908,

S1283

ON A

# LOWER GANGES BRIDGE.

2



Calcutta:

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# REPORT

OF THE

## ENGINEERING COMMITTEE

APPOINTED AUGUST 1908

ON A

### LOWER GANGES BRIDGE.

UNDER the orders of the Railway Board, conveyed in their No. 2195R.C., dated 10th August 1908, an Engineering Committee consisting of—

THE HON'BLE MR. INGLIS, C.S.I., Chief Engineer and Secretary, Public Works Department, Bengal.	...	<i>President,</i>
MR. PALMER, C.I.E., Chief Engineer, Calcutta Port Trust	...	} <i>Members,</i>
„ JOHNS, Chief Engineer, Oudh and Rohilkhand Railway	...	
„ ADAM, Senior Government Inspector, Calcutta	...	
„ GALES, Engineer-in-Chief, Conoor-Ootacamund Railway	...	
„ NEELY, Bengal-Nagpur Railway	...	<i>Secretary,</i>

assembled in Writers' Buildings, Calcutta, on 17th August 1908 "to consider and report on the engineering considerations connected with the building of a bridge across the Lower Ganges."

2. At the Committee's request the Manager of the Eastern Bengal State Railway very kindly placed at their disposal all the drawings in his possession of the river near Sara, including the original drawings of Mr. Spring's project.

3. The Committee left Calcutta the same evening for Sara and spent the four following days in examining the river on board the ferry steamer *Porpoise* belonging to the Eastern Bengal State Railway. Their investigations extended from Goalbathan on the south of the Sara reach, to Rampur Boalia on the west of Isabpur—a distance of over 50 miles.

4. It may be mentioned that the river stood at what may be described as the flood level of ordinary years, which is about 5 feet below the record flood level. The Committee were thus enabled from actual observation to form fairly accurate conclusions as to the length of bridge required as well as to note the behaviour of the river banks near the proposed bridge sites under the action of ordinary floods.

5. The width of the main river was measured by triangulation at the places mentioned below, and at approximately the same places lines of soundings were also taken across the river. The widths obtained from bank to bank were as follows:—

Isabpur	...	...	...	6,150 feet wide.
Mirganj	...	...	...	5,400 do.
Damukdia (Mr. Spring's No. 3 cross section)	...	...	...	6,400 do.
Sara (Mr. Spring's No. 8 cross section)	...	...	...	4,000 do.

These results when plotted gave sections which did not materially differ from those recorded by Mr. Spring in the drawings accompanying his project report, except at Damukdia where the width of the deep channel is now 6,400 feet as compared with 5,400 feet in Mr. Spring's section. Over the area of the deep hole near Sara, mentioned by Mr. Spring, the deepest sounding obtained was 60 feet below the existing flood level.

6. The present course of the river between Rampur Boalia and Goalbathan was sketched as accurately as was possible from the deck of the steamer, and is shown coloured blue on the accompanying map to a scale of 1 inch= 1 mile.

7. The Committee again met at Writers' Buildings on the 24th, 25th and 28th, and discussed the points referred to them. The conclusions at which they arrived are stated in the following paragraphs.

ARTICLE I OF REFERENCE FROM RAILWAY BOARD.

*"Do they consider that the river can be trained and bridged at Raita by a bridge built of the size and according to the scheme of training proposed by Mr. Spring in his report and estimate of 1903 with due regard to freedom from excessive risk during construction and to permanency when completed without liability to excessive cost for maintenance?"*

8. With regard to this article, the Committee assume that by Raita is meant the Raita peninsula on which there are two proposed bridge sites, viz., that corresponding to Mr. Spring's cross section No. 3 and that corresponding to his cross section No. 9. These will be afterwards referred to as the Upper and Lower Sara sites respectively.

9. Under this article the queries to which the Committee are asked to reply are—

- (a) the possibility of training and bridging the Ganges at the Raita peninsula with due regard to freedom from excessive risk during construction.
- (b) the sufficiency of Mr. Spring's scheme of training.
- (c) the permanency of the completed work without liability to excessive cost for maintenance.
- (d) the sufficiency of the waterway provided by Mr. Spring.

10. With regard to (a), it is in the opinion of the Committee only essential for the proper protection of the bridge site that one guide bank fully armoured should be completed in a single season and the opposite natural bank suitably protected, the approach banks on both sides being merely brought up to a few feet above high flood level. These works, entailing as they do about 200 lakhs cubic feet of earthwork and probably not more than 100 lakhs cubic feet of stone, are feasible without undue exertion, or liability to failure through non-completion. The Committee therefore consider that a bridge can be constructed at either of the Sara sites with freedom from excessive risk.

The Committee would also point out that the source of supply of protection stone would probably be three-fold, *i.e.*, from the north and south sides of the river by rail, and down the river by boat. The difficulty, therefore, of completing both guide banks in a single season is not materially greater than that of completing one, provided that an ample quantity of stone is stacked beforehand in close proximity to the bridge site on both sides of the river.

11. As regards the selection of the exact site, the Committee consider that the decision should not be finally come to until the work is actually about to be put in hand, but under existing conditions the Lower Sara site is preferred owing to the lesser width of the river at this place. But in this connection the possible difficulties that may be caused to construction working, by the ferry arrangements between Sara and Goalbathan, are an important factor which should receive due consideration in the selection. For these reasons the Committee would recommend that the choice between the Upper and Lower Sara sites, or any site adjacent thereto, should be left to the decision of the Engineer in charge when the work is about to commence.

12. With regard to (b), the Committee are of opinion that the scheme of training proposed by Mr. Spring is sufficient to protect the bridge and its immediate approaches.

13. As regards (c), viz., permanency when completed, the Committee consider that, with a view to conserving the river in its present course, it would be advisable to provide further protective works similar in design to those at the bridge itself, viz., protective works at or near the Upper Sara site if the bridge is built at or near the Lower Sara site; at or near the

Lower Sara site if the bridge is placed at or near the Upper Sara site; and in either case that Raita Point should be securely held.

14. (d) With regard to the size of the bridge, the Committee are of opinion that the waterway recommended by Mr. Spring is ample, but consider that the Engineer in charge should be given a free hand to vary the length of the bridge to suit the actual conditions obtaining in the bed of the river at the time of commencing work, provided that no material reduction is made in the waterway. In this connection attention is invited to the measurements of the river in ordinary flood as obtained by the Committee. They appear to leave little room for doubt as to the adequacy of the waterway provided both by Mr. Spring, and by the Committee of which Mr. O'Callaghan was President.

#### ARTICLE 2 OF REFERENCE FROM RAILWAY BOARD.

*"If the Committee are unable to advise building a bridge according to Mr. Spring's scheme, and if they consider Raita a good site, they are asked to advise what scheme of bridging and training do they suggest be adopted. What would be a rough approximate estimate for such a bridge for double line?"*

15. The views expressed by the Committee on Article 1 above furnish also a reply to the first clause of this article.

As regards the second query in this article, the following figures are submitted as a rough approximate estimate for such a bridge with a double track on the standard gauge.

Mr. Spring in his report estimates the cost of the bridge proper at, in round figures, 73 lakhs of rupees. The Committee would point out that this estimate is low, judged by Mr. Spring's own formula as given on page 145 of his Technical Paper No. 153 on River Training and Control. It is considered that in view of the abnormal character of the work—the wells going down 150 feet below L. W. L.—an extra sum of 17 lakhs of rupees should be added to the figure given above for the cost of the bridge proper for a single line.

To provide for the second track a further sum of 30 lakhs of rupees is required.

The estimate of 57 lakhs of rupees for the training works in the immediate vicinity of the bridge is accepted as sufficient, but for the additional protective works recommended in paragraph 13, a further sum of 23 lakhs of rupees should be provided. The Committee however are of opinion that these additional protective works need not be taken in hand until the completion of the bridge, and may thus be constructed at somewhat cheaper rates than those provided in the estimate for the bridge guide banks, in consequence of improved facilities for carriage of stone following on the completion of the bridge.

The total cost of the bridge with the additional protective works recommended will therefore be approximately as follows:—

		Rs.
Mr. Spring's estimate for single line bridge proper	...	73,00,000
Additional provision recommended	...	17,00,000
Add for double line	... ..	30,00,000
Mr. Spring's estimate for guide banks	...	57,00,000
Add for additional protective works	...	23,00,000
Total	...	Rs. 2,00,00,000

#### ARTICLE 3 OF REFERENCE FROM RAILWAY BOARD.

*"The Committee are asked to advise solely from an engineering point of view which is the best site between Isabpur and Raita for the building of a bridge across the Ganges with reference to cheapness of cost, ease of construction without undue risk, and freedom from difficulties of maintenance."*

16. So far as cheapness of cost, ease of construction without undue risk, and freedom from difficulties of maintenance are concerned, the Committee are unable to differentiate between any of the sites—Isabpur,



Mirganj, Upper Sara, Lower Sara. It is true the necessity for additional protective works is less immediate at Isabpur and Mirganj than at the Sara sites, but similar provision may be found necessary at any time in view of possible changes in the course of the river.

Mr. Spring in his report seems to indicate that the quantity of stone required for the guide banks at Isabpur or Mirganj can be reduced as compared with that necessary at Sara, and that this reduction and the lower charges for carriage of stone to the Isabpur sites will effect a saving which he estimates at 10 lakhs of rupees. The members of the Committee having had the advantage of seeing the action of the river in flood on its banks at these sites, find themselves unable to recommend any reduction in the guide banks at the Isabpur sites over those considered necessary at Sara.

Under certain conditions of stone supply however, the cost of stone delivered at Isabpur or Mirganj may be slightly less than at Sara, but in view of the uncertainty as to the actual sources of the supply and the relative quantities to be derived from each source, it is impossible to give any reliable forecast as to the probable saving under this head. Suffice it to say that the maximum saving is not likely to exceed 5 lakhs of rupees and may be much less.

17. In the preceding paragraphs the Committee have dealt with the questions specifically referred to them by the Railway Board. The reference was however accompanied by the documents noted below which, though possibly forwarded rather for consideration than reply, appear to call for some remarks as certain of the points raised are of the first importance, and the Committee's replies may tend to elucidate the reasons which have led them to the conclusions already expressed.

The documents are—

I.—Note by the Railway Board. (Appendix C.)

II.—Extract from the Bengal and North-Western Railway Company's letter No. 186, dated 8th April 1908, to the Under-Secretary of State for India with two enclosures. (Appendix D.)

I.—NOTE BY THE RAILWAY BOARD. (SEE APPENDIX C.)

18. *Paragraph 2.*—The Committee agree that to endeavour to train back the Ganges to a bridge site from which it had escaped would be a work bordering on the impossible. To provide against the occurrence of such a contingency they have recommended in paragraph 10 that both sides of the bridge site should be suitably protected simultaneously—a work which in their opinion can be accomplished in one season without undue risk of failure.

19. *Paragraph 3.*—As regards the liability of the bridge to be isolated by the river breaching the approach banks, the Committee would invite attention to the following quotation from paragraph 3 of the report of the Committee presided over by Mr. O'Callaghan in 1891 with which they concur.

“\* \* \* \* the Committee observe that all possible spills from  
“the Ganges towards the Brahmaputra necessarily pass under the  
“existing Northern Bengal Railway, the spill bridges of which now  
“control, and can doubtless continue to control, the action. Such  
“a mishap as a left bank evulsion is no less imminent in the  
“present condition of things than it will be after a bridge is built,  
“and its results would then be only in degree more disastrous than  
“now. The Committee, therefore, deem it essential that the Nor-  
“thern Bengal line should continue to be efficiently protected against  
“cross spills, and that special care should be devoted to the mainte-  
“nance of the floor and flank protection of all spill bridges, both  
“on the Northern Bengal line between the Ganges and Nattore, and  
“on the Eastern Bengal line between Raita and Poradaha.”

The Committee are supported in their belief, that the proper control of these spill channels offers no substantial difficulties, by the opinion of their President as well as that expressed by Mr. Odling in his Note of 27th June 1891. It seems desirable that early action should be taken in notifying the spill channels under the Embankment Act as recommended by Mr. Odling.

As regards the maintenance and protection of the bridge being a never-ending source of anxiety and expense, the Committee are of opinion that the adoption of the measures recommended in paragraph 13 of this report will

reduce such anxiety and expense to a minimum. The maintenance of these protective works would no doubt be a charge for a whole-time officer.

II.—EXTRACT FROM BENGAL AND NORTH-WESTERN RAILWAY COMPANY'S LETTER No. 186, DATED 8TH APRIL 1908, TO THE UNDER-SECRETARY OF STATE FOR INDIA WITH TWO ENCLOSURES. (SEE APPENDIX D.)

20. In dealing with the above letter from the Board of Directors of the Bengal and North-Western Railway to the Under-Secretary of State and its enclosures, it is difficult to avoid repetition, as the same arguments are put forward both in the letter, and in the notes by Messrs. Gracey and Izat, and by Messrs. Rendel and Robertson.

21. *Appendix D, Article 2(1), paragraph (a).*—In this paragraph it is stated that Mr. Spring reports that from Godagari to Isabpur "14 miles of left bank bordering on the Barind . . . . . may be looked on for all bridge building purposes as a permanent bank," and the conclusion is apparently drawn that Isabpur is on the Barind.

This, the Committee would point out, is a misapprehension of the facts of the case. A reference to Mr. Spring's report, Chapter III, paragraph 8, page 10, shows that the Barind extends "from the mouth of the Mahananda at Sultanganj—two miles above Godagari—to Karchaka." This latter place is some 15 miles above Isabpur. The Committee desire to emphasize this point as a rather widespread misapprehension appears to exist as to the nature and height of the left bank at Isabpur. In neither respect does it appear to differ materially from the *quasi*-permanent banks lower down.

And as regards the conclusion drawn, that at Isabpur only the right guide bank need be built before the bridge is commenced, the Committee would invite attention to their previous expression of opinion that whether the bridge is built at Isabpur, or at any of the sites to the east, both banks will require protection during the first season of operations in the river bed.

22. *Appendix D, Article 2 (I), paragraph (b).*—The Committee are not prepared to attach importance to the difference in depth of scour—72 feet as compared with 100 feet—referred to in this paragraph. The object of providing foundations 150 feet deep below low-water level is to ensure security, should such a scour occur, and they believe it may occur at any site.

With regard to the remarks on the changes of direction of the main river round the S bend at Raita, a study of the map accompanying this report shows that a large cut-off above Raita has taken place, and that the river has deserted the channel under the west bank of the peninsula. With its present tendency to cut to the north in combination with the protective works recommended in paragraph 13 of this report, the Committee are of opinion that the river will be conserved in its present favourable alignment.

23. *Appendix D, Article 2 (I), paragraph (c).*—The point raised by the Board of Directors in this paragraph has not been lost sight of by the Committee in forming their conclusions. The provision of such lines for the prior conveyance of material may be accepted as essential, and their construction offers little or no difficulty. The cost of the Azimganj connection would probably be a charge against the bridge.

24. *Appendix D, Article 2 (IV) and paragraph 1 of enclosure No. 2.*—This paragraph deals with matters which do not fall within the scope of the reference made to the Committee.

25. *Appendix D, Article 2 (IV) and paragraph 2 of enclosure No. 2.*—The Committee inspected the Govindpore and Boral spill channels which are those referred to, and have expressed in paragraph 19 of this report their concurrence in the conclusions arrived at by Mr. O'Callaghan's Committee.

With regard to the concluding portion of the paragraph the Committee would remark that the possibility of deep scour is not confined to any particular locality.

26. *Appendix D, Article 2 (IV) and paragraph 3 of enclosure No. 2.*—Colonel Gracey and Mr. Izat are under a serious misapprehension as to the quantity of earthwork to be completed in a single working season. The 600 lakhs cubic feet of earthwork in Mr. Spring's report includes, in addition to the quantity for the guide banks, the full amount of earthwork required to raise the approach banks to formation level—a maximum height of about 36 feet above the highest flood—whereas all that is obligatory for the latter is that they should

be raised to a height of a few feet above high flood-level. The approximate quantities of earthwork and pitching stone which the Committee estimate as necessary for the securing of the site have already been given in paragraph 10 of this report. The quantity of earthwork that would similarly have to be completed in one working season at the Isabpur sites would not differ from that at the Sara sites so materially as to affect the issue.

27. *Appendix D, Article 2 (IV) and paragraph 5 of enclosure No. 2.*—The Committee do not anticipate the dangers at either of the Sara sites contemplated by Colonel Gracey and Mr. Izat provided the measures recommended in this report are adopted.

28. *Appendix D, Article 2 (V) and enclosure No. 1.*—The previous remarks of the Committee in conjunction with the map of the present course of the river will, it is believed, lead Messrs. Rendel and Robertson to modify their views. The Committee would further add that the present course of the river above Raita is more or less straight for about 10 miles, while the Sara reach for a distance of about 10 miles has been approximately straight for over a century. Mr. O'Callaghan's Committee in their report

“...attach supreme importance to the straight alignment of the “present reach,” (i.e., the Sara reach) “which practically has been “constant for at least 110 years, being maintained,”

the necessary measures for which have already formed a sub-head of the Committee's recommendations,

On the other hand, it may be explained that the reach above Isabpur shows a distinct tendency to embayment to the south, a fact which Messrs. Rendel and Robertson, for whose opinion the greatest respect is entertained, could not have been aware of from the map before them.

29. In submitting these comments on the opinions of such eminent engineers the Committee have no desire to minimise the exceedingly formidable character of the works, but they are of opinion that the anticipations of the Bengal and North-Western Railway Authorities as regards the Sara site are unduly pessimistic, and that the constructional advantages afforded by one site over another are highly problematical.

30. To avoid any risk of misunderstanding the Committee wish it to be clearly understood that the approximate estimate put forward in their report excludes the cost of all *permanent* connecting lines, as this has been expressly excluded from the reference made to them by the Railway Board. The figure arrived at may be taken as representative of the cost of a bridge at any of the sites which have been discussed in this report. It should not, however, be forgotten that under certain conditions of stone supply a saving of not more than about five lakhs of rupees may be effected in the cost of a bridge at either Isabpur or Mirganj, and that the necessity for protection works at these sites is less immediate than at either of the Sara sites.

The Committee would further add that only the general question of bridge site with the approximate estimation of the cost of a double line bridge has been considered by them, and that they have not gone into matters of detail such as the best type of well, the most economical length of span, the description of girders, and other points in design, leaving these matters for settlement by the Railway Board and its advisers.

31. In conclusion the Committee would ask that their thanks be conveyed to Colonel Cowie, Manager, Eastern Bengal State Railway, for his kindness in placing at their disposal every facility for examining the river, and to Mr. Haughton, Chief Engineer, Eastern Bengal State Railway, for the very valuable information he gave concerning the changes in the course of the Ganges, and on other matters connected with this enquiry.

W. A. INGLIS	...	<i>President.</i>
F. PALMER	...	} <i>Members.</i>
W. A. JOHNS	...	
J. ADAM	...	
R. R. GALES	...	
ALEC. J. NEELY	...	<i>Secretary.</i>

CALCUTTA :

*The 29th August 1903.*

Enclosures :—

Map (scale 1"=1 mile).

Tracing showing cross sections of River.

## APPENDIX A.

No. 2195R.C., dated Simla, the 10th August 1908.

Memo. by—The Railway Board.

THE following documents are forwarded to the members of the Engineering Committee considering the project of the bridge on the Lower Ganges :—

1. Memorandum by the Chairman, Railway Board.
2. Note by the Railway Board.
3. Extract from Bengal and North-Western Railway Company's letter No. 186, dated the 8th April 1908, with enclosures Nos. 1 and 2.
4. Report and estimate on the Lower Ganges Bridge by Mr. F. J. E. Spring, C.I.E.

## APPENDIX B.

### BRIDGING THE LOWER GANGES.

AN Engineering Committee consisting of—

- The Hon'ble Mr. Inglis, C.S.I., Chief Engineer and Secretary, Public Works Department, Bengal ;  
Mr. Palmer, C.I.E., Chief Engineer, Calcutta Port Trust ;  
„ Johns, Chief Engineer, Oudh and Rohilkhand Railway ;  
„ Gales, Engineer-in-Chief, Coonoor-Ootacamund Railway ;  
„ Adam, Senior Government Inspector, Calcutta, with  
„ Neely, Bengal-Nagpur Railway, as Secretary ;

will assemble in Calcutta at as early a date as possible to consider and report on the Engineering considerations connected with the building of a bridge across the Lower Ganges.

The particular points on which the Committee are asked to advise are :—

- (1) Do they consider that the river can be trained and bridged at Raita by a bridge built of the size and according to the scheme of training proposed by Mr. Spring in his report and estimate of 1903 with due regard to freedom from excessive risk during construction and to permanency when completed without liability to excessive cost for maintenance?
- (2) If the Committee are unable to advise building a bridge according to Mr. Spring's scheme, and if they consider Raita a good site, they are asked to advise what scheme of bridging and training do they suggest be adopted. What would be a rough approximate estimate for such a bridge for double line?
- (3) The Committee are asked to advise, solely from an Engineering point of view, which is the best site between Isabpur and Raita for the building of a bridge across the Ganges with reference to cheapness of cost, ease of construction without undue risk, and freedom from difficulties of maintenance.

The Hon'ble Mr. Inglis is invited to be Chairman of the Committee, but if he is unable to accept, the Committee will, please, nominate their own Chairman.

It is suggested that the Committee assemble in Calcutta on Monday, the 17th. Messrs. Johns, Adam and Gales have been requested to be in Calcutta on the 16th and to put themselves in communication with Mr. Neely on arriving there. Mr. Inglis is asked to kindly let Mr. Neely and Mr. Palmer know the time and place fixed for the first meeting. The Eastern Bengal State Railway have been requested to place a Steamer at the disposal of the Committee at Sara and provide reserved carriages for their accommodation.

T. R. WYNNE,

The 10th August 1908.

Chairman, Railway Board.

## APPENDIX C.

### NOTE BY RAILWAY BOARD.

1. The Committee has been assembled to consider the questions put to them, because in the opinion of the Railway Board the training of the river and the confining of it to a narrow bridge as proposed by Mr. Spring is a work which is full of risks.

2. In the opinion of the Board it is quite possible that after the construction of the first training bund the river may change its course entirely. If this occurs to make use of the work so far done, it will be necessary to train the river back to the bridge site. This, in their opinion, would be a work of the greatest magnitude and difficulty, involving very heavy expenditure.

3. Furthermore, assuming that the bridge had been built, the Board are of the opinion that its maintenance would be a never ending source of anxiety and expense, and at any season the river might break through the approach banks and leave the bridge site.

4. It is further considered that the final conclusion stated in paragraph 2, Chapter XVI, of Mr. Spring's report is not in accordance with the body of the report, especially with reference to the remarks contained in paragraph 10, Chapter III, of the same report.

5. For the information of the Committee the following papers are forwarded :—

Report by Mr. Spring on a bridge across the Lower Ganges.  
Extracts from some correspondence between the Bengal and North-Western Railway and the Secretary of State dealing with the Engineering aspect of bridging the river at Raita.

Report by Messrs. Rendel and Robertson of Great George Street, Westminster.  
Joint Engineering Report by Colonel Gracey and Mr. Izat.

T. R. WYNN.

S. FINNEY.

The 10th August 1908.

#### APPENDIX D.

*Extract from the Bengal and North-Western Railway Company's letter No. 186, dated the 8th April 1908, to the Under-Secretary of State for India, India Office, Whitehall, S.W.*

##### BRIDGING THE LOWER GANGES.

2. The Engineering question is dealt with in :—

(I).—*Mr. Spring's Report on the Lower Ganges Bridge Sites,*

(a) Mr. Spring states (page 3), "the conclusion to which I have come is that the task of bridging the Ganges is an exceedingly formidable one . . . nothing approaching to it in difficulty has heretofore been attempted in India, or, indeed, so far as I know, anywhere else," and he sums up his conclusion, from an Engineering point of view (page 63) in the following words: "To the best of my professional judgment there is nothing to choose between the alternative bridge sites," but it is submitted that his report does not bear out this conclusion, as in page 10 he reports that from Godagari to Isabpur the "14 miles of left bank bordering on the Barind . . . may be looked on for all bridge building purposes as a permanent bank," and it will be seen from the enclosed map that these 14 miles are straight, whereas at the Raita site the river is an S bend, the left bank is not stable, and the right bank (page 40) has been eroded about 2 miles in the last 40 years," *i.e.*, an average of 250 feet a year. From these facts the conclusion may be drawn that at Isabpur only the right training bund need be built before the bridge is commenced, whereas at Raita both training bunds must be built in one year, and the risks of carrying out the work in one season immensely increased.

(b) Again, at Isabpur, Mr. Spring states (page 5) that he found in the dry season the water "72 feet deep in places," whereas at Raita he found it at the same season 100 feet deep (page 4). Both of these scour-holes were made by erosion, but he states that "swirl" scours "might be even deeper" (page 4), and it is evident that such swirl scours are much more likely on the S bend at Raita, where (page 4) "although just now the main river on the west of Raita is flowing east and west, only a few years ago it was flowing from the south-wards to Raita and then taking a right angle turn to the eastward," than at Isabpur, where the current flows constant along the straight reach of the river.

(c) Mr. Spring appears to make a point of the great advantage that will be derived from the facility with which stone and other stores can be carried to the Raita site by existing railways, but during the two years which must be expended in the preparation of materials and plant before the bridge itself can be commenced, the approaches to the Isabpur site can be completed, and used for carrying in stores and other materials for the works.

Mr. Spring's report, when analysed, in fact shows that under any circumstances the construction of a bridge must be an exceedingly risky and difficult undertaking, and that the difficulties and risks must be greater at Raita than at any suitable point between Godagari and Isabpur.

(II).—*Brief Memorandum by the Railway Board on the alternative schemes for providing direct Railway communication between Northern Bengal and Calcutta.*

In paragraph 18 the Railway Board, on which there are two well known Engineers, state that the Sara site is recognized "as a difficult one" and that "the advantage lies unquestionably with the Rampur Boalia site," which is practically the same as the Isabpur site.

*(III). Report of the Ganges Bridge Committee.*

As might be expected from the constitution of this Committee, which was not strong in engineering specialists, they merely confine themselves (page 13) to reiterating Mr. Spring's dicta which have been dealt with above, viz.: "So far as the mere building of the bridge is concerned there is nothing, to the best of my professional judgment, to choose between the several alternative bridge sites. So far as the training works of the river is concerned, there is but little to choose."

*(IV). Joint Note on the proposed bridge over the Lower Ganges by Colonel Grasey and Mr. Izat.*

The experience possessed by these two engineers of bridging rivers in the Gangetic plain is well known. They have also special knowledge of training works on the Lower Ganges, derived from the recent construction and maintenance of a training bund for the main stream near the mouth of the Kosi, which has proved successful. They are of opinion that "the bridging of the Ganges near Raita, and the subsequent maintenance of the bridging works are too risky and should be avoided if it is possible to do so," whilst at Isabpur they are of opinion that the bridging and training works can be carried out "without incurring any undue risk."

*(V). Letter from Messrs. Rendel and Robertson on the Lower Ganges Bridge from an engineering point of view.*

With the information they had before them, which is that referred to above, the opinion expressed by these eminent engineers is that "the problem of the bridge, both as regards construction and maintenance, is one of such difficulty that, in our opinion, the selection of the easiest and safest site for it must rule all other considerations," and the site chosen for it at Raita "is perhaps the very worst possible site for it."

3. My Directors have desired me to write fully as above, because they wish that it should be fully recognised before the work is commenced, the numerous difficulties and risks that must be encountered in bridging the Lower Ganges at the best site that can be selected, and the special risks that attend upon the Raita site. The former risks they are willing to meet, but the risks of bridging at the Raita site are so great that they do not think in justice to the Company's shareholders they should encounter them unless the Secretary of State is willing to underwrite any loss of outlay that may be incurred owing to the bridge at Sara being rendered useless, which they believe to be a not remote contingency.

## ENCLOSURE No. 1.

## BRIDGING THE LOWER GANGES.

*Copy of letter, dated 30th March 1908, from Messrs. Rendel and Robertson to the Managing Director, Bengal and North-Western Railway.*

As requested by the Chairman and Managing Director at our interview last week, we beg to make the following observations on the question of the best site for a bridge over the Lower Ganges to connect the Bengal and North-Western and the Bengal Northern Railways with the Eastern Bengal Railway, *from the engineering point of view*. The subject is not new to us, having been sent to us for report by the East Indian Railway Company in June of last year.

2. As we understand it, the present proposal is that the bridge should be placed at the point known as Raita, a little above Sara. So far as we can judge from the four-mile-to-the-inch Revenue Survey map, this reach of the river, which is like the letter S, is perhaps the very worst possible site for it, and we can only suppose that the site has been under consideration because the Eastern Bengal Railway ferry has been situated there, and the natural course would be to place a fixed bridge there also.

3. The map and such other information as we possess would lead us to select a reach higher up the river, and we observe that Mr. Spring speaks of a "quite ideal site" at a place called Mirganj, not far from Isabpur, and only rejects it because of the cost of the approach lines.

4. Now although the question of the approach lines is important, and might perhaps determine an ordinary case, the present is, in our opinion, as far as possible from being one. The problem of the bridge, both as regards construction and maintenance, is one of such difficulty that, in our opinion, the selection of the easiest and safest site for it must rule all other considerations, and we shall be surprised if the necessary further enquiry places it at Raita. We expect it will be found somewhere in the neighbourhood of Isabpur.

## ENCLOSURE No. 2.

*Joint Note on the proposed bridge over the Lower Ganges by Colonel Gracey and Mr. Isat.*

WE have carefully considered the report of the Ganges Bridge Committee and the report by Mr. Spring on the Lower Ganges Bridge referred to therein.

The various sites proposed appear to have now been reduced to two, that at (1) Isabpur, which the Bengal and North Western Railway have declared themselves willing to accept, and (2) that at Raita, which the Eastern Bengal Authorities are understood to advocate.

1. In regard to traffic facilities, it appears from the table on page 13 of the Committee's Report that for traffic from the east the distance to Calcutta will be the same whether Isabpur or Raita is chosen, and that for traffic from the West the distance will be increased by ten miles if the Raita site is selected. It is, therefore, clear that, as regards traffic facilities, the Isabpur site is the better. It is true that if the Isabpur site is chosen it will be necessary to construct additional lines of railway costing about one crore of rupees, but these lines are in any case required to open out new tracts of country.

2. The whole question of whether the Isabpur or Raita site should be selected entirely turns on the possibility and cost of building and maintaining the bridge at the sites mentioned. Whichever site is selected the length of the bridge will be the same, and in each case great training works will be required.

Isabpur is at the bottom of a long straight reach of the river with a permanent left bank, and there will be no difficulty in selecting a site where the river hugs the high bank, so that only the training work on the opposite bank need be completed in one working season. Raita is outflanked by two spill channels, one on each side of the river, and is situated on a horse-shoe bund, and thus from an engineering point of view, is very badly and dangerously situated. In a position of this kind we are of opinion it will be absolutely necessary to complete both training bunds in one working season.

At Isabpur the direct current will run straight through the bridge and no abnormal scour need be anticipated. At Raita the current runs in every direction setting up cross currents and swirls, causing great scour holes, which have been measured in the dry season to an actual depth of about 100 feet below the lowest water level in the river. What that scour must be when the river is in high flood can be easily imagined.

3. Turning now to the actual construction of the bridge, we estimate from the experience gained from the Ganges fender at the Kosi Bridge that 1,500 cubic feet of stone per foot run will be required to protect the exposed faces of the training bunds, and the length of the faces will be about 7,000 feet, so that each bund will want 105 lakhs of cubic feet of pitching stones, or 210 lakhs cubic feet for the two bunds. We further estimate that at Raita it will be necessary to carry out about 600 lakhs of cubic feet of earthwork on the bunds and bridge approaches. It will thus be seen that 210 lakhs cubic feet of stone must be carried to the site of the works and placed in position, and 600 lakhs cubic feet of earthwork completed in one working season of, say, 200 days. Taking into consideration the risk from epidemics of cholera, plague, small-pox, etc., on the breaking out of which the work-people will desert, we consider that the risk is too great for the work to be attempted if any alternative is available.

At Isabpur, on the other hand, only one-half of this work will have to be carried out in one working season, and we consider that what is required can be done without incurring any undue risk.

4. In regard to the construction of the bridge itself we do not think that any unusual difficulties need be anticipated at either site beyond the great magnitude of the work itself.

5. Besides the difficulties connected with the construction of the bridge and training works, the maintenance of these after they have been completed must be considered. At Isabpur only direct action from the water running down a straight reach of the river will be experienced, and it is not thought that anything except ordinary scour need be anticipated, but even this will be very great, as the water will be about 5,000 feet wide and averaging 40 to 100 feet deep, running with an average velocity of 8 to 10 feet per second. At Raita the same volume of water will have to be dealt with, but here, instead of running direct through the bridge, it will strike the bridge and training works at varying angles, setting up whirlpools and eddies which will cause enormous scour and probably undermine any foundation that can be laid in at reasonable cost. There is also the risk of the bridge being outflanked and thus rendered useless.

Our conclusion is that bridging the Ganges at Raita and the subsequent maintenance of the bridging works are risky and should be avoided, if by any means it is possible to do so, and, with the Isabpur site available and better suited for traffic purposes, we are unable to understand why the very great risk should be encountered.

The survey map of the country, scale 4 miles = 1 inch, is attached, and particular attention is drawn to the Raita peninsula. The course of the river, within the last four years, above the chosen site, is shown in light blue.

PUBLIC WORKS DEPARTMENT REORGANIZATION COMMITTEE

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# REPORT

OF THE

# PUBLIC WORKS DEPARTMENT REORGANIZATION COMMITTEE

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VOLUME I.

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CALCUTTA  
SUPERINTENDENT GOVERNMENT PRINTING, INDIA  
1917.



# PUBLIC WORKS DEPARTMENT REORGANIZATION COMMITTEE.

## VOLUME I.

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REPORT  
OF THE  
PUBLIC WORKS DEPARTMENT REORGANIZATION COMMITTEE.

CHAPTER I.

GENERAL.

Appointment of the committee and terms of reference.

1. The committee was appointed by the Governor General in Council by Public Works Department Resolution No. 06-E.A., dated the 24th November 1916, the first two paragraphs of which are reproduced below:—

“The Governor General in Council has recently considered the organization, methods and procedure of the Buildings and Roads Branch of the Public Works Department with the object of deciding whether it can be improved, and rendered more economical and efficient. Whilst the Governor General in Council desires to recognise the great services of the Public Works Department in the past, and the important part that it has taken in the development of India, a recognition with which the Secretary of State desires fully to associate himself, there is a considerable body of opinion that the changing conditions make it desirable to reconsider the methods under which Public Works are carried out and more particularly to secure, if and whenever this is possible, the substitution of private for departmental agency. It is urged that much of the work at present carried out by the Public Works Department could be entrusted to private agency, and that greater economy could thus be secured, and further that much greater use might be made by Government of local bodies, some of which at present employ a skilled public works agency. Much work of a simple and unimportant character which is now undertaken and supervised by highly salaried officers of Government could, it has been suggested, be carried out at reduced cost under contract subject to Government inspection. In the second place, it is urged that, if local bodies are encouraged and enabled to arrange more extensively than at present for the execution by their own staff or by private agency of their works, it will not only be a further step in the direction of decentralization but also would stimulate the growth of firms of standing in the building and allied trades and so encourage further industrial activity. Such development will, further, tend automatically to react upon the educational system of the country. A demand for more highly trained engineers in private employ would involve the provision of facilities for the best possible training at the Engineering Colleges. And it is considered that such provision must be an integral factor in any schemes for the development of private enterprise such as would be connoted in changes of the kind in view.

“For the purpose of examining these matters the Governor General in Council has accordingly determined, with the approval of the Secretary of State, to appoint a Committee whose duty it will be to inquire into and report generally upon the organization and the system

NOTE—The figures in the margin refer to the serial numbers in the index to the evidence on subjects dealt with in the report at pages 115 to 122 of this volume.

of administration of the Buildings and Roads Branch of the Public Works Department, with special reference to the considerations advanced in the foregoing paragraph, and to make such suggestions for change as the circumstances seem to justify. Among the particular points which the Committee should inquire into are the following :—

“(i) whether the methods at present adopted for the execution of civil works are economical and suitable for the purpose for which they were devised ;

“(ii) whether under the existing system private enterprise is sufficiently encouraged, and whether it is possible and desirable to entrust the construction and upkeep of certain classes of public works to agency other than departmental, and if so, upon what lines such change should be effected ;

“(iii) whether any changes recommended by the Committee necessitate any modification of the organization of the staff of the Public Works Department, and, if so, what ;

“(iv) whether the Public Works Department meets the needs of other Departments of the Administration, and whether the relations *inter se* of the various subdivisions of the Buildings and Roads Branch, Sanitary, Architectural, Electrical and Civil Engineering, are satisfactory ;

“(v) whether further decentralization within the Public Works Department itself is desirable, and, if so, to what extent and in what directions ;

“(vi) whether the Public Works Department Code which regulates the execution and maintenance of civil works is unduly restrictive, and, if so, in what direction change is desirable ;

“(vii) whether the system of education in Government Engineering Colleges is organised on a sufficiently broad basis to meet the needs of private agency as well as of Government, whether it attracts suitable candidates and whether the standard of instruction is sufficiently advanced to provide fully qualified civil engineers for employment by Government, local bodies, and private engineering and contracting firms, and, if not, in what directions and to what extent improvement is required ;

“(viii) whether adequate provision is made for the practical training on works of students who have received their scientific education in English or Indian Colleges.”

2. The committee was composed of the following Constitution of members, appointed by the Governor General in Council :— the committee.

F. G. Sly, Esq., C.S.I., I.C.S. (President), Commissioner, Nagpur Division, Central Provinces.

Sir Noel Thomas Kershaw, K.C.B., Local Government Board, England.

C. S. Cobb, Esq., M.V.O., lately Chairman of the London County Council.

Rai Bahadur Lala Ganga Ram, C.I.E., M.V.O., late of the Public Works Department, Punjab.

A. T. Mackenzie, Esq., late of the Public Works Department, Madras.

Mr. D. G. Harris, Under Secretary to the Government of India, Public Works Department, was appointed our secretary.

Procedure  
adopted.

3. On arrival of the members from England we held our first public meeting in Bombay on the 8th January, and thereafter we visited successively Poona, Nagpur, Calcutta, Madras, Rangoon, Bankipur, Allahabad, Roorkee, Lahore and Simla, holding inquiries at each of these places. During our tour we held 35 sittings and examined in all 136 witnesses, comprising 55 members and ex-members of the public works department, 14 officers of the Indian civil service experienced in general district administration, 6 officers of the accounts department, 8 representatives of other departments, including police, education and forests, on whose behalf work is executed by the public works department, 9 witnesses concerned with engineering and technical education, 12 non-official members of local boards and municipalities (including the engineering staff of those bodies) and 32 other witnesses, among whom were contractors, consulting engineers, private architects and representatives of large engineering and contracting firms and of the various chambers of commerce. In addition we received written memoranda from 72 individuals and associations interested in our inquiry who, in response to a general invitation issued by us to the public, gave us the benefit of their views but whom we did not examine orally. During our tour we also visited a large number of important buildings constructed during recent years by the buildings and roads branch of the public works department, the major departmental stores, brickfields and workshops, the works of several private engineering firms, and the principal engineering colleges, schools of art and technical schools.

In order that we might have the benefit of local knowledge and experience, each local Government nominated a senior officer of the public works department who was co-opted as a temporary member of the committee for the period during which we remained in the province concerned. The following gentlemen, to all of whom we are indebted for valuable help and advice, were co-opted in this manner and acted temporarily as our colleagues from time to time :—

In Bombay . . . . .	Mr. R. J. Kent, Chief engineer.
In the Central Provinces . . . . .	Mr. G. A. Durie, Superintending engineer.
In Bengal . . . . .	Hon'ble Mr. H. H. Green, Chief engineer.
In Madras . . . . .	Mr. W. J. J. Howley, Superintending engineer.
In Burma . . . . .	Mr. B. M. Samuelson, Superintending engineer.
In Bihar and Orissa . . . . .	Mr. W. S. Bremner, Superintending engineer.
In the United Provinces . . . . .	Hon'ble Mr. H. M. Willmott, Chief engineer.
In the Punjab . . . . .	Mr. D. W. Aikman, C.I.E., Chief engineer.

Throughout our investigation we received the cordial co-operation of all the local Governments and Administrations whose territories we visited, and we desire to express our obligations to them for their assistance. We also wish to acknowledge our indebtedness to all who, often at the expense of much time and labour, gave oral evidence before us or furnished us with written memoranda of their views.



We also desire to express our great obligations to Mr. D. G. Harris, our secretary, for the efficient manner in which he has performed his important duties. His professional knowledge, his intimate acquaintance with the organization of the department, and his devotion to duty have been of the greatest assistance to us throughout our inquiry.

## CHAPTER II.

### HISTORY AND PRESENT ORGANIZATION OF THE PUBLIC WORKS DEPARTMENT.

4. The public works department was first organized on a definite basis in 1854 in succession to the old military boards of the three presidencies, constituted for the purpose of carrying out military works, and traces of this military origin can still be found in some of the present methods of the department. At that date the staff of engineers was drawn from various sources, including the Thomason civil engineering college at Roorkee, which had been founded in 1847 primarily with the object of imparting a civil engineer's education to European and Indian officers and subordinates to fit them for employment on the Ganges canal, which was then under construction. In 1866, in order to meet the increasing demand for public works, three separate branches were formed, the military works branch, the civil works branch including irrigation, and the railway branch, and to these was added in 1870 the public works accounts branch. In 1893, in accordance with the recommendation of the Aitchison Commission on the Indian public services, the provincial service was created for the purpose of providing for the more extensive employment of Indians from the engineering colleges in India. By 1895 the public works department had become a purely civil department by the separation of the military works branch, and in 1905 the railway branch was formed into a separate department on its present basis. Since that date the public works department has been responsible only for civil works including irrigation. During the same period, with the development of local self-government, certain classes of public works have been entrusted, to an extent varying in different provinces, to the control of district boards and municipalities. In 1910 the public works accounts branch was abolished as a separate entity and merged in the civil accounts department.

5. The personnel of the engineering branch of the public works department is divided into three establishments, the engineer establishment, the upper subordinate establishment and the lower subordinate establishment. The engineer establishment is again sub-divided into two services—the imperial and the provincial. The strength of the imperial service of engineers is maintained by the annual appointment by the Secretary of State in England of a varying number of selected candidates, by the appointment in India of Royal Engineer officers, and by the occasional admission of other qualified persons. The provincial service of engineers is open only to statutory natives of India, and its strength is maintained by the appointment annually of a fixed number of qualified students from the Indian engineering colleges, by the promotion of a fixed number of selected upper subordi-

rates of the department, and by the occasional admission of other qualified persons. There is no distinction between the members of the imperial and provincial services except in regard to pay, leave and pension, and the combined establishment is divided into the following classes :—

Designation.	RATE OF PRESENT MONTHLY PAY.	
	Imperial.	Provincial.
	Rs.	Rs.
Chief engineer . . . . .	2,500—2,750	2,500—2,750
Superintending engineer . . . . .	1,500—2,000	1,200—1,600
Executive engineer . . . . .	800—1,250	535—850
Assistant engineer . . . . .	380—750	250—475

The Public Services Commission has recommended the Public Services amalgamation of the two services into a single superior Commission engineering service and has proposed, for officers recruited Report, in India, scales of pay of Rs. 300—550 for assistant Annexure engineers and Rs. 600—1,050 for executive engineers, and XVIII, for all officers holding the rank of superintending engineer paras. 7 and 20. irrespective of the place of recruitment the same pay of Rs. 1,500—2,000.

The upper subordinate establishment is recruited by the appointment of passed students of the Indian engineering colleges to which a certain number of appointments annually are guaranteed, including non-commissioned officers and soldiers of His Majesty's army in India, by the promotion of selected lower subordinates and by the appointment of other suitable candidates. This establishment is divided into three classes, designated respectively sub-engineers, supervisors, and overseers. The pay of each class is fixed by the local Governments, subject to a maximum salary of Rs. 550 per mensem; in general it varies from about Rs. 60 as a minimum to Rs. 550 as a maximum.

The lower subordinate establishment is maintained at the required strength by the appointment of students holding certificates from the engineering colleges, and of other suitable candidates. The members of this establishment are designated sub-overseers, and their pay is fixed by the local Governments, varying generally from about Rs. 30 as a minimum to Rs. 100 as a maximum.

In addition to the permanent staff of the department, officers with the same designations, but engaged as temporary establishment, on a purely temporary and non-pensionable basis, are employed in every class of the establishment, the extent to which such temporary establishment is employed varying from time to time with the excess of work in progress beyond the capacity of the permanent staff.

All major local Governments also employ a certain number of specialist officers who undertake duties which, while falling to the lot of the department, are regarded as outside the scope of the work of a civil engineer. These specialist officers include consulting architects, sanitary engineers and electrical engineers, and in some provinces mechanical engineers, plumbing experts, boiler inspectors, workshop superintendents, etc. In a few cases these

officers are employed permanently, but usually they are engaged on short-term covenants with special conditions of service applicable to each.

Further, an executive Engineer may entertain the necessary temporary works establishment for the construction of any work duly sanctioned, the pay of which establishment is charged direct to the work concerned. The main conditions attached to the entertainment of this class of establishment are that the persons must be employed for the subordinate supervision of stores or labour, must be paid by the day or month, their employment ceasing with the cessation of the work, and the rate of pay must in no case exceed Rs. 250 a month.

6. The magnitude of the operations of the buildings and roads branch of the public works department may be gauged from the statement below which shows, for each of the major provinces, the average annual expenditure during the three years prior to the war from 1911-12 to 1913-14 on works executed by this branch and on the establishment employed thereon. The details of this expenditure are shown in Statement I attached to this report.

Province	Works.	Establishment.
	Rs.	Rs.
Madras . . . . .	64,14,458	13,50,785
Bombay . . . . .	1,10,43,563	16,50,455
Bengal . . . . .	68,72,845	11,44,924
United Provinces . . . . .	93,04,855	14,64,570
Punjab . . . . .	63,13,014	9,53,858
Burma . . . . .	95,90,949	22,74,270
Bihar and Orissa . . . . .	47,08,788	7,49,239
Central Provinces . . . . .	58,78,718	10,05,844
Assam . . . . .	38,67,630	6,81,283
<b>TOTAL . . . . .</b>	<b>6,39,94,820</b>	<b>1,12,75,228</b>

The following are the main heads under which the expenditure on works is classified :—

*Provincial civil works* include all works the cost of which is met from the current revenues of the province concerned, and comprise, in general, the main lines of communication and all buildings required in connection with provincial administration, such as office buildings, courts of justice, police stations, barracks and offices, government schools and colleges, hospitals and the like.

*Imperial civil works* consist mainly, in the major provinces, of the construction and maintenance of buildings for the use of departments directly administered by the Government of India, such as post and telegraph offices and customs houses.

*Military works* are usually executed by officers of the military works services, but in all provinces, and especially in localities where no military engineer is available, a certain amount of such work is entrusted to the public works department.

*Local fund works* include expenditure on the works of district boards executed through the agency of the public works department, and vary greatly in amount in the different provinces, according to the capacity of

the engineering establishment employed by each district board.

*Contribution works.*—The department may, at the discretion of the local Government concerned, be called upon to undertake works for which the outlay is provided wholly or in part from funds of a public nature, but not included in the financial estimates and accounts of the empire, or from contributions from the public. In this category fall works such as a town hall or reservoir for a municipality, a school or hospital for which funds have been raised by subscription, churches built from private donations, and the like.

*Famine relief works.*—The public works department is responsible for the preparation and maintenance of the programme of famine relief projects, and is also liable, in times of famine, to be required to undertake famine relief works. This expenditure is occasionally of considerable magnitude; for example, in the year 1900-01, of a total expenditure on works of Rs. 2,10,91,573 in Bombay no less than Rs. 1,79,28,857 was incurred on works in connection with famine relief.

Present organization of the department.

7. Under the present organization each province is divided into a number of public works divisions in charge of executive engineers of (usually) between 10 and 20 years' service, the size of a division varying considerably according to territorial considerations and to the amount and extent of the work contained within it. Each division contains a number of sub-divisions, usually 3 or 4, in charge of assistant engineers, selected upper subordinates or (occasionally) selected lower subordinates. The divisions are grouped into circles in charge of superintending engineers, officers of (usually) 20 to 28 years' service, each circle consisting of from 3 to 6 or more divisions. The general control of all engineering operations in each province is vested in one or more chief engineers, who are also secretaries to the local Government. In some provinces where irrigation works are very extensive, e.g., the Punjab and United Provinces, the public works department is divided into two separate branches, the buildings and roads branch dealing with all matters connected with communications, buildings of all kinds, sanitation, electricity, waterworks, etc., and the irrigation branch dealing with irrigation matters only. Elsewhere less distinction is made and the work is divided and officered as may be found most convenient. In all provinces (except Assam) there are two chief engineers, one for buildings and roads and one for irrigation, while in Bombay and the Punjab, on account of the magnitude of the operations, there are three. In addition to this staff there are in the major provinces a certain number of specialist officers, such as architects, sanitary and electrical engineers, who are attached to the buildings and roads branch of the department.

The Government of India exercises general supervision and control over the provincial public works expenditure, and maintains a detailed and direct check over the organization of the department and over matters connected with its personnel. The public works department of the Government of India is under the member of council in charge of the revenue and agriculture portfolio, who is assisted by a secretary, a deputy secretary and an under secretary, all of whom are drawn from the ranks of the department itself.

8. The duties of the several classes of departmental officers may briefly be described as follows:—

(a). In the *executive engineer* is vested the executive charge of his division, and he is responsible for the management of all public works within his division. He arranges for all details of their construction, superintends the work of his assistants and maintains the accounts. He is responsible for the proper custody and efficient repair of all government works within his charge, and it is his duty to prepare designs and estimates for new works when called upon to do so. He is further required to exact a proper performance of their duties from the establishment subordinate to him, to pay particular attention to the economic application of labour and materials, and to prevent waste; for these purposes he is required to tour frequently over his charge. He is the professional adviser of all departments of the administration within the limits of his charge, and is required to keep himself in touch with the local officers of other departments in regard to their requirements. In some provinces he is also the technical adviser on public works to local bodies and may, at the discretion of the local Government, be called upon to execute works on their behalf. Within certain limits, the executive engineer may be empowered to accord technical sanction to estimates for works and repairs at the discretion of the local Government.

Duties of officers  
of the public  
works depart-  
ment.

(b). The *superintending engineer* is the administrative head of his circle, and is responsible for the efficiency of the executive system throughout the several divisions therein, and for seeing that all orders in regard to the execution of works and maintenance of accounts are carried out. He may prepare the designs and estimates of the more important works himself, or entrust the same with general instructions to the executive engineer, as he may deem fit. It is his duty to examine and record his opinion upon all projects submitted through him to higher authority, particularly as to the suitability of the designs and the reasonableness of the rates. He is expected to make frequent tours of inspection, and may, within certain limits, accord final or technical sanction to estimates for works and repairs at the discretion of the local Government.

(c). The *chief engineer* is the administrative and professional head of the department, and as such exercises general control over all engineering operations and is professionally responsible for the character and suitability of all designs and estimates submitted through him to the local Government for sanction. He is required to give all legitimate support to the accounts officers in enforcing strict attention to the rules relating to disbursements of money and the custody of stores. He is responsible for the preparation of that portion of the budget estimates relating to his department, for the control of the annual grants, and for advising the local Government in regard to postings, transfers, etc., of superintending and executive engineers.

(d). The duties allotted to the *specialist officers* of the department vary in the different provinces. The consulting architect is, in general, responsible for the design of the more important buildings, and his advice on architectural matters is available for the officers of the depart-

ment whenever they desire to consult him. In Bombay 17(viii). he is also responsible for the construction, in the presidency town, of all buildings designed by himself. The sanitary engineer prepares all major sanitary projects, and in some provinces he also maintains a staff of engineers 79(v). and undertakes the execution of his schemes. The sanitary engineer is subordinate to the chief engineer in all provinces except Bengal and Bihar and Orissa, 79(vii). where he works directly under the branch of the general secretariat which is responsible for local and municipal affairs. The electric inspector carries out statutory inspections under the Indian Electricity Act and in addition, in all provinces except Bombay, acts as adviser to the local Government on electrical matters; in Bombay 36(i). this latter function is performed by a separate electrical engineer.

**Acknowledg-  
ment of the past  
work of the  
department.**

9. Before proceeding to examine in detail the present administration and organization of the department, and to suggest such reforms as appear to us to be required, we desire to place on record our warm appreciation of the great work which has in the past been done by the public works department for the development of India, and to which so much of its material prosperity is due. The department was organized to suit the then existing conditions of India, and in making recommendations for changes in the present organization we in no way wish to imply that the policy adopted in the past was not suitable to those conditions. The changes we suggest are designed to meet the altered circumstances of the present day, which have resulted in great measure from the work of the department itself. We have therefore endeavoured to examine its working from a wider standpoint, and to determine whether it has advanced *pari passu* with the general development of the country. We wish also to make it clear that, in any criticism we may have to make as to its efficiency or organization, we are far from desiring to attribute any failure to the past or present members of the service, which includes a body of public servants who have done work of the greatest value for India, and whose devotion to the public interests is, we are convinced, second to that of no other Indian service.

### CHAPTER III.

#### TRANSFER OF PUBLIC WORKS TO DISTRICT BOARDS.

**Public works  
undertaken by  
government and  
by local bodies.**

10. The main branches of the administration in charge of local bodies vary somewhat from province to province, but normally include roads and other communications, primary education, medical institutions, sanitation, vaccination, veterinary institutions, markets and rest houses, pounds and ferries, including the construction and maintenance of buildings relating thereto. There is, however, no clear distinction between the classes of public works undertaken by government and by local bodies. In Madras, all roads in rural areas 77(i). (with very few exceptions) are in charge of the district

boards; in Bengal and Bihar and Orissa, government maintains only the main trunk lines of road communication; whilst in most other provinces all the more important roads are in the direct charge of the public works department, the less important being left to the district boards.

- 31(i). There are no district boards in Burma, the road cess  
7(ii). collections being administered by the deputy commissioner of each district through the agency of the public works department. The local bodies in all provinces except Burma are responsible for primary education, including the provision of buildings, but there is no clear dividing line in secondary education, such schools being maintained by both government and local bodies to a varying degree in the different provinces. Similar instances also occur in other branches of the administration.

There are also variations in the agency by which public works are constructed and maintained. As a general rule all government roads and buildings are in the direct charge of the public works department, although exceptions occur, some of which are noted below.

- 63(ii). A few municipal corporations of the presidency and other large cities employ their own engineering staff competent to meet all their requirements; municipal councils of important towns usually entertain an engineering establishment adequate to meet all ordinary requirements, but invoke the assistance of the public works department for the preparation, and sometimes the construction, of large projects such as water-works and drainage; small municipal towns as a rule engage only a subordinate establishment sufficient to carry out petty works and repairs, and rely on the public works department for larger projects.

- 31(ii). The district boards of Madras, Bengal and Bihar and Orissa entertain full engineering establishments with a fairly well qualified district engineer in charge, and carry out practically all their own works. In other provinces, district boards generally employ a less highly trained agency to deal with their minor works and repairs, other works being executed for them by the public works department, for whose assistance they ordinarily pay a percentage on the value of the work done. The system is least developed in Bombay and the United Provinces, where the district boards employ only a small subordinate agency to carry out original works costing less than Rs. 2,500 and Rs. 3,000 respectively and repairs. A trial has been made in the Central Provinces of a different arrangement, under which a local fund divisional engineer is appointed for each commissioner's division, at the expense of the district boards and smaller municipalities utilizing his services for their works, and in addition the construction and maintenance of certain government roads and buildings are entrusted to the local fund divisional engineer, grants to cover the expenditure being made to the district boards concerned. The district boards of Bengal and Bihar and Orissa also occasionally carry out small works for government.

11. The average annual expenditure during the three Expenditure on years from 1911-12 to 1913-14 on works executed through public works the agency of district board establishment in the major by local bodies. provinces, and on the establishment employed thereon, is tabulated in the statement below. The details of this

expenditure are shown in Statement II attached to this report.

Province.	Works.	Establishment.
	Rs.	Rs.
Madras . . . . .	78,76,436	9,43,972
Bombay . . . . .	15,82,906	1,83,800
Bengal . . . . .	36,24,590	4,81,290
United Provinces . . . . .	8,58,334	85,280
Punjab . . . . .	22,16,328	2,36,230
Burma . . . . .	1,63,371	59,810
Bihar and Orissa . . . . .	31,29,352	5,06,783
Central Provinces . . . . .	8,71,301	1,25,463
Assam . . . . .	8,61,588	59,870
<b>TOTAL . . . . .</b>	<b>2,11,84,206</b>	<b>26,82,498</b>

The expenditure on works executed by municipal committees is not available for all provinces. The average for the triennium ending 1913-14, in so far as figures have been supplied, is tabulated below :—

Province.	Works.	Establishment.
	Rs.	Rs.
Madras . . . . .	..	..
Bombay . . . . .	30,41,485	6,66,804
Bengal . . . . .	7,25,921	1,06,074
United Provinces . . . . .	18,50,448	1,29,438
Punjab . . . . .	..	..
Burma . . . . .	31,15,359	3,25,945
Bihar and Orissa . . . . .	8,58,552	36,415
Central Provinces . . . . .	8,56,919	36,226
Assam . . . . .	67,851	10,857

Defects of existing arrangements.

12. The main defect of the present system is the duplication of engineering staff entailed thereby, one establishment being employed for roads and buildings directly managed by government, and another for public works in the charge of district boards, both working alongside each other in the same area. The evidence received by us shows the unsuitability and extravagance 34(i). of this arrangement. The evil is intensified in Madras, where a third engineering establishment is employed 59(i). by the collector for the maintenance of small government irrigation tanks, with the result that the district engineer travels along a road to supervise its maintenance, the public works officer to look after the buildings on it, and the collector's overseer to repair the small irrigation tanks near it. Economy is thus sacrificed by the employment of separate staffs to do similar classes of work in the same area, and we are not satisfied that such duplication of staff is necessary to the requirements of government or of district boards. As stated above, there is no clear distinction between the classes of work undertaken by government and by local bodies, or the agency by which they are constructed, and with the advance of local self-government the sphere of work undertaken by local bodies will increase and that of government will decline.

Another evil of the present system is that in many districts the public works expenditure of a district board alone is not large enough to justify the employment of 30(i). a competent engineering staff. We are in full agree-



Decentralization Commission Report, para. 748.

- ment with the principle of the recommendation of the Royal Commission on Decentralization that a district board should in any case maintain an adequate staff for its own works, but this is not possible where the expenditure does not permit of the employment of a competent district engineer. This difficulty was the main cause of the failure of a system in force in the United Provinces from 1882 to 1887, during which period district boards employed an engineering staff to carry out their own works and to make and maintain all roads other than trunk roads. After four years of working, it was abandoned because it was found that the dual establishment for provincial and local works was costly and involved a waste of power, that the district boards did not secure a sufficiently good engineering staff and that there was no control by a superior supervising staff.
- 28(iii).
- 32(i). The defect of absence of control by a superior supervising staff over the public works of local bodies is common to nearly all provinces. Whilst the designs and estimates for all projects except petty works are subject to the technical scrutiny and approval of superior officers of the public works department, these officers exercise little or no supervision over construction. The ill-effects of the absence of this supervision are intensified by the employment of a poor subordinate staff. Although in some provinces (e.g., Bengal and Bihar and Orissa) the superintending engineer is *ex-officio* an inspector of works of local bodies, the evidence received by us shows that in practice he exercises little supervision.
- 32(ii).

To remedy these defects, two alternatives are possible, the first that all public works should be undertaken by the public works department which is the system at present practically in force in Bombay and the United Provinces, the second that all ordinary public works should be transferred to local bodies, and for the reasons stated below we recommend the latter alternative.

Public Services Commission Report, Annexure XVIII, para. 4.

13. The Royal Commission on the Indian Public Services has recommended that the public works department should confine itself strictly to work which cannot be discharged either by private enterprise or through the agency of district boards and municipalities with the necessary financial support from government. In the next chapter we propose to make some suggestions for the encouragement of private enterprise, and we now deal with the second portion of this recommendation, regarding the transfer of public works to local bodies.

**Transfer of public works to district boards recommended.**

- 28(i). In 1892 a scheme was introduced in a substantial portion of Bengal, exceptions being made of districts with an irrigation staff and of certain backward tracts, for the transfer from the public works department to district boards of the maintenance of all public buildings and roads. The scheme also included the construction of original works for government by district engineers (not by district boards), who were given allowances for this additional work. The funds placed at the disposal of district boards for the maintenance of the works transferred to them were based on the average annual expenditure incurred on them during the previous four years, whilst for the construction of original government works the district engineer was provided with the necessary additional establishment. After four years of trial, the working of this scheme was examined by a committee, the majority of whose members condemned it, mainly

on the ground of deterioration of the standard of work and unnecessary increase of rates, and recommended the abolition of district board engineering establishments, except a small staff for undertaking petty works only, and that all other public works, whether required by government or by district boards, should be undertaken by the public works department. This recommendation was not accepted by government because it involved a radical departure from the accepted principles of local self-government. Since then, however, government buildings and trunk roads have gradually been taken back by the public works department. We have carefully examined the report of the committee and the correspondence relating thereto, and are satisfied that the defects found in this Bengal scheme were not inherent in the main principle, and that failure was due to the unsuitability of the district board engineering establishment for the large additional work thrown upon it, the insufficient professional control provided by government and the lack of proper audit of expenditure. These defects are, however, easily surmountable. With all public works in the charge of one agency, we believe that there will be sufficient work, and there is certain to be a future increase, in all except small and backward districts to give full-time employment to a district board engineering staff of suitable qualifications. We are further of opinion that government grants to cover the cost and reasonable establishment charges will enable district boards to entertain such a staff. Adequate control by a government staff of inspectors of works with a small central agency of administrative and technical experts can be provided, whilst efficient audit can be secured by an expansion of the existing system of audit of local fund accounts. Another important objection urged against the proposal is that the government agency for dealing with famine relief will be weakened, of which the public works department is the backbone. We fully recognize the importance of this aspect of the proposal, but consider that the objection will be overcome by government taking the power to requisition the district board engineering staff both for relief works in time of famine and for the preparation of famine programmes. The establishment and maintenance of relief works in time of famine or scarcity are already included within the duties of district boards in the various local self-government Acts. 43(iii).

In paragraph 12 we have stated the objections to the present dual arrangement, and we are strongly opposed to the alternative proposal for the transfer of district board works to the public works department. The centralization of such work in a government department would result in a serious discouragement to local self-government, which it is the policy of government to advance. One of the important recommendations of the committee appointed by the Government of Bombay to consider and report on the extension of the principles of local self-government is that district boards should employ their own engineering establishments for the execution of their works, but whilst this would be a considerable advance on the present backward state of affairs in that presidency, we do not consider that it goes far enough as a declaration of ultimate policy. The general trend in the advance of local self-government in all countries is for the transfer of public works from

Report of the  
Committee 1915,  
Chap. II, paras.  
55 to 64.

government to local bodies, and we recommend that it should be the declared policy in India to transfer public works (excluding irrigation which was outside the scope of our reference) from the public works department to local bodies. Important advantages of this change will be that it will give to local bodies a considerable share in settling the lines of development of the tracts for which they are appointed, and will bring public works into proper relation with the district and divisional administrations. We believe that district boards will welcome such an extension of the sphere of local self-government, and that at least in advanced districts they can be entrusted with this duty under proper safeguards.

27(i).

Decentralization  
Commission  
Report, para.  
746.

14. The Royal Commission on Decentralization has recommended that "routes of general trade or through main local roads should be a charge of district boards, that sub-district boards should be responsible for minor roads, *i.e.*, those within the *tahsil* or sub-district area." Whilst this may be a suitable classification from the standpoint of financial responsibility, we are opposed to any arrangement involving the employment of three separate engineering establishments for the maintenance of different classes of roads in the same area. We recognize that government must secure the efficient maintenance of the main through routes of communication, important from military, trade or other considerations, but this does not necessarily involve the entertainment of a separate engineering staff for that purpose. In our opinion, the maintenance of all roads, under proper safeguards, should in principle be the function of local bodies, and the policy of government should be directed towards the eventual introduction of this system in its entirety. It has worked satisfactorily in the Madras presidency, where we have no reason to believe that the roads are less efficiently maintained than in other parts of India, and with the advance of local self-government we recommend that the same system should be gradually extended to other provinces. Similarly, we consider that the preparation of projects for new roads and their construction should not ordinarily be beyond the capacity of the district board engineering establishment, subject to the supervision of the inspecting staff recommended in our organization.

Proposed  
arrangements for  
roads and build-  
ings.

77(iii).

If this view is accepted, it follows that government buildings should ordinarily be entrusted to the same agency, in order to avoid unnecessary duplication of staff. We, therefore, also recommend that the construction of buildings required by government should generally be entrusted to local bodies. Exceptions would, of course, be made of large important building projects beyond the competence of the district board engineering staff, and similarly it will probably be convenient for local Governments to maintain under their own control government buildings situated at the headquarters of the province and any other important building centres sufficiently large to form a separate charge. Provision for such purposes is made in our scheme for the reorganization of the public works department.

As regards the maintenance of government buildings, we are strongly impressed with the desirability in any case of relieving the engineering staff of this mass of petty repairs work, which requires no engineering skill,

absorbs an undesirable amount of the time and energy of the trained staff, and has a deadening effect on their technical skill. Much of the evidence received by us 2(ii). recommends that each department should be responsible for the ordinary annual repairs of the buildings occupied by it, an arrangement that is already in force in some 2(i). provinces in the police and jail departments. The main arguments urged against this proposal are that 2(iii). it would absorb too much of the time of officers to the detriment of their more important duties, and that the scarcity of reliable petty contractors necessitates some expert supervision even for simple repairs. We are not impressed by these arguments, and although some difficulty may be experienced at the start we recommend that the ordinary annual repairs of government buildings should generally be entrusted to the department occupying them, not as disbursing officers under the public P. W. D. Code, works department, but under a system of contract grants Vol. II, para. fixed with reference to the class of building and to the 1458. average cost of past maintenance at a percentage of the capital cost and placed at the disposal of the department like other contract contingent allotments. The buildings should be inspected at suitable intervals by an engineering officer in order to certify to their condition. Exceptions might, if considered desirable, be made of considerable groups of buildings at the headquarters of an engineering officer of the district board or government establishment, where supervision would not cause so much interference with other duties. It may also be desirable for special reasons to exclude officers' residential buildings from this arrangement. We are opposed to any arrangement under which a department would entertain any separate permanent technical building establishment, and therefore consider that special repairs, or additions requiring professional supervision, should be carried out in the same manner as original construction.

In tracts provided with government irrigation, an alternative arrangement would be for the officers of the 51(ii). irrigation branch of the public works department to take over government roads and buildings, which is already done in some provinces and which might be a suitable course provided that the works are conveniently situated within their charges and will not interfere with their own legitimate duties, but we recognize that difficulties may arise owing to irrigation charges not coinciding with district boundaries and from the multiplication of the duties of an irrigation specialist, and as we were precluded by our terms of reference from inquiry into the working of that branch, we make no recommendation on this point.

**Financial arrangements for the transfer of works to local bodies.**

15. When government works are thus made over to local bodies, it will be necessary for government also to transfer the requisite funds to the local body concerned. In our opinion the assignment should cover not only the cost of original works and the average cost of maintenance, but also the cost of the additional establishment that it will be necessary for the district board to employ on this account, calculated at a percentage of the expenditure on works. It will be desirable to revise the amount of the assignment for recurring charges at stated intervals of (say) five years, with reference to past actuals. We consider that the local body should be required to keep the financial accounts of public works in such form as

the local Government may direct, which should include a ledger account of assignments for particular works.

27(viii). Whilst we recognize the advantages of lump sum grants to local bodies for purposes within the sphere of their own functions, in order to allow freedom of decision as to the objects to which funds should be devoted, this does not apply to individual public works undertaken by them on behalf of government.

16. In provinces other than the Central Provinces, **System of administration.**

27(vi). the district officer is ordinarily the chairman of the district board, and witnesses in favour of the transfer of government works to district boards generally consider that the interests of government in the administration of public works will be adequately safeguarded so long as this continues. But in some provinces an advance in local self-government is contemplated by the appointment of a non-official chairman elected by the board, and under such conditions it is generally recognized by those who gave evidence before us that for the present at all events some alternative method is desirable for the representation of government interests on the body entrusted with government works. A proposal was made by the Chief Commissioner of the Central Provinces for the creation of a separate board of works for each district, composed of representatives of all the interests concerned, including government, the district board and municipalities, which should be entrusted with the management of public works. Although this proposal has several advantages we deprecate the creation of another public body in each district, which would interfere with the functions of existing bodies, and we prefer an arrangement under which the management of public works would be delegated by the district board to a committee of its members, on which the head of the district would also sit as chairman, even if not a member of the district board. Subject to its general control, the district board would be required to delegate to this committee the powers necessary for the management of all public works, including the power of appointment of the subordinate staff. We do not recommend that the inspector of works should be a member of this committee, but he should attend meetings when invited to do so or when his presence may be helpful and give his advice. All inspection reports and recommendations of the inspector of works should stand referred to the committee.

8(i). 27(vii). ✓

17. (a). *District engineers.*—An essential feature of our scheme is that each district board should employ a district engineer of sufficient qualifications, together with the necessary subordinate establishment, to carry out all ordinary public works required both by the district board and by government. Districts vary considerably in the importance of their public works, but in all except backward tracts the joint expenditure will usually be large enough to justify the employment of a competent trained engineer. We recognise that the salary must vary from province to province and from district to district in accordance with local conditions, but as a general guide we suggest the following scale as likely to meet requirements:—

	Rs.
1st class districts . . . . .	800—40—1,000
2nd class districts . . . . .	500—40—700
3rd class districts . . . . .	300—20—400

We are opposed to any arrangement under which the district board engineer will receive separate allowances for government works, the system at present in force 29(vi) in Bengal and Bihar; he should be a whole-time officer of the board, paid as such and responsible for all public works entrusted to him.

Some witnesses have recommended that all district 29(v) board engineers of a province should be formed into a service, under which an officer would start in a less important and be promoted in due course to a more important district, on the grounds that such a provincial cadre would have the advantage of securing a regular flow of promotion and would obviate the evil of an engineer spending his whole service in one district with little or no promotion. But this arrangement would restrict the powers of district boards in the selection of their engineer, which would in our opinion be an undesirable interference with local self-government, and would weaken their responsibility for the efficiency of their staff. Difficulties would be likely to arise over transfers ordered by the local Government, for a district board might be unwilling to part with its engineer and accept the proposed transfer, and it would practically involve the creation of a new government service somewhat similar to the public works department. In our opinion the disadvantages outweigh the advantages, and we recommend that each district board should be free to recruit its engineer in the open market from the best candidates available in India. We believe that in practice this will secure one of the advantages claimed for a provincial cadre, because engineers who have proved their worth in small districts will naturally be considered favourably as candidates for the posts in larger districts.

At the same time some government control over the appointment, dismissal and emoluments of district board engineers is necessary to secure the interests of government and the efficient working of the scheme, and we recommend that the professional qualifications and the scale of pay for the different classes of district engineers should be prescribed by the local Government, that each appointment should be subject to the approval of the commissioner, that the dismissal of a district board engineer should be subject to similar approval, and that the local Government should have the power to require a district board to dispense with the services of a district board engineer who, in their opinion, is unfit to hold the appointment. In most provinces these powers already 29(i) exist.

A pension scheme is unsuited to this class of appointment, but we recognize the importance of some provision for the future of district board engineers, and we recommend the establishment of a compulsory provident fund on the lines of that in force in state railways, to which both the district board and the individual would contribute. Our colleague, Rai Bahadur Lala Ganga Ram, dissents from the recommendations made in this paragraph, for the reasons recorded in his minute attached to this report.

(b). *Inspectors of works.*—For the proper control of public works under our scheme, we consider it necessary to provide a government service of inspectors of works 27(v).

who would be qualified engineers of experience competent to guide professionally the operations of district boards and to safeguard the interests of government. They should, ordinarily be recruited from selected district board engineers, but we would not wholly restrict recruitment to that source if better candidates are available from outside. Such officers should be engineers of standing, whose status in their profession should carry due weight, and the scale of salary that we recommend is Rs. 1,250 rising by annual increments of Rs. 50 to Rs. 1,750, which should attract officers of the status of senior executive engineers and superintending engineers. Their appointments should be permanent but not pensionable, and they should be required to join the provident fund established for district board engineers. At the outset we recommend that there should be one inspector of works for each commissioner's division where the scheme is introduced, which will much facilitate its working, but when initial difficulties have been overcome and experience has been gained, it should be possible to reduce the number and increase their charges.

We do not consider it desirable to give to inspectors of works powers of direct control over district boards or their engineering staff; their functions should be advisory, control being exercised by the commissioner and local Government. Their position should be that of technical adviser to the district boards and to the commissioner. Their principal duties should be to give professional approval to the plans and estimates of public works both of government and of district boards, subject to the money limits fixed for each by the local Government; to inspect works and bring any defects to the notice of the district board, and generally to assist the district board in its conduct of public works; to attend important meetings of the public works committee and give professional advice; to inspect the offices of district board engineers; to submit to the commissioner confidential reports on the work of the district board engineer, and to bring to his notice any case of a district board engineer whom he considers unfit for his appointment; to report to the commissioner any cases in which the rules for the conduct of public works have not been observed; to inspect the condition of government buildings, the ordinary annual repairs of which have been made over to the department occupying them; to prepare the plans and estimates of any government work not entrusted to the district board, and to arrange for its execution, when so required. In this matter we attach great importance to the personal performance of his duties by the inspector. These duties should not be delegated to subordinates or be conducted by correspondence from a centre.

(c). *Chief engineer and specialist staff.*—We do not propose any material alteration of the central organization at the headquarters of the province. The chief engineer will remain the head of the department, on Rs. 2,500—50—2,750, with a personal assistant of the status of an inspector of works, and will control the inspectors of works, from which branch of the service he will ordinarily be selected. He will be assisted by three specialists for sanitary, architectural and electrical engineering, where the provincial conditions justify their

employment. In a later chapter (paragraphs 53 and 54) we make recommendations as to the method of recruitment, conditions of service and salary of these specialist appointments.

For the construction of government works not entrusted to local bodies, we do not propose that any permanent staff should be maintained beyond that recommended later on for the specialist branches of the service; such works should be carried out under the direct control of the specialist concerned or the inspector of works as the case may be, the necessary temporary establishment being engaged for the purpose.

Estimate of  
cost.

18. In framing our proposed scales of pay for the government service of inspectors of works and of the central staff of chief engineer and specialists, we have provided prospects which will, we believe, compare favourably with those recommended by the Public Services Commission for officers of the public works department of over 15 years' service. Our suggested scale of pay for district board engineers is designed to provide prospects somewhat superior to those recommended by the Public Services Commission for officers of the public works department of under 15 years' service recruited in India. We are unable to make any accurate comparison between the total cost of our scheme and that of the existing establishments of the public works department and of district boards, because this involves the grading of districts into classes, which we are not in a position to do, and because in some provinces the public works department establishment is jointly employed on irrigation and buildings and roads. We have, however, endeavoured to apply our scheme to the United Provinces, where the buildings and roads branch is separate, but which gives the most unfavourable comparison possible, because there is no duplication of staff, district board works being executed almost wholly by the public works department, and we estimate that even there the cost will not exceed that of the existing arrangement. We attach a statement (Statement III) giving details of the comparative cost in that province, which shows that the cost of our proposed organization will be Rs. 5½ lakhs, as against Rs. 5¾ lakhs under the proposals of the Public Services Commission and Rs. 6 lakhs\* at present. In provinces where the public works department and district board establishments are duplicated, we are convinced that there will be a considerable saving in engineering staff and also in office establishments and travelling allowances.

Public Services  
Commission  
Report,  
Annexure  
XVIII,  
para. 21.

Control by  
government.

19. With the transfer of government works and the corresponding funds, we recognize the necessity for control by government both over such government works and also in the interests of the public over the works of local bodies. In the preceding paragraphs we have already dealt with certain forms of such control—the representation of government on the public works committee, audit of expenditure of government grants, the appointment, dismissal and emoluments of district board engineers, and the functions of inspectors of works. It remains for us to deal with other aspects of this question. We attach (Appendix A) a note by our colleague, Sir Noel Kershaw, on the functions of the Local Government Board, England and Wales, in relation to public works. It will be seen that even under such an advanced system of local self-government, the Local Government Board



exercises very substantial powers of control. Public works of any importance are almost invariably financed by loans, to which the sanction of the Board must be obtained. The application of a local body for sanction to raise a loan is examined not only with reference to the financial arrangements of the loan; the necessity for and suitability of the project is investigated by the technical specialist staff of engineers of the Board. In important cases a local inquiry is held into the object and nature of the proposal, at which any person interested can represent his views, associations of rate-payers, property-owners and the like being sometimes represented by counsel. This method of control is inapplicable to Indian conditions, where public works such as buildings and roads are generally constructed out of revenue and not out of loan funds. If a local authority neglects to keep a highway in repair, the remedy is by indictment of the local authority concerned. Again, if a local authority fails to provide necessary sanitary works, complaint may be made to the Local Government Board by any interested person, and if satisfied of the default, the Board may make an order for the completion of the necessary work, enforceable by writ of *Mandamus* from the High Court, or may employ some person to do the work and collect the cost as a receiver of rates. The powers of auditors, appointed by the Board, are also very considerable. Any rate-payer or property-owner may attend the local audit and object to any item in the accounts. The auditor is required to disallow any item of account contrary to law and surcharge the same on the person making or authorizing the making of the illegal payment, and to charge against any person accounting the amount of any deficiency or loss incurred by the negligence or misconduct of that person, or of any sum which ought to have been but is not brought into account by that person. We do not consider that local self-government in India has sufficiently advanced to admit

- 27(ix). of powers being taken to surcharge individual members of local bodies, but we consider that there should be
- 27(x). power to surcharge a local fund, if a government grant for a particular work has been improperly expended. The powers of the Local Government Board depend largely on the initiative of representatives of rate-payers, property-owners and other interested persons, but public opinion is not generally advanced enough in India to perform a similar function. We have examined the various local self-government Acts, and we recommend that for the present government should take the following powers of control over the proceedings of local bodies entrusted with government works :—

(a). The collector may suspend, and the commissioner may cancel, any resolution relating to public works.

(b). The commissioner may require a local body, which has neglected a particular service after being called upon to execute it within a reasonable period, to take such action as he may consider desirable, subject to an appeal to the local Government against such order. (Compare paragraphs 803 and 860 of the Report of the Decentralization Commission).

(c). The commissioner may require the execution of a public work at the cost of the local fund, if a government grant for that particular work has not been properly expended.

(d). A member shall be prohibited from having any pecuniary interest direct or indirect in any contract given by a local body.

(e). The local Government may dissolve any local body refusing to take over government works and require a fresh election.

(f). The local Government may supersede a local body for incompetency or wilful neglect of duty.

In Madras where there are no commissioners, the local Government should nominate an officer to discharge the functions allotted to the commissioner in the preceding paragraphs. Experience will probably show that some of these safe-guards may be dispensed with, either generally or in particular areas.

**Municipal works.**

20. In the above sketch of our proposals, we have generally recommended the transfer of government works to district boards, because we believe that local body ordinarily to be the best suited for the purpose, but we contemplate that in some cases a similar arrangement may be made by government with a municipal body for works situated in their town, if that is found to be more suitable. If a town is large enough to employ a competent engineering staff, it may also be desirable to transfer to it government works within its jurisdiction. In smaller towns the municipal committee will be able to arrange with the district board for the execution of its works on terms to be mutually agreed upon. Where small municipalities are situated within easy reach, *e.g.*, in the outskirts of the presidency towns, they may find it convenient to combine 63(i). for the employment of a joint engineering staff.

**Military works.**

21. The military requirements in regard to public works are generally provided by the military works services, but in most provinces a small amount of such work is undertaken by the public works department in places where it cannot be conveniently managed by the separate military organization, the average annual expenditure on such works being about Rs. 9 lakhs, inclusive of Burma, where all military requirements are met by the public works department. We consider that such works can with other government works be equally well undertaken by local bodies.

Under the present system of recruitment the public works department provides appointments for thirty Royal Engineer officers, being a portion of the war reserve, in the irrigation and buildings and roads branches, of which the latter usually absorbs about twenty-four. We recognize that our proposals for a smaller government service will make it more difficult to employ so many Royal Engineer officers, and will not provide such a good training ground, but with the development of irrigation and railway construction it should be possible to employ more Royal Engineer officers in those branches.

**Recommendations for immediate progress.**

22. Whilst recommending that the policy of government should be to transfer government works to local bodies, we recognize that this cannot be carried out on a large scale at once, and that progress towards this end must be gradual. It remains for us to state the provinces in which we consider that local conditions are sufficiently advanced to warrant an immediate commencement. In our opinion local self-government has already progressed sufficiently to justify its introduction in the more advanced districts of Madras, Bengal and Bihar and Orissa, where the district boards employ an engineering

staff for their own works, and are in charge of nearly all the roads. In Madras, government buildings should be made over to the same agency instead of remaining with a separated irrigation branch. We also recommend 60(i). that the petty irrigation works at present in charge of the collectors may be made over to the district boards, and in addition some of the scattered minor irrigation tanks managed by the irrigation branch. In our opinion the present arrangement is unsuitable, and in order to give the district boards a living interest in the maintenance and development of these small irrigation works, we recommend that the district board should be given a liberal percentage of the irrigation revenue derived therefrom. In other provinces such small irrigation tanks are generally not government property, and are managed by their owners or the village community. In the Central Provinces and Berar we consider that local conditions are also suitable for the introduction of the system in the more advanced districts, particularly of Berar, and that it will give better results than the present arrangement of divisional local fund engineers. A trial may also be made in a selected commissioner's division of the Punjab, and a start might possibly be made in some districts of Assam. In Bombay and the United Provinces the district boards have not hitherto even undertaken their own public works, and we recommend that a substantial advance on this backward condition of local self-government should be made by the introduction of our scheme in selected commissioners' divisions. No district boards exist at present in Burma, but if and when they are introduced our general policy will doubtless be considered.

23. During the transition stage from the existing Arrangements arrangement to the complete transfer of government works during the to local bodies, considerable difficulty will arise not transition stage. only in the recruitment of the public works department but also in the employment of the present staff. The curtailment of future recruitment to the department will depend upon the extent to which our recommendations are accepted, and an estimate of the time within which it will be possible to give effect to them. As regards the future of the staff at present employed in tracts where it is decided to introduce the change, we anticipate that the district boards will be ready to employ some of the officers and subordinate establishments and that the staff will be willing to accept this service under the terms laid down in Article 803 of the Civil Service Regulations. Some other officers may be employed in vacancies in other provinces and also in the irrigation branch. Failing such alternatives, there remains the course of enforcing compulsory retirement on the abolition of the appointment under the terms of Article 426 of the Civil Service Regulations, but the transition stage will undoubtedly be a long one and we scarcely anticipate that it will be necessary, except perhaps in a few cases, to resort to this expedient. It would certainly be desirable to avoid it.

#### CHAPTER IV.

##### ENCOURAGEMENT OF PRIVATE ENTERPRISE.

24. We now deal with the second important subject included in our terms of reference, which is whether the methods at present adopted under the existing system private enterprise is sufficiently encouraged for the execution of works.

All work carried out by the public works department is executed by one of three methods, either by piecework, or by contract, or by the employment of departmental labour. Piecework is the system chiefly employed. A piecework agreement is essentially a continuous tender by the contractor to execute specified work at specified rates without reference to quantity or time; if the contractor proves unsatisfactory, the engineer in charge can dispense with his services at any time by paying for the amount of work executed up to date, and similarly the contractor is at liberty to cease work whenever he desires to do so. Piecework contractors have usually little or no professional knowledge and employ no supervising staff, all supervision being carried out by government agency; they provide the labour and in most cases the ordinary building materials. Contract entails a regular legal agreement for the construction of a complete work either at a lump sum or more usually in accordance with a schedule of rates, and is seldom adopted except in large centres where firms of standing and repute are available. The up-country contractor employs for the most part no professionally skilled supervising agency, and the government staff usually sets out, supervises and measures the work, and supplies most of the tools and plant required and the stores imported from England. The execution of works by the direct agency of the department employing daily labour is ordinarily practised only in the case of petty repairs or in places where circumstances are exceptional and not even piecework contractors are available. When carrying out work departmentally the engineer in charge takes the place of the contractor, employing his own labour and either manufacturing his own materials or purchasing them at market rates; this method therefore entails constant supervision and complicated accounting. As already stated piecework is the method mainly employed, in some cases tenders being accepted for completed work, in others for labour only. We were informed that in Madras, during the past five years, no less than 42,467 piecework agreements have been entered into as compared with 625 regular contracts. Departmental execution of works is more common in 23(i). Madras than in other provinces, and is being followed even for the construction of important buildings in Madras town, such as the engineering college costing about Rs. 12 lakhs of rupees for works only, as an experimental measure in order to test the real cost of construction; we do not consider that this system should be followed for such large projects.

Discussion of arguments in favour of the piecework system.

25. The majority of the officers of the public works department who have given evidence before us have declared themselves in favour of the piecework as opposed to the regular contract system. Their main contentions are that the large contractor, as the term is understood in more advanced countries, is practically non-existent in India, that the contractors available are nearly always middlemen and not professional builders, employing pieceworkers for the execution of their works, and that hence they demand higher rates than the piece-workers would be content with if employed directly while requiring the same amount of supervision on the part of the departmental staff. Our inquiry shows that the number of reliable firms of contractors employing skilled staff is extremely small outside Calcutta, but it appears to us 21(iii). 67(i).

- that the main reason for the absence of the master contractor lies in the public works department itself. As now organized that department, with its detailed subordinate supervision, is working rather as a body of contractors than of engineers, and there is consequently no room for the introduction into the system of a further contracting agency, but we can find no reason why, if the organization of the department is suitably modified, contractors in the accepted sense of the term should not arise in India as in other countries. The "middleman" contractor appears to us to be a direct outcome of the present system, and we doubt whether under a different system he could survive in competition with a regular contractor who would, in his own interests, employ the most economical methods and act as middleman only when compelled to do so by circumstances. In the absence of such contractors, and with the public works department organized as at present, it is doubtless cheaper for the latter to employ their piece-workers direct, but it must be remembered that government is in reality playing the part of the master contractor itself and incurring large expenditure on staff which should not rightly be charged to the establishment of the employer at all. Whilst we are wholly unable to accept the extreme recommendation made to us by some witnesses that reliable firms of contractors should be entrusted with works without any supervision beyond the inspection of the completed project, a system that is not followed even in England, we believe that the detailed supervision exercised by the public works department under the present system could be reduced by the employment of such firms. With the growth of the system it will be possible to secure the employment by contractors of qualified engineers, who will relieve the government staff of their present executive duties and render necessary the maintenance of only a small inspecting staff, with a permanent clerk of works on each large work or group of works. The existence of the present large subordinate supervising establishment deters reliable firms from tendering for government works, and even if its status is improved as recommended by us, it is in itself an effective bar to the employment of qualified engineers by contractors. Nor do we believe that the piecework system is conducive to economy in other directions. Not only must the present multiplicity of petty contracts increase the sum total of the contractors' incidental expenses to a figure considerably in excess of that which a single contractor would incur, but in addition government suffers from the inconvenience that the progress of the whole work may be delayed by any single piece-worker. The limit of time allowed for completion finds no place in a piecework agreement, and we consider that this is a serious defect in the system.
- 21(ix). Several witnesses have urged that it is advantageous for government to have the power to terminate the agreement at any moment, and that it is much easier to make a piece-worker demolish bad work or remove inferior material than a contractor. This contention appears to indicate an error in the departmental methods of dealing with contractors and to confirm certain evidence given
- 20(ii). before us to the effect that there is a tendency on the part of the engineers to condone breaches of contract rather than to suffer the inconvenience of a change of contractor.
- 21(v). We received evidence that small contractors actually rely
- 67(iii)-(iv).

on such lenient treatment to tender at very low rates in the hope of getting the contract and later, during the execution of the works, of obtaining a rise in rates. If this is the case it indicates a serious flaw in procedure, since increases of rates during construction render competition nugatory and consequently prevent tendering by respectable contractors, who refuse to quote rates at which they know they will be unable to complete the work. One of the reasons given for the preference for piece-work agreements is that contracts are more likely to lead to litigation 67(v), and not infrequently fail to stand the test of a civil court. The remedy for this defect is to revise the standard forms of contract in accordance with past experience. Contract documents should be properly drawn up in the first instance and thereafter be fully enforced; and, except in very special circumstances such as war conditions, all rates, specifications and conditions should be strictly adhered to. Government will then be in a stronger position than it is at present in regard to the piece-worker, who can throw up the work at any time if his demands for increased rates are not met.

It has been suggested that the major portion of the 21(iv) work of the department is scattered throughout the districts and is hence unattractive to large contractors. Whilst this is largely correct, we believe that in time contractors will extend the sphere of their operations from the larger centres into the districts, and we consider that they should at least be given every opportunity of doing so before other methods are adopted.

As will be seen from the arguments enumerated above, there is a tendency on the part of the engineers to judge the question from a purely departmental standpoint. We consider, however, that it should be viewed in a wider aspect, and as a result of our inquiry we are impressed with the necessity of encouraging the growth of contractors, a measure which we believe will tend to general industrial development and will give to the building and allied trades a stimulus which they at present lack. The introduction of the contract system will afford new openings for indigenous firms employing indigenous trained staff. We consider that, in judging this question, a prominent place should be given to these aspects and that immediate economy should be regarded as only one consideration among many.

**Recommendations for the encouragement of private enterprise in the execution of public works.**

26. At present the number of regular contractors and contracting firms available in India for the execution of public works is very limited, but we recommend that the policy of government should be directed to the encouragement of the growth of such a class. We are of opinion that this can most suitably be done by inviting tenders for complete works and by the introduction of the system of lump sum contracts, and our recommendations are therefore framed on these lines. We realize that advance must be gradual, but we believe that, if our proposals are accepted, a class of contractors will grow up to whom it will be possible to entrust work without the necessity for the present detailed subordinate supervision.

(a). *Original works*.—We recommend that tenders should invariably be invited in the first instance for the complete work in the case of a building, or for a substantial contract in the case of a road, and that, if such tenders are received, the whole work should be given to a

single contractor, even if the resulting cost is likely to prove somewhat greater than that at which it would be possible to execute the work by piecework. We further consider that it should be incumbent on the officer empowered to accept the tender to record for the information of his superior officer his reason for refusing any tender for a complete work and accepting a tender for a part only of the work.

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- 1). We also recommend a more extensive use of the lump sum contract, and consider that the introduction of this system in its entirety is the ultimate policy to be aimed at, by lump sum contract being understood a contract for the complete execution of a work at a fixed sum, accompanied by a supplementary schedule of rates upon which additions or deductions can be calculated. The form of contract should lay down that the contractor must set out the work himself and maintain a whole-time competent foreman on it, and should also specify a time limit. The terms of the contract should be rigidly adhered to, and no revision of the fixed sum permitted on the grounds of omission or mistake. We believe that this system will lead contractors to employ qualified staff, since under it the contractor will be responsible that the classes of workmanship and materials are in accordance with specification (a responsibility which at present rests mainly with the officers of the department) and thus lead eventually to the reduction of the government supervising establishment. In view of past practice, we consider that due warning should be given to all contractors, if necessary by public notice, that no revision of the terms of the contract will be permitted after once the tender has been accepted. There will probably be little or no saving in supervision at the outset but this will come in time, and we recommend on this ground that preference should be given to lump sum contracts, provided the contractor is reliable, even if the cost of the work is thereby somewhat enhanced. Two arguments have been raised against this system, firstly, the increased risk of litigation inherent in a lump sum contract, and secondly, the fact that contractors may send incompetent supervisors to take charge of works at a distance from their principal place of business. In regard to the first there is a possibility of litigation at the outset, but litigious contractors will cease to be employed and the evil will hence cure itself. As to the second, if contractors are so blind to their own interests, they will be responsible for the failure of private enterprise generally and their own in particular.

- 21(vi). (b). *Repairs.*—In regard to repairs we consider that the present piecework and departmental systems are, on the whole, suitable. Various suggestions have been made to us for the encouragement of private enterprise in this respect also, that most frequently advocated being that all the repairs to buildings or roads within a certain area should be made over to a contractor for execution for a term of years. We do not recommend this system, which would inevitably lead to monopoly, but we see no objection, if it is considered desirable, to an exception being made in the case of the collection of road metal, in order to allow of the employment of machinery for the purpose and of the grant by the contractor of adequate advances to his labour. If, as proposed by us, the repairs of most government buildings are made

over to the administrative departments concerned, the importance of this branch of the present activities of the public works department will be very considerably reduced.

(c). *Electrical and sanitary work*.—In the case of electrical and sanitary work we deprecate departmental construction wherever, as in some of the presidency towns and larger centres, private agency is available. We recommend also that wherever such private agency is available and is willing to undertake maintenance work at reasonable rates, it should be employed for the purpose, departmental maintenance being resorted to only where no reliable firms exist, or where their tenders are excessive. Where private firms are available for construction only, departmental work should be strictly confined to *bonâ fide* maintenance, and any tendency towards the departmental execution of original works checked, as the latter leads inevitably to the accumulation of stores and the employment of special establishment, both of which we consider undesirable.

System recommended for calling for and accepting tenders.

27. From the evidence it appears that, under the present system, calls for tenders for public works are not in all cases sufficiently widely advertised, and we recommend that, in the case of large contracts, the local press and the trades journals\* should be more freely utilized for the purpose. For smaller works, notices should be posted at the office of the executive engineer and at other important public offices. It has been suggested that a list of contractors, classified according to their professional qualifications, financial status, etc., should be maintained in each division, and tenders invited only from those who, from the information contained in the list, appear capable of undertaking the work. This may lead to difficulties in practice, but we see no objection to the maintenance by the executive engineer of a list of approved contractors in his division and to the issue by him to such of them as he considers desirable of individual notices of contracts to be allotted, in addition to the public notification referred to above. Officers inviting tenders should reserve to themselves the right to refuse to accept the lowest or any tender, but we consider that when a tender other than the lowest is accepted, the officer doing so should record his reasons for the private information of the higher authorities. We are unwilling to accept in full the suggestion made by certain witnesses that contractors should be classified according to the staff maintained by them, and a specified percentage added to their rates to cover the cost of such establishment, but the saving which will accrue to government owing to the employment of contractors maintaining a skilled staff should invariably be taken into consideration and due allowance made by the officer empowered to accept the tender.

Supply of materials by government.

28. In many cases piecemeal agreements are given for labour only, the materials being supplied to the contractor by government and the cost deducted from his bill. In favour of this system under which government undertakes the manufacture of the materials required for its works, either departmentally or through the agency of petty contractors, it has been urged that it ensures that the quality is up to the specified standard, that the



- rates at which government can procure materials in this manner are lower than those at which they can be purchased in the open market, and that the presence of a large government stock prevents fluctuations in price and ensures the maintenance of a reserve available to meet sudden demands. We see no reason to believe that government-manufactured materials are superior to those produced by private enterprise, or that the latter is incapable of supplying to government specifications.
- 72(i). As to economy, we find that no profit and loss accounts are kept of these operations and consequently the prices at which government materials are issued are frequently fictitious, excluding charges for superior direction, interest or depreciation, factors which both private firms and government should take into account in fixing
- 9(i). their prices. At Akra near Calcutta and at Madras large permanent brickfields are maintained by government. We found that these brickfields are not worked to their full capacity and sometimes, when the demand is slack, lie idle for considerable periods with the consequent dead charges accumulating but finding no place in the departmental accounts or in the cost of outturn. We do not believe that the cost of this occasional production of material to meet a fluctuating demand can be anything but extravagant in comparison with that of the regular outturn of private firms supplying the more or less steady demand of the open market. Nor do we consider that the suggested advantage of maintaining a reserve is, in most cases and especially in the larger centres, a sufficient justification of the system. Government work does
- 46(i). not usually form so large a percentage of the total works under construction that the sudden demands of the former are likely to exhaust the open market, and such demands are, in any case, infrequent. It may be true that the present system insures government against sudden rises of market rates, but it also prevents it from taking advantage of similar falls. We consider that this system is
- 55(ii). disadvantageous to private enterprise, especially when materials are issued to contractors at low but actually fictitious rates, not indeed deliberately but owing to want of knowledge of the actual cost. We recommend that when materials are available in the open market the
- 55(i). contractor tendering for the work should be encouraged to undertake the supply of all materials required for it, and that government manufacture should cease except possibly in outlying places where such materials cannot otherwise be economically obtained. We consider that there is no justification for the maintenance by government of brickfields in large centres, such as Akra near Calcutta and at Madras, and we recommend that the government connection with such operations should cease, except in so far as government may wish to continue freeholders of the land.
29. The same remarks apply, to a large extent, to **Maintenance of workshops by government.** the maintenance of workshops. We consider that there is no justification for the maintenance of workshops by government except in the cases of temporary shops on large outlying works, where private enterprise is not available, and of small shops utilized solely for the execution of petty repairs. A workshop on any large scale can hardly run economically unless the fluctuating demand for special work is supplemented by the more or less constant demand for standard articles, and it is particularly

in regard to the latter that we consider government competition with private enterprise to be undesirable. The evidence that work executed in government shops is cheap is inconclusive in the absence of profit and loss accounts of these undertakings, and in the larger centres competition will prevent abnormal inflation of prices. An inquiry into the workshop maintained by the public works department at Roorkee in the United Provinces led to its abolition, and there is less justification for the maintenance of such workshops in more advanced provinces like Madras. We therefore recommend that government workshops should be abolished, with the exception of those specified above, and private enterprise aided by the limitation of government competition and the addition of government trade to private trade. We realize that the abolition of the existing shops must be gradual, but we consider that the manufacture of articles of stock pattern therein should cease immediately, and that the use of such stock patterns should be insisted upon wherever possible.

Local purchase  
of European  
stores.

30. Much importance was attached by several witnesses, particularly those representing the various chambers of commerce, to the discouragement of private enterprise resulting from the rules relating to the purchase of European stores. Under the rules at present in force articles required for the public service and not manufactured in India must be obtained by indent on the India Office. Local governments, superintending engineers and executive engineers are empowered to sanction departures from this rule up to limits of Rs. 3,000, Rs. 1,000 and Rs. 200, respectively, provided the articles are already in India at the time of order and that their price and quality are not unfavourable as compared with those of similar articles obtained through the India Office; while local governments have full powers and superintending and executive engineers powers up to Rs. 2,500 and Rs. 500, respectively, to sanction departures from the rule, provided the articles are in India at the time of order, in cases where serious inconvenience to the public service would be caused by waiting to obtain them from England through the Director General of Stores.

In favour of the present system it is urged that the purchase of European stores through the India Office ensures economy, since tenders are called for in the large manufacturing market of England and the necessity for dealing through middlemen is obviated, and that quality is safeguarded by means of inspections during manufacture and before despatch, and by tests conducted by the stores department, and that the framing of contracts and specifications receives the expert supervision necessary in this connection. The advantages of centralized buying are also secured, the Secretary of State being able to place large contracts for a year or more at a time at favourable prices. The system has, however, been severely criticised not only by the representatives of the chambers of commerce and of private firms, but also by the great majority of witnesses from the public works department. It is stated that any economy obtained by indenting on England is often counterbalanced by the inconvenience due to the delay involved and occasionally by serious waste of public money owing to the progress of

88(v). work being retarded; cases arise where firms in India are actually holding stocks of materials at prices which compare favourably with India Office rates and yet unless "serious inconvenience to the public service" can be claimed, the department is prohibited from purchasing them locally. It is also urged that, when articles are ordered through the Indian branch of a British manufacturing firm, the firm is responsible that the goods supplied are in accordance with specifications, intact, and work satisfactorily at site, which is not always the case when orders are placed through the stores department.

There are in general three classes of firms through whom stores are obtainable in India, *viz.*, Indian manufacturing firms, branches of British manufacturing firms and agents of British manufacturing firms. The declared policy of government is to encourage the purchase of articles locally manufactured and produced, and the rules already prescribe that preference shall be given to such articles; we shall later propose measures to ensure that practical effect is given to this policy. In regard to the branches of British manufacturing firms we do not consider that the rules are equally satisfactory. While it is not necessary specially to encourage the establishment in India of branches of British engineering firms manufacturing articles that could equally well be produced in the country, we consider that more encouragement should be given to firms doing work of a kind which cannot at present be performed in India, such as the manufacture of electrical appliances, motors, generators, large and complicated machinery, etc. The existing demand for such plant is too small to admit of the manufacture being undertaken locally, and hence we are of opinion that firms dealing in plant of this nature should be encouraged to open branches and maintain stocks in India, thus tending to make the country self-contained in this respect. It will be for the Government of India to lay down in the first instance what articles are to be included in this category, the list being subject to revision as indigenous manufacture develops. Several such branches have already been established, but the existing rules militate both against their success and against the establishment of further ventures and also, in our opinion, affect adversely the efficient working of the public works department. Under existing conditions there is no inducement for any manufacturing firm to maintain in India a staff of experts capable of erecting the machinery it produces and explaining its working to the person in charge, with the result that difficulty is often experienced in the erection and working of machinery of types not hitherto used. We consider that it is advisable both from the point of view of efficiency and also to obviate the necessity for the employment of further government specialists, a question which is dealt with in the next chapter, that the public works department engineer should be able to give a contract to a reliable firm for machinery to be supplied, erected and set to work on site. It would also be highly advantageous to introduce in this connection, wherever possible, a modified system of centralized buying, running contracts being entered into with the manufacturing firms for stated periods without any direct specification of quantity, an indication being given, however, of the probable extent of purchase. Officers might then be permitted

to obtain their requirements direct from the contracting firms at the agreed-on prices. The introduction of such a system would also lead to firms in India maintaining a stock of spare parts for such installations, thus avoiding serious delays in cases of accidents or breakdowns, and it would be to the interest of such firms to see that the best results possible are obtained by their clients from the machinery or plant they purchase. Again, when a spare part is urgently required but is not obtainable in India, although the firm manufacturing it may have a branch which can obtain it immediately by means of a cable to its head office, such a procedure is prohibited and the formality of indenting through the India Office must be observed. We are informed that a proposal has lately been submitted to the Secretary of State with the object of permitting officers to purchase plant and machinery from Indian branches of British manufacturing firms which maintain a staff capable of erecting the articles which they supply, subject to certain restrictions as to cost and the purpose for which the plant is required, but we would go further and recommend that subject to the conditions that the article is of a standard pattern, is one which cannot in existing circumstances be produced in India, and that the firm is approved by the Director-General of Stores for the supply of the particular article required, officers of the buildings and roads branch of the public works department should be given the same powers to call for tenders and to purchase European stores and plant from branches of British firms as they possess in respect to similar articles manufactured in the country.

The question of agency firms stands in our opinion upon a different footing. An agent cannot be expected to have the same expert knowledge as a representative of the manufacturing firm, nor are they responsible to the same degree for the firms they represent. A manufacturing firm will not usually open a branch unless there is at least a reasonable prospect that the increase in production will cover the cost of its maintenance, without necessitating enhancement in prices, whereas commission will be added by an agent to the manufacturers' prices, and the Secretary of State can certainly expect to buy more cheaply than such an agency can afford to sell. Consequently we recommend no alteration in the existing rules in so far as such agency firms are concerned, considering that purchases of European manufactured articles from them should be, as at present, permissible only in cases of urgency and when the articles are actually in the country at the time of order.

In regard to the testing of materials and plant, the 96(i). Alipore test-house, an institution equipped with appliances of the latest type, will probably prove adequate to meet existing demands, in so far at least as tests of the strength of materials are concerned, though possibly further test-houses of the same nature may be required later at the principal centres. There is, however, a large variety of articles which could be bought in India for which far simpler tests would suffice, and such tests could be conducted at small expense under suitable arrangements in each province. The real test however takes place when the plant is erected and set to work, especially in the case of electrical and other machinery. No respectable firm,

which had itself supplied and erected an installation, would risk its reputation by refusing to replace portions found to be faulty owing to inferior workmanship, and in many cases such faults cannot be detected until the plant has been at work for a period. This test, which we consider the most important, can only be applied when a firm in India is responsible. In so far as expert supervision of specifications and contract documents is concerned, we see no reason why this cannot be obtained in India as well as in England.

P. W. D. Code,  
Vol. III,  
App. 30,  
rule 3 (b) and  
schedule B.

In paragraph 28 of this chapter we have proposed that contractors should be encouraged to supply all materials required for their works, contracts being given for complete works and where possible at lump sum rates. The present stores rule restricts this privilege to approved firms of standing and repute, who are important structural contractors, whose command of capital, plant and labour are a guarantee against any risk of abuse, and who are not likely to risk the removal of their names and the loss of reputation resulting from the supply of inferior materials and stores. At present the names of nine firms only, eight in Calcutta and one in Bombay, are included in the list of such approved contractors. We are not in favour of this arrangement and consider that contractors should be permitted to supply all materials required for the execution of their contracts, the engineer in charge specifying the required quality or brand, preference being given, where possible, to Indian manufactured articles.

To ensure due encouragement and support to the Indian manufacturer we recommend that the following procedure should be adopted. All indents to the Secretary of State should be submitted through a central authority whose duty it will be to eliminate anything which can be made in India, or which is obtainable from the surplus stores of other departments, or from a branch of an approved British manufacturing firm in India, any tests that are necessary being made in the country. If, as appears not improbable, the development of general industrial activity in India leads to the expansion of the functions of the central and provincial industrial departments, they could suitably undertake this scrutiny also, and thus safeguard the encouragement of Indian industries. We believe that the acceptance of this recommendation will give considerable stimulus to private enterprise and have an important bearing on the general industrial development of the country.

- 84(ii). 31. Certain witnesses have represented that there is no necessity for the employment by government, of architectural, electrical and sanitary experts, and that the work at present performed by these officers should be entrusted to private firms. Our inquiry shows that the amount of work available would not be sufficient materially to stimulate private enterprise. If, for example, the consulting architect to the Government of Bombay and his entire staff were abolished, it would not give scope for more than one more large architectural firm in Bombay. In such matters it is usual, in the case of any undertaking of the same scope as government work, to employ whole-time experts rather than to utilize private firms, and the cost of a whole-time government
- 6(i). **Employment of private experts as architects, electrical and sanitary engineers.**
- 17(i).

architect and his establishment is in general only about half the amount of the fees which would be payable to private firms for the same work. Further, no great reduction of departmental establishment would be possible, as experts would still be necessary to examine and advise government in regard to projects prepared by private firms, while the electric inspectors would still be required for statutory purposes. It has also been suggested that government architectural work should be thrown open to competition by private architects, but owing to the lack of interest in the development of architecture on its artistic side in India at present we cannot support this proposal, although we recognize the suitability of such a system for such important projects as the new capital at Delhi, the Victoria Memorial in Calcutta, and any special case where the local Government considers it desirable to invite outside assistance and where the field of competition will not be confined to India; but as a general rule we consider that, provided sufficient work exists for a whole-time officer, the system under which government maintains its own architects, sanitary and electrical engineers is, for the present, suitable.

## CHAPTER V.

### REORGANIZATION OF THE PUBLIC WORKS DEPARTMENT.

#### 1. *General proposals for reorganization.*

Necessity for recommendations.

32. As has already been explained, the transition stage during which public works in India will be in course of transfer from the public works department to local bodies will, in some provinces, extend over a substantial period, during which some at least of the operations of the department will continue. In accordance with the terms of reference we have, therefore, examined the existing organization and procedure of the department, and after consideration of the evidence which has been given before us we consider that, in the interests of general efficiency, certain changes in organization are desirable, that the present procedure is capable of considerable simplification, and that further decentralization is also required. Our recommendations on these subjects are contained in the following paragraphs.

Reorganization of establishment.

33. The reorganization of the establishment of the department was considered by the Royal Commission on the Public Services in India, which has recommended the abolition of the provincial service, as at present constituted, and the amalgamation of its personnel with that of the imperial service. In addition the commissioners have suggested that the upper subordinate branch should be transformed into a service organized on the model of the existing provincial civil services, and that, as suitable members of such a service became available for appointment as sub-divisional officers, a corresponding reduction should be made in the cadre of assistant engineers, the process of reduction being allowed to continue until the number of assistant engineers becomes just sufficient to provide for their promotion, in an officiating capacity, to executive rank after eight years of service. With these recommendations we are in full agreement. We consider that the department should be reorganized

Public Services Commission Report, Annexure XVIII, para 7. Ditto, para. 5.

in three services : a superior engineering service consisting of officers to fill the higher executive and administrative appointments, a second service organized on the model of the existing provincial civil services which will provide the bulk of the sub-divisional officers, and a single subordinate service, each of the two last mentioned with the necessary leave and training reserve.

P. W. D. Code,  
Vol. I, paras.  
14 and 15.

P. W. D. Code,  
Vol. I, para. 36,  
C. S. R. Art. 124,  
Note 1.

Public Services  
Commission  
Report,  
Annexure  
XVIII,  
para. 5.

34. At present the pay of an upper subordinate ranges, Scales of pay in the ordinary course, from Rs. 60 to Rs. 400 per mensem. for the provincial and subordinate services. In addition, officers holding the rank of sub-engineer, 1st grade, may be granted two periodical increments of Rs. 50 per mensem each on completion of five and ten years respectively in that grade, as a reward for long and meritorious service. Upper subordinates placed in charge of sub-divisions draw also a sub-divisional allowance of Rs. 30 per mensem, or Rs. 50 per mensem in the case of a certain proportion of the upper subordinates in the United Provinces and the Punjab. The Government of India has recognized that the pay of this service is inadequate, and has authorized local Governments to reorganize the scale of pay of their upper subordinate establishments according to provincial requirements, subject to certain general principles and to a maximum and mean salary not exceeding Rs. 550 and Rs. 195 respectively. A revised scale of pay has already been introduced in the United Provinces, while in certain other provinces the reorganization has been sanctioned but is awaiting the return of more settled financial conditions before being introduced. We consider, however, that such reorganization of the existing establishment will not meet the necessities of the case. As pointed out by the Public Services Commission, the supply of upper subordinates qualified for appointment to sub-divisional charges is inadequate and it is hence essential that, before the number of assistant engineers can be materially reduced, the qualifications of the lower service should be raised. Our inquiry has convinced us of the importance of the duties of sub-divisional officers and of the necessity for filling sub-divisional charges not only with officers of good professional qualifications but also of a high moral standard, and we recommend a scale of salary starting at Rs. 250 and rising by annual increments of Rs. 15 to Rs. 550 per mensem, with a selection grade on Rs. 600—20—700 per mensem for ten per cent. of the members of the service.

✓ The extra cost entailed by the formation of this service may, we consider, be met in part at least by an alteration of the principles upon which the cadre of the engineering establishment is at present calculated. Under the existing system the superior establishment of the department, *i.e.*, the number of officers of over 10 years' service, is maintained at a strength sufficient not only to man all administrative and divisional posts but also to provide a reserve of officers of the same standing to fill leave vacancies in these appointments, the number of assistant engineers being fixed so as to provide a regular flow of officers to the superior ranks as senior men retire. We do not consider that this leave reserve in the superior posts of the executive and administrative grades is necessary, and recommend its abolition. The number of superior officers, who will, if the Public Services Commission's recommendations are accepted, be officers of

Ditto

over eight years' service, should be equal to the number of superior posts, and leave vacancies occurring among them should be filled in an officiating capacity by assistant engineers, the sub-divisions vacated by the latter being held by officers of the proposed second service, the cadre of which must be sufficient to fill all leave vacancies in the superior service, to man all sub-divisions not held by assistant engineers, and to provide a leave and training reserve in the service itself, the leave reserve being thus where it is normally to be found in other services, namely in the inferior ranks.

It also appears to us that, with the formation of this second service and the consequential improvement in the class of officer holding sub-divisional charge, a reduction in the number of both divisions and sub-divisions should be possible, and a further saving be thus effected, particularly if the bulk of the repair work which at present devolves upon the public works department is transferred to other agencies for execution.

We do not desire to suggest any regular scale for the pay of the subordinate service, which need not be uniform throughout India, but we recommend that, in view of the increased scale of wages in all employment and in the interests both of honesty and efficiency, the minimum pay should be raised from the present rate of Rs. 30 to 53(ii).  
Rs. 50 per mensem.

Admission of  
mistris into  
the subordinate  
service.

35. A matter upon which considerable stress has 62(iii).  
been laid by some witnesses is the desirability of appointing to the permanent staff of the department a certain number of the more capable *mistris*. The *mistri* is a master craftsman, employed by government on the subordinate supervision of construction work, who discharges most of the functions which in Europe devolve upon the clerk of works. It is commonly agreed that there has, in the last thirty years, been a steady deterioration in the *mistri* class and that craftsmen of the old type are seldom available, and it is urged that everything possible should be done to attract the best craftsmen and thus re-establish the class which is being lost. In our opinion, the reason for this deterioration is to be sought in the ever-increasing demand for skilled labour; the young *mistri* no longer stays with his father until he has obtained a thorough knowledge of his craft, as was formerly the case, but attracted by the prospect of high wages, he seeks employment when only half trained. The offer of permanent appointment will, we consider, do little if anything to improve the general type, and there are obvious disadvantages in the formation of a permanent service of skilled craftsmen, or in the admission of such men to the general subordinate service. We agree, however, that there is room in the public works department for two distinct classes of subordinate, the first of the sub-overseer type, for the execution of surveys and the preparation of simple projects, and the second for the direct supervision of construction work. The latter class might suitably be recruited, in part at least, from among the more capable *mistris*, men so selected being appointed to the temporary, as distinct from the work-charged, establishment. At present the pay of such *mistris* is charged direct to the particular work on which they are engaged and according to the strict terms of their employment their services



- should be dispensed with on its completion. In practice, however, the better men are retained practically indefinitely, some of them indeed having been employed continuously for long periods of years, and we see no reason why this fact should not be recognized. We have considered whether, prior to appointment to the temporary establishment, such *mistris* should be required to undergo
- 62(i). a course of instruction in elementary estimating, surveying and drawing, but are of opinion that, although an acquaintance with these subjects would enhance their utility, insistence on any educational qualification would debar a large proportion of the best type of craftsman. The younger *mistris* should be encouraged to attend classes at the technical schools, and there acquire sufficient knowledge to enable them to prepare a simple estimate or to set out a work, but we deprecate any idea of educating them up to the sub-overseer standard, or of opening special classes for them at the engineering colleges. The main value of the *mistri* lies in his practical experience, and we are opposed to any measures which may, even indirectly, tend to give undue prominence to the theoretical training of men of this class.
- 51(i). 36. The extent to which the irrigation and the roads and buildings branches of the department are separated varies considerably throughout India. In Madras there is no separation at all, and each officer undertakes within the limits of his charge all kinds of engineering work required by government, whatsoever its nature, with the exception of certain small tanks maintained by the collector. In Bombay certain divisions contain both classes of work, and a superintending engineer may have, within his circle, some divisions engaged wholly on irrigation, some engaged wholly on roads and buildings, and some "mixed" divisions doing both, transfers of establishment being made indiscriminately between the branches as the exigencies of the service demand. In the United Provinces and the Punjab the two branches are entirely separate and form practically two departments, transfers of establishment from one to another being made only in very exceptional circumstances. We are not prepared to recommend the adoption of any uniform system. Before doing so it would have been necessary for us to investigate to what extent the maintenance of separate branches is desirable in the interests of irrigation, a question not covered by our terms of reference and which would have tended to enlarge undesirably the scope of our inquiry. The matter was considered by the Irrigation Commission of 1901-03 and, although uniformity of system throughout India was not recommended, the general tenor of their report was in favour of specialization in irrigation management by a separate staff. The importance of the question will be greatly lessened if effect be given to our recommendations in regard to the transfer of works to local bodies; with the passing of the buildings and roads branch in its present form and the substitution of an inspecting agency in its place, the irrigation branch will automatically be separated. In the circumstances we desire to make no recommendation; it appears to us that the various systems at present in force have grown up to suit the particular local conditions and requirements of each province.

**Powers of promotion to the rank of chief and superintending engineer.**

37. Prior to the year 1910 provincial Governments, with the exception of Madras and Bombay, had no power to appoint their own chief and superintending engineers, all promotions to and in those classes being made by the Government of India. The suitability of this system was questioned by the Decentralization Commission of 1907-08, which held that the provincial public works Commission Decentralization Report, paras. 218-220. staffs were large enough to secure continuous promotion and to provide adequately for the filling of the higher posts, that frequent transfers were undesirable, that officers should be kept as far as possible within the same province, and that the local Governments themselves were the best judges of their own requirements; and it recommended that the Governments of all major provinces should be given the same powers in the matter as those enjoyed by Madras and Bombay. As a result of this recommendation the Government of India, in 1910, delegated to local Governments the power to appoint their own superintending engineers, but retained in their own hands the appointment of chief engineers, further reserving to themselves the right to make inter-provincial transfers in the event of a serious block in one province and very rapid promotion in another. It soon, however, became obvious that the Government of India's power of interprovincial transfer was nominal, since the local Governments concerned had usually made their own promotions before the Imperial Government was aware that the vacancies had occurred, and it was also found that difficulties arose in regard to the appointment of a chief engineer to a province of which he had no previous local knowledge or experience. In order to ensure against unduly rapid promotion in any one province, and to enable them to transfer an officer, selected for a chief engineership, to a superintending engineer's post in his new province for some period prior to his appointment as chief engineer, the Imperial Government in 1913 further qualified the delegation by prohibiting local Governments, without first reporting the matter for approval, from promoting any officer to the rank of superintending engineer 3rd grade with less than 21 years' service, or to that of superintending engineer 1st grade with less than 27 years' service. Thus a large number of such promotions are now reported for approval to the Government of India. The disadvantages of the system are evident. Local Governments are often unwilling to part with their best men, particularly if there is a probability that they will succeed to chief engineerships in their own provinces within a reasonable time, and it has been suggested that there is a tendency to recommend the transfer of an officer, not altogether in the first rank in regard to efficiency, and so clear the way for more competent juniors without the necessity for superseding the senior. It has also been urged with considerable force that even the best of officers, transferred in the last years of his service, may not prove a successful chief engineer in a locality with the particular problems and conditions of which he is unfamiliar. We consider that the balance of advantage is in favour of allowing the provincial Governments to make their own promotions, and that the interests of the individual, the safeguarding of which is the principal attraction of the present system, should not be allowed to interfere with the general efficiency of the department. The existing system causes a

large number of references to the imperial secretariat, who at best are working largely without personal knowledge of the men concerned, and is apt to lead to friction with local Governments. The statement below shows, for each province, the sanctioned cadre of engineers and the sanctioned number of administrative posts, and in the present circumstances there appears to be no reason for denying the right to make its own promotions to any province except Assam, which maintains a small cadre of only 21 officers. Bengal already has this right, since its elevation to the rank of a presidency Government.

Province.	SANCTIONED STRENGTH.	
	Total cadre.	Administrative posts.
Punjab . . . . .	165	17
United Provinces . . . . .	127	12
*Bombay . . . . .	101†	10†
*Madras . . . . .	99†	11†
Burma . . . . .	92	9
Central Provinces . . . . .	62‡	8†
Bihar and Orissa . . . . .	49†	7†
*Bengal . . . . .	49†	7†
Assam . . . . .	21	2

Our recommendations in regard to the increased employment of district board staff will, if accepted, result in a decrease of cadre strength, but this must of necessity be gradual. In the Punjab and the United Provinces, moreover, of the total cadre strengths 122 and 70 respectively are in the irrigation branch, which will be unaffected, and in both provinces large canal projects are in course of preparation which are likely to absorb a portion at least of any decrease in establishment which may be possible in the buildings and roads branch. Burma is not likely to be materially affected by our recommendations for a long time to come, owing to the backward state of local self-government in that province, while in the Central Provinces again the development of irrigation will probably compensate in part for the reduction of building and road work. It is possible that the spread of the district board system in Bihar and Orissa will result in a reduction of the public works department cadre to such an extent that in that province also it will be impossible to ensure regular promotion to administrative posts, but we foresee little or no difficulty in combining it with Assam and Bengal and constituting a joint cadre of the three provinces for this purpose only. For the present we recommend that the power to appoint their own superintending and chief engineers should be delegated to all the local Governments and Administrations in the above list with the exception of Assam, which should be amalgamated with Bengal for this purpose. In order to guard against unduly rapid promotion to the senior post of the department we would, however, make the proviso that no officer of less than 25 years' service should

\* These provinces already make their own promotions.

† Includes one post sanctioned only temporarily.

‡ Includes two posts sanctioned only temporarily.

be promoted to the rank of chief engineer without the approval of the Government of India. Local Governments will, of course, be at liberty to ask the Imperial Government to transfer an officer to them from some other province, should they consider no suitable promotion can be made from their own establishments.

Tenure of the office of chief engineer.

38. A further point which has been put before us in regard to the terms of appointment of chief engineers is that the present rule, which requires that a chief engineer shall retire at the age of 55 years, causes administrative inconvenience. The objections to the existing system are three in number. Frequent changes in the administrative and professional head of a department are undoubtedly detrimental to efficient working and yet it is an undeniable hardship for a really capable officer to be prevented from rising to the highest post in the department because, for no fault of his own, he has only become eligible for promotion a short period before the date of his superannuation. Similarly it is unfair to a local Government that a capable chief engineer, having served for a comparatively short period in that position, should, although in full possession of his powers, be forced to retire and thereby subject it to the inconvenience of a change of incumbents. Finally it has been suggested that local Governments do not always exercise the same rigid selection in the case of an officer with a short period of service before retirement as they would if a specified tenure of office were prescribed, irrespective of the age of the holder. The Public Services Commission has recommended a modification of the rule regarding compulsory retirement of officers on attaining the age of 55 years, and we consider that, in the interests both of the department and of the administration, a relaxation of the existing strict rule in the public works department is required in the case of chief engineers. We therefore recommend that any officer selected for the post of chief engineer should be granted a minimum tenure of three years of that office, irrespective of the fact that he may, during such tenure, exceed the age of 55 years. At the same time we think that where an officer has passed the age of 52 at the time when his promotion to the position of chief engineer comes up for consideration, this fact and the effect of his promotion on juniors eligible for the post should be fully weighed before his promotion is decided upon.

Promotions to and in the administrative and executive ranks.

39. The question of promotion in the public works department is one to which we have given careful consideration. Although it has always been laid down that seniority is not in itself a sufficient ground on which to base a claim for promotion, that no officer should be promoted who is not considered decidedly deserving of it on the ground of good service, that more importance should be attached to merit, and that the convenience of the public service should be paramount to all other considerations, yet there is abundant evidence that these rules have often, in the past, been very loosely interpreted, the main criterion for promotion having been that an officer should have nothing particular recorded against him rather than that he should have anything particular recorded in his favour. The result has been that some officers have been promoted both from the executive to the administrative and from the assistant to the

14(iv).

C. S. R. Art. 650.

Public Services Commission Report, para. 73.

C. S. R., Art. 650.

P. W. D. Code, Vol. I, para. 77, (before amendment).

73(ii).

executive grades who not only cannot be considered the best candidates available but who cannot even be considered fully qualified within the meaning of the regulations for the positions they occupy. The Decentralization Commission in their report laid great stress on the necessity for a more rigorous selection of officers for the higher posts, particularly with reference to the Indian civil service, and, in pursuance of the general principle involved in their recommendations, the Government of India issued in 1916 a revised code of rules for the regulation of promotion in the public works department. The essence of these rules is that promotion to the rank of chief and superintending engineer shall invariably be made by selection from the most competent and otherwise suitable superintending engineers and executive engineers respectively, and that seniority shall be regarded only where other qualifications are practically equal; while in regard to the promotion of assistant engineers to executive rank it is laid down that no assistant engineer shall be promoted to the rank of executive engineer unless he is considered to be fully qualified to hold charge of a division, and that, subject to this condition, an officer shall be promoted in his turn on completion of the prescribed period of service. In regard to the rules for promotion to the ranks of chief and superintending engineer, we fully endorse the Government of India's order that such promotion shall be made by pure selection, and we trust that local Governments will administer the rule with full rigour, all personal and other considerations being disregarded. We have also considered carefully the revised rule relating to promotion to executive rank, and we should have preferred a system of selection at this stage also, but we are convinced that there are grave difficulties in the way of giving effect to such a recommendation. In the first place it must often happen that, in the early years of his service, one young officer will have considerably greater opportunities of showing his worth than another. Thus, for example, one assistant engineer may be employed upon a large construction work, and so be kept constantly in the eyes of the authorities, while another may be doing unobtrusive but none the less meritorious work in backward districts, with not the same opportunity of coming to the front; any system of pure selection must inevitably favour the former at the expense of the latter.

49(i). In the second place it has been represented to us that, during the first years of his service, the Europe-recruited engineer has certain natural advantages, due largely to early environment and inclination, over his Indian colleague, and that selection at this stage would at times lead to the supersession of Indians who, though qualified for divisional charge, might not be so well equipped practically as their juniors recruited from Europe who had spent their youth in an environment where things mechanical play a much larger part than in India. The result would be either injustice to the Indian or the establishment of two separate standards of efficiency, a condition of affairs which we deprecate. The effect upon recruitment in England of such a change in the system of promotion to executive rank would also need careful consideration. Hence we do not propose that any change should be made in the existing rule, which has not yet been long enough in force to show how it will operate in practice, but we consider that a very strict

Decentralization  
Commission  
Report, paras.  
637-641 and 649.

P. W. D. Code,  
Vol. I, paras. 75  
and 76 (revised).

interpretation should be placed upon the words "fully qualified," and that no officer, either Indian or European, should be promoted to substantive executive rank until he has shown conclusively that he is capable of managing a divisional charge efficiently and economically, and is fit to be entrusted with the full powers which, in paragraph 68 below, we recommend should be delegated to executive engineers.

**Compulsory retirement of inefficient officers.**

40. The question of the compulsory retirement of inefficient officers was dealt with at some length, more especially in regard to the Indian civil service, by the Decentralization Commission, and the Secretary of State has since passed orders on the subject. These orders enunciated his power to order the retirement of any officer definitely proved unfit for further advancement. The same principle has since been made applicable to the public works department, and inefficient officers may now, with the approval of the Secretary of State, be removed from the department at any stage of their service, a pension being granted where the circumstances justify such a concession. The Public Services Commission laid stress on the importance to the services of a strict and regular application of these principles and with this conclusion we are in entire agreement.

Decentralization Commission Report, paras. 642-643 and 649.

Public Services Commission Report, para. 72.

**Proposed promotion board.**

41. As already stated, we are of opinion that, in the past, sufficient attention has not been paid to the principle of selection in making promotions to the administrative grades, and that assistant engineers have been promoted to executive rank before they were qualified to act as efficient divisional officers. We realize that the position of the head of the department is, in such cases, difficult, since to mar the career of any officer by superseding him is a step which would naturally only be adopted with reluctance, and a heavy responsibility rests on the chief engineer in recommending such supersession. It is probably due to this fact that excessive leniency has been shown in the past, and we fear lest, if the present system be allowed to continue, the same may be the case in future. For this reason we consider it advisable to remove the onus of recommending supersessions from the shoulders of an individual, and to entrust all substantive promotions to executive or administrative rank to a board, the recommendations of which would naturally be more impersonal than those of a single officer. Such a board might suitably consist of the chief engineer, a selected superintending engineer and an experienced administrative officer of another department. Promotions would be made after a consideration of the reports of all the eligible candidates, and the board would have power to call for explanations, should they so desire, from any of the superior officers whose remarks required further expansion or elucidation. They would also examine the reports of all officers whose names were likely to come before them during the following year or two and might even, in case of conflicting remarks by two or more of such an officer's superiors, recommend his transfer so as to obtain the benefit of a further opinion before his time for selection fell due. In this manner they would be enabled to collect reliable data before arriving at their final recommendations. We desire to make it clear that our proposal is not in any way to be regarded as an attempt to trench upon the legitimate

73(i).

authority of the chief engineer as head of the department, but is intended to relieve that officer of the very difficult position in which he must, under existing circumstances, often find himself, and to entrust the exercise of patronage, at all times one of the most anxious of duties, to a board rather than to an individual officer.

42. Although the division is usually considered as the executive unit of the department, and although the executive engineer is theoretically responsible to the higher authorities for the execution and management of all works within his division, in practice the sub-divisional officer actually arranges the details of the work and superintends its execution. It is also, in most cases, the sub-divisional officer who disburses payments, and who is responsible both for the measurements of the work done and for the primary accounts. The sub-divisional officer thus plays a most important part in the operations of the department; it would indeed hardly be an exaggeration to say that it is upon the integrity and capability of its sub-divisional officers that the efficiency of the service mainly depends. As we have already indicated, the supply of upper subordinates qualified for appointment to sub-divisional charges is inadequate, and it is mainly with the object of attracting a superior class of men for these posts that we have recommended the formation of a provincial service. Under the present system not infrequently happens that a sub-division, containing work entailing an expenditure of from one to two lakhs of rupees per annum, is placed in charge of a lower subordinate on a total salary of perhaps eighty to one hundred rupees a month. That it should be necessary to draw at all on the lower subordinate class in order to fill posts of this importance argues defects in the cadre strength of the superior establishments which require early attention, but until these defects can be remedied subordinates placed in sub-divisional charge should, in the interests both of honesty and of efficiency, be given at least a reasonable remuneration for the duties they are required to perform. We therefore recommend that the sub-divisional allowance admissible to subordinates should, in every case, be raised to Rs. 50, and that the minimum salary (including sub-divisional allowance) payable to a subordinate placed in sub-divisional charge should be fixed, irrespective of what his substantive pay may be, at Rs. 150 per mensem.

43. The engineers of the public works department are, in regard to the undertaking of private practice, subject to the ordinary rules of the Civil Service Regulations, which lay down that, before any work entailing the payment of a fee can be undertaken by an officer in government employ, the previous sanction of the head of his department must be obtained. It has been urged that this rule, in effect, debar engineers from taking up private work of any kind, since such work, particularly if it is of the nature of advice or criticism, if required at all is usually required immediately, and there is no time to refer the matter to the higher authorities. Some witnesses have suggested that officers of the department should, without the necessity for superior sanction, be permitted to take private consulting practice, and in support of the proposal it has been urged that a general raising of the level of engineering throughout

**Rules relating to the taking of private practice by engineers of the public works department.**

C. S. R., Art. 74.

71(i).

India would result, that persons who now embark on constructional projects without professional assistance because as a rule none is available would invoke the advice of the nearest public works department engineer and that, as the private practice of medicine by officers of the Indian medical service has proved of advantage to India as a whole and popularized sound systems of treatment, so the private practice of engineering by the officers of the public works department would lead to the extended application of sound principles of engineering practice which, under existing circumstances, are often sadly lacking. While admitting that these arguments are not without force, we see grave difficulties in the way of a relaxation of the present rule. An engineer is a whole-time servant of the government, paid as such, and there would be a very real danger that private practice, even if only consulting practice, to an unlimited extent, might interfere seriously with the officer's legitimate duties. The case of the medical service is not an exact parallel apart from the question of salary, for if civil surgeons were debarred from giving their services, unnecessary danger to human life would be caused. Any such permission would also, we consider, be opposed to the spirit of our general recommendations regarding the encouragement of private enterprise, as it would hardly be possible to permit private practice to government engineers in localities where other practitioners do not exist, and to deny it elsewhere, whereas to grant it in the latter case would entail the institution of competition between a salaried whole-time servant of government, who utilized his practice merely as a means of adding to a guaranteed income, and a private engineer whose fees were his only source of livelihood. Taking all these factors into consideration, we are unable to recommend any change in the existing rule.

**Proposed institution of central designing offices.**

44. The suggestion has been made that it would be an improvement in procedure to create a central designing office in each province, which would be responsible for the designs of all works to be undertaken by the department. It is urged, in favour of the suggestion, that the employment of a skilled specialist staff would lead to greater efficiency and economy than can be obtained under the present system where the project is prepared by an executive engineer who may or may not have previous experience of the class of building he is called upon to design. We are, however, opposed to this proposal. The difficulties of preparing designs without full knowledge of the local conditions would be great in many cases. The advantages claimed for it are already largely met by the adoption of standard plans, and, in our opinion, to divorce design altogether from construction and to degrade the executive engineer to the position of a builder, pure and simple, would result in serious detriment to the efficiency of the most important section of the departmental establishment.

**Cost of establishment in the various provinces.**

45. We have collected statistics showing the extent of the charges of the different classes of officers, the relative cost of establishment, both for direction and construction, to work executed and the staffs employed. The figures in the table on the next page relate to the triennium 1911-12 to 1913-14.



PROVINCE	EXTENT OF CHARGES. (IRRIGATION AND BUILDINGS AND ROADS BRANCHES).						COST OF ESTABLISHMENT (BUILDINGS AND ROADS ONLY).					UPPER SUBORDINATE ESTABLISHMENT (BOTH BRANCHES).	
	SUPERINTENDING ENGINEERS.		EXECUTIVE ENGINEERS.		SUB-DIVISIONAL OFFICERS.		Average annual cost of works.	Average annual cost of establishment.	Percentage of establishment to works.	Average annual cost of direction.	Percentage of direction to works.	Sanctioned permanent strength.	Temporary upper subordinates.
	Average area per circle.	Average expenditure per circle.	Average area per division.	Average expenditure per division.	Average area per sub-division.	Average expenditure per sub-division.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Square miles.	Lakhs of rupees.	Square miles.	Lakhs of rupees.	Square miles.	Lakhs of rupees.	Lakhs of rupees.	Lakhs of rupees.	Per cent.	Lakhs of rupees.	Per cent.	No.	No.
Madras . . . . .	20,538	14 87	4,639	3 35	1,123	81	64 14	13 51	21 0	2 20	3 4	318	190
Bombay . . . . .	26,556	34 70	4,275	5 11	686	82	110 44	16 50	14 9	3 48	3 1	249	93
Bengal . . . . .	22,747	17 76	7,240	5 85	1,574	1 27	68 73	11 45	16 6	3 20	4 7	71	11
United Provinces . . . . .	18,777	16 04	3,852	3 26	1,252	1 06	..	..	..	..	..	109	27
United Provinces (buildings and roads only) . . . . .	26,817	23 27	7,151	6 14	2,024	1 74	93 05	14 65	15 7	3 52	3 8	64	25
Punjab . . . . .	10,526	19 29	2,138	3 95	912	1 68	..	..	..	..	..	181	65
Punjab (buildings and roads only) . . . . .	32,208	19 84	7,433	4 72	2,684	1 70	63 13	9 54	15 1	3 00	4 7	41	7
Burma . . . . .	36,548	17 23	7,462	3 92	2,950	1 55	95 91	22 74	23 7	5 68	5 9	125	28
Bihar and Orissa . . . . .	16,623	12 53	5,543	4 18	1,363	1 03	47 09	7 49	15 9	2 38	5 0	60	23
Central Provinces . . . . .	41,947	24 80	9,322	5 51	2,099	1 24	58 79	10 06	17 1	2 65	4 5	55	48
Assam . . . . .	42,329	33 24	8,781	6 03	2,364	1 62	38 68	6 81	17 6	1 90	4 9	34	5
Average . . . . .	22,308	19 29	4,866	4 19	1,349	1 16	..	..	..	..	..	..	..
Average (excluding United Provinces and Punjab irrigation branches)	27,897	20 36	6,421	4 70	1,567	1 15	..	..	17 6	..	4 4	..	..

NOTE.—The figures in columns 2 to 7 are based on the number of permanent circles and divisions (exclusive of special and extra divisions) included in the cadre in 1913-14. The figure in column 5 includes the expenditure in temporary divisions but in working out the average the aggregate expenditure has been divided by the number of permanent divisions only. The figures in columns 8 to 12 are taken from Statement I appended to the report. The figures in columns 13 and 14 are extracted from the classified list of establishment for June 1914.

These figures show considerable variations in the different provinces, and we have failed in several cases to obtain explanations of such variations. Owing to the different systems in force and to the varying conditions under which public works are executed throughout India, we realize that the figures are not in every case directly comparable and hence we refrain from making specific recommendations on the subject, and we content ourselves with pointing out the principal variations and with suggesting that the reasons for them might advantageously be investigated by the Government of India and the local Governments concerned. In this respect increased intercommunication between provinces as to the relative economy of the systems in force appears to us to be desirable.

The average percentage borne by the cost of establishment to that of works throughout India is 17·6, and varies from 14·9 in Bombay to 23·7 in Burma. The circles, divisions and sub-divisions in the latter province are, however, well above the average in area, and the high percentage is probably in part attributable to the scattered nature of the work. The figure of 21 per cent. in Madras is also high. This latter percentage is an approximate estimate only, for the irrigation and buildings and roads works are jointly carried out by a single staff, and the maintenance of a large number of small scattered irrigation works doubtless necessitates the employment of a large establishment, but we desire to draw attention to two facts—the small expenditure per circle, division and sub-division compared to that in most other provinces and also the very large number of upper subordinates entertained. There appears to be no *primâ facie* reason why Madras alone should require 30 per cent. of the whole upper subordinate establishment employed in India. As will be seen from Statement II attached to the report, the district boards in Madras carry out annually work costing Rs. 78·76 lakhs with an expenditure on establishment of Rs. 9·44 lakhs, whereas the establishment charges of the public works department, excluding direction, amount to Rs. 11·31 lakhs on a works expenditure of Rs. 64·14 lakhs only. Excluding Madras and Burma the average for the remaining seven provinces is 15·9 per cent. 101(ii).

The average percentage borne by the cost of direction, *i.e.*, chief and superintending engineers and their offices, throughout India is 4·4, which accounts for almost exactly 25 per cent. of the total establishment charges. The percentage of 5·9 in Burma is again the highest, but this is probably due to the causes already mentioned. The figures for Bengal and for Bihar and Orissa are somewhat above the average and appear to us to call for comment; whereas in these provinces a chief engineer superintends only an average of 8 permanent divisions, in the Punjab and United Provinces a chief engineer superintends 22 divisions, and hence the necessity for two chief engineers in Bengal and Bihar seems to require further justification. The areas and expenditure per circle in these two provinces, especially the latter, are also below the average.

It has been suggested by some witnesses that the direction charges of the department could be substantially reduced, without loss of efficiency, by the abolition of the post of superintending engineer, the executive engineer 92(i).

being given larger powers and corresponding direct with the head of the department. We hesitate to support this proposal, which would throw an undesirable amount of work upon the chief engineer, to the detriment of the exercise of his proper functions of general control, but in view of the fact that the number of divisions per circle varies from 7 in Bombay to 3 in Bengal, we recommend that the question of the necessity for the full number of superintending engineers at present employed should receive careful consideration.

A further point to which we would draw attention is the small size and expenditure per sub-division in Bombay. A sub-divisional officer in that presidency has a charge extending over only 686 square miles, against an average of 1,349 square miles, and an expenditure of only Rs. 72 lakhs against an average of Rs. 1.16 lakhs. The charges of these officers appear capable of expansion.

## 2. Relations of the public works department with other departments of the administration.

46. Several witnesses have recommended that it is desirable to bring the public works department into closer relations with other branches of the administration, and particularly with the district administration. At present the executive engineer is *ex-officio* professional adviser of all departments of the administration within the limits of his charge, but in other respects the department is more isolated than is usually the case with other branches of the administration, for example forests, education and the like. We do not accept the view that this is justified by the technical character of the work and that the operations of the department are less concerned with the ordinary affairs of the people. Even for the executive engineer to perform his duty as professional adviser it would be advantageous if the limits of his charge could be made to correspond with the boundaries of the civil administrative units. This is already the case in the United Provinces, where each district constitutes a sub-division, an average of three districts being combined to form a divisional charge; in the majority of cases, however, the limits of the division are determined more with reference to the nature and quantity of the work contained within it than to administrative convenience, but this latter factor deserves

- 26(i). some consideration. It has been recommended to us that every district should be provided either with an executive engineer or with a competent assistant engineer who would act as professional adviser to the civil head of the district in regard to all public works. We have considered whether such an arrangement is possible, but have come to the conclusion that, although it would have great advantages over the existing system, its introduction would in many cases involve additional expense and might prove impossible in provinces where irrigation and buildings and roads are under the management of a single staff, in which case the divisional boundaries must necessarily have reference to the irrigated areas. If our proposals in regard to the transfer of works to district boards are accepted the question will solve itself and hence we are unwilling to recommend any definite changes in the present arrangements during the transition period in view of the expense and dislocation

entailed thereby. But we advise that, wherever it can be done without difficulty or extra expense, the public works department charges should be so redistributed as to make them coincide, as far as possible, with the civil administrative units.

**Position of the chief engineer as head of the department.**

47. The chief engineer, under the system at present in force, is also secretary to the local Government or Administration, and is entrusted with very little power as head of a department, the whole control of public works being vested in the local Government. As chief engineer he has the power, when detached from the headquarters of a local Government, and subject to a report to that authority, to sanction the commencement of any urgently required work or repair up to a limit of Rs. 2,500 ; to sanction purchases of office furniture ; to accept a tender up to the limit of the sanctioned estimate provided the amount does not exceed the power of acceptance of the local Government ; to appoint, within sanctioned limits, office clerks, draftsmen and office servants ; to grant leave to this establishment and to other officers if specially empowered to do so ; and to dismiss any person appointed by himself or by any lower authority. Powers of technical sanction he has none

nor, with the exceptions noted above, has he any power over the establishment of the department. If the code rulings were strictly followed he could not, without a reference to the local Government, transfer a superintending or executive engineer at all, or move a subordinate from one circle of superintendence to another. In a great number of cases the chief engineer acts without reference to higher authority, issuing his orders in the name of the local Government, but this fact does not, in our opinion, make the position any less anomalous. We recommend that the chief engineer should exercise the ordinary powers of a head of a department on his own authority, and be entrusted with adequate powers both in respect of the control of works and of establishment. In all technical matters, such as the grant of technical sanction to estimates, the purchase of tools and plant, the local purchase of European stores, etc., the powers at present exercised by the local Government should be vested in the chief engineer. The local Government should be concerned only with the general administration of the department ; the chief engineer, by virtue of his office, should be responsible for its detailed control, and should be the final authority on technical matters.

P. W. D. Code,  
Vol. I, para. 254

**Position of the chief engineer as secretary to government.**

48. The question whether the chief engineer, who is also the head of a large spending department, should continue to be secretary to the local Government is one to which we have given careful attention. The public works department is the only department of which the head is also a secretary to government. The system is sanctioned by long usage, and this privilege is highly valued by the service and is said to be an attraction for recruitment. It is not, however, easy to say to what extent these views are prejudiced by the fact, referred to in the previous paragraph, that at present the chief engineer has practically no power at all in that capacity and that the large majority of his orders are therefore issued as secretary to the local Government. The position of the public works secretary in regard to his department

is in this respect different from that of any other secretary in regard to the professional departments included in his branch. In the former case the secretary actually controls the management of the department, in the latter he is not only responsible for showing, in each instance, how far the proposals of the head of the department concerned are in accordance with precedent and with the previously formulated policy of Government, but also how far they conflict with or conform to the interests of other departments. He is also responsible for securing the advice of the financial department in cases involving important expenditure and generally for presenting the case to the local Government with such complete information as to enable the head of the province to pass orders thereon. In cases where the secretary is doubtful whether the proposals of the head of the department can be accepted, on either administrative or financial grounds, it is usual (and in matters of importance should be the rule) to let the latter officer see the notes unofficially before the papers are submitted, and thus give him the opportunity either to explain away the difficulties or, as occasionally happens, to modify his proposals. The functions of the secretary are thus purely ministerial and advisory, and he is in no way, as some public works officers appear to imagine on the analogy of the present position of their own secretary, the administrative head of the departments with which he deals, the orders issued by him being, in actual fact as well as in name, the orders of the local Government. It is hence very questionable whether such secretarial work should form part of the duties of an engineer. An officer who is in the front rank of his profession may not infrequently be entirely unsuited for secretarial work, finding it irksome and distasteful, and both his professional work and the general administration suffer accordingly. It is urged that any change to the dual system in force in other departments would involve increased labour and waste, by requiring the work to be done twice over, and that public works matters are too technical for any outside control, particularly with the frequent changes made in secretariat appointments, with the result that the consistency and efficiency of the department's working would tend to suffer. But the force of these arguments is substantially lessened if the chief engineer is given the full and extensive powers which he should rightly possess as head of the department, for the number of cases requiring submission to the local Government would be much decreased and would consist almost wholly of such as, under the present system, he would have in any circumstances to prepare for the orders of the head of the province, whereas he would be saved a large amount of drafting and other ministerial work which at present devolves upon him, to the detriment of his professional duties. Moreover, looked at from the point of view of the public works department itself, it is questionable whether the position of its chief is not in some respects weakened by his appointment as secretary. In that capacity he ceases to represent his department and becomes the channel through which the orders of the local Government are communicated, and cases must inevitably occur when the orders which he is called upon to issue as secretary conflict with his views as chief engineer. As professional head of an important department he would occupy a more indepen-

dent position and would be able to press his views with greater force than he can as a secretary of the local Government. It is also the case that his secretarial duties interfere with his inspection work, preventing him from performing much touring, which we regard as an important defect of the existing arrangement. The main objection of the public works department, although not specifically stated, appears to be based upon the apprehension that the civilian secretary might usurp functions which he should not rightly possess, but this apprehension could suitably be met by giving the chief engineer regular and direct access to the head of the province or member in charge of the portfolio as has been recommended by the Public Services Commission in the case of directors of public instruction. This difficult question also requires consideration from a wider standpoint. The Decentralization Commission laid great stress on the danger of specialized departments pursuing their own course without reference to the views of other departments or to considerations affecting the people as a whole. We do not find that the public works department has avoided this danger in some important matters, notably in the attitude of some provincial departments towards private enterprise, which we have discussed in an earlier chapter of this report. In England the permanent heads of government departments are administrative officers and not experts, but experts are attached to the departments who advise upon points submitted to them. There is in England the further control by ministers, by parliament and by public opinion. In the present conditions of India the function of control of experts is also ordinarily exercised by a secretarial system manned by officers of general administrative experience and knowledge of the people and the country. The absence of such control is likely to lead to narrow departmentalism, and to it can be traced some of the complaints that the public works department is too isolated from the general administration. We do not accept the position that the public works department is concerned only with departmental efficiency; it should possess a wider outlook as a department intimately connected with the industrial development of the country. Only one local Government has suggested any change in the position of the chief engineer, from which it may perhaps be inferred that no great inconvenience is experienced in the practical working of the present system. Moreover, if public works are transferred to local bodies, the matter will right itself so far as the particular branch with which our inquiry deals is concerned, as when the public works department is constituted mainly as an inspecting and advisory body, cases must necessarily be submitted to government through the local and municipal departments, and the chief engineer will occupy his proper position as the professional head of the department. The majority of us (Mr. Sly, Sir Noel Kershaw and Mr. Cobb) consider the present arrangement unsuitable and believe that the separation of the chief engineership from the secretaryship would be in the interests, not only of the general administration, but of the department itself, but in view of the fact that time will give effect to our opinion and as the position is sanctioned by nearly sixty years of usage, as great importance is attached to it by the officers of the department, and in deference to the opinions of

Public Services  
Commission  
Report,  
Annexure IV,  
para. 26.  
Decentralization  
Commission  
Report, para.  
487.

14(iii).

those of our colleagues who desire the continuance of the existing system, we prefer to make no recommendation on the subject.

49. Too much stress cannot be laid upon the desirability of a real and close co-operation between the executive engineer and the head of the district. The executive engineer is the professional adviser of the collector, and unless a close touch is maintained between these officers the interests of the district works are bound to suffer. We do not propose to lay down any definite rules defining this relation preferring, with the Decentralization Commission, to leave the matter to the discretion of the various local Governments, but we desire to refer to the complaints of aloofness and lack of co-operation which have been preferred by the members of other departments against the public works, and to suggest that local Governments should impress upon all executive engineers that their duties as professional advisers to all the departments of the administration within the limits of their charges should be discharged not only in the letter but in the spirit also. The position of an executive engineer is admittedly a difficult one, as he is the servant of many masters, it is often impossible to please everybody, and refusal to do so leads to accusations of departmentalism, but we are convinced that these complaints would largely disappear in the face of a more genuine co-operation between the executive engineer and the district officer, and of a realization that both are working with one common object in view. It has been suggested to us that the executive engineer should be required to submit his diary through the collector to the superintending engineer, thereby giving the former an opportunity of bringing to notice anything upon which he might desire to comment without the necessity for an official reference, but we do not consider that there is any sufficient reason for recommending the adoption of this proposal, more especially as an executive engineer's charge may extend into three or four different districts.

Decentralization  
Commission  
Report, para.  
545.

- 52(i). which have been preferred by the members of other departments against the public works, and to suggest that local Governments should impress upon all executive engineers that their duties as professional advisers to all the departments of the administration within the limits of their charges should be discharged not only in the letter but in the spirit also. The position of an executive engineer is admittedly a difficult one, as he is the servant of many masters, it is often impossible to please everybody, and refusal to do so leads to accusations of departmentalism, but we are convinced that these complaints would largely disappear in the face of a more genuine co-operation between the executive engineer and the district officer, and of a realization that both are working with one common object in view. It has been suggested to us that the executive engineer should be required to submit his diary through the collector to the superintending engineer, thereby giving the former an opportunity of bringing to notice anything upon which he might desire to comment without the necessity for an official reference, but we do not consider that there is any sufficient reason for recommending the adoption of this proposal, more especially as an executive engineer's charge may extend into three or four different districts.
- 33(iii). to us that the executive engineer should be required to submit his diary through the collector to the superintending engineer, thereby giving the former an opportunity of bringing to notice anything upon which he might desire to comment without the necessity for an official reference, but we do not consider that there is any sufficient reason for recommending the adoption of this proposal, more especially as an executive engineer's charge may extend into three or four different districts.
- 2(iv). 50. We have now to deal with a complaint which has been raised by a number of officers of the public works department in regard to the large amount of unfruitful work demanded from them by other departments of the administration in the preparation of projects that fail to mature. It is stated that, in requisitioning the services of the department for the preparation of designs and estimates, the requisitioning officers neglect to give sufficient consideration to the question of available funds for expenditure, with the result that there is a continual preparation and piling up of sanctioned projects in the department, to await provision of funds, out of all proportion to the allotments likely to be available within any reasonable period, and that long before funds are forthcoming many of these projects are either out of date or are no longer required. The result is that a very considerable amount of the energy and time of the public works department officers is uselessly absorbed. It was also urged that a great deal of unnecessary labour is thrown upon the department by the frequent changes in views of the officers of other departments, on whose behalf projects are prepared, between the initiation and completion of the works. The original plans are usually called for by the local
- Preparation of projects on behalf of other departments.

officer of the department concerned, and preliminary line plans, with an approximate estimate, are made out; it often happens, however, that when these are submitted the head of the department does not agree with the local officer's views and modifies the requirements, and the preliminary plans and estimates have then to be drawn up afresh. Finally, when the executive engineer has satisfied both the local officer and his superior, the work may again be modified, or even thrown out altogether, by the local Government. Up to this stage however the work is merely in a preliminary state and, although these modifications absorb a good deal of time, even the officers of the public works department agree that there is no practical method of avoiding it altogether. What is condemned as the main flaw in the system is the procedure after the administrative sanction of the department concerned has been obtained, and the proposed work has been returned for preparation of the detailed plans and estimates for technical sanction. It is stated that frequently, owing to the failure of the departmental officer to examine carefully the preliminary plans, or to his failure to state his requirements in their entirety in the first instance, alterations and additions are demanded in the detailed drawings and that these modifications frequently necessitate new plans and estimates. The head of the department may have other changes to make and the process is repeated. In addition it frequently 2(vi). occurs that the departmental officers who approved of the preliminary plans are transferred before the detailed drawings are submitted, and their successors hold different views as to what is actually required. Finally it is alleged that even when the work is under construction the officers interested in it often desire alterations to be made not merely in the design but in the materials and class of construction also, thus involving the preparation of further revised estimates. It may thus happen that a work of no great magnitude may have to be designed several times before all authorities are satisfied, and it is to this procedure that the officers of the public works department attribute, in a large measure, the charge of dilatoriness often brought against them. The question of a suitable remedy is difficult; it is obviously undesirable that this duplication of work should be permitted to continue and yet it is equally undesirable that a department should be forced to accept a building which does not meet its requirements. The best solution appears to lie in the issue of executive orders to the effect that ordinarily, once administrative sanction has been given (and it may possibly be advisable to require the public works department to submit the preliminary plans in somewhat more detail than at present in order to render them thoroughly intelligible to a non-professional officer), no further alterations should be required, and that it should be considered as a reflection on an officer if he is found to be habitually making such alterations. In other words a much closer scrutiny of the preliminary proposals than is apparently sometimes accorded at present should be an important duty of the department concerned. We have considered the possibility of 2(viii). surcharging other departments with the cost of the preparation of these projects; the present system is obviously unsatisfactory as no charge is made and the expenditure involved goes to swell the general public



C. A. C., Vol. I,  
Art. 95.

works department establishment charges against works actually executed. It has, however, been pointed out to us that the buildings and roads branch is a "service" as opposed to a "quasi-commercial" department, and that no such charge is permissible unless a change of classification is introduced; we are not willing to recommend so drastic a measure and consider that it will be sufficient if the importance of a close scrutiny of the preliminary proposals, so as to obviate the need for subsequent alterations, be strongly impressed upon all members of departments which employ the agency of the public works department for the execution of their works, and if it be laid down that estimates shall not be demanded for any work unless there is every reasonable probability that funds for its construction will be available within a period not exceeding (say) three years. We would, however, suggest that the cost of the preparation of such projects for each department, calculated at the rates laid down by the Royal Institute of British Architects, together with the total of the construction estimates, should be tabulated in a statement for the information of government and the departments concerned, as in this way the local Government will have a ready means of ascertaining whether the cost of the preparation of projects for any particular department was out of proportion to the estimated value of the works.

P. W. D. Code, Vol. I, para. 649. 51. In the case of provincial works local Governments are authorized to give administrative sanction to any provincial work costing not more than Rs. 20 lakhs, and are empowered to delegate to officers subordinate to them such powers of administrative sanction as they possess by civil officers.

3(i). may consider desirable. It has been stated in evidence before us that but little advantage has been taken of this permission, and that the powers delegated to civil officers are unnecessarily restricted, which entails frequent references to the local Government even in the case of small and unimportant works. In Bombay commissioners of divisions and heads of major departments can accord administrative sanction to provincial works other than residential buildings costing not more than Rs. 10,000, in the Central Provinces the limit is only Rs. 5,000, while in Bengal it is the same except in the case of the director of public instruction whose powers extend to Rs. 10,000. We consider that Rs. 5,000 is too low a limit and entails unnecessary references to higher authority, and we therefore recommend that commissioners of divisions and heads of departments should be authorized to give administrative sanction to provincial works excluding residential buildings up to a limit of Rs. 10,000. We further recommend that the limit for "minor works," *i.e.*, those which are provided for in the budget by means of a lump sum allotment for each service head, should be raised from the existing limit of Rs. 5,000 to the same figure of Rs. 10,000. At present the necessity for every work costing more than Rs. 5,000 must be foreseen some two years before its construction can be commenced, and consequently there is often undesirable delay in undertaking buildings which may be badly required and which, from the point of view of provincial finance, are of a comparatively unimportant nature. If these recommendations are accepted, we believe that a considerable portion of the delay which at present takes

P. W. D. Code,  
Vol. II, para.  
1819.

61(i). Rs. 5,000 to the same figure of Rs. 10,000. At present the necessity for every work costing more than Rs. 5,000 must be foreseen some two years before its construction can be commenced, and consequently there is often undesirable delay in undertaking buildings which may be badly required and which, from the point of view of provincial finance, are of a comparatively unimportant nature. If these recommendations are accepted, we believe that a considerable portion of the delay which at present takes

**Powers of public works department officers in regard to the budget allotments for works required for other departments.**

place between the initiation of a project and its construction will be obviated.

52. Some officers of other departments have urged 75(i). that their requirements do not receive sufficient consideration in the preparation of the budget, where funds are allocated in the first instance to particular works, and also that the powers of the public works department to transfer funds from one work to another are too extensive, with the result that they never know whether a particular work in which they are interested is progressing or whether the funds provided for it have been transferred to some other work, and they have suggested that no such transfer should be allowed without a previous reference to the head of the department concerned. On the other hand the officers of the public works department 75(ii). are the only persons competent to decide whether it is possible to expend the full allotment upon any stated work, and references such as those proposed would lead to delays and consequent lapse of grants. We agree that the public works department must be the final authority in the matter, and are proposing in a later section that more extensive powers of re-appropriation be delegated to executive engineers, but to meet the views of the civil departments we suggest that the following procedure already in force in some provinces should be generally adopted. The allocation of funds in the public works department budget should be considered in the first instance by a committee, consisting of the financial secretary to the local Government, the chief engineer, the commissioners of divisions and the heads of the various departments most concerned. On the decisions of this committee, subject to the approval of the local Government, the budget estimate for the year will be based, and the allotments thus provided should be adhered to by the public works department as far as possible. The committee should also indicate the order of urgency of the works so included. Should the executive engineer find that during the course of the year he will be unable to expend the full allotment provided for any work, and decide to transfer the surplus to another work, he will take into consideration the order of urgency, and on making the re-appropriation will report the fact, with his reasons for so doing, both to the superintending engineer, who will immediately inform the head of the department concerned, and to the civil officer in charge of the district. In this way all interested parties will know what progress is to be anticipated on the various works.

### *3. Specialist branches of the public works department.*

**Recruitment and terms of service of specialist officers.**

53. The specialist branches of the public works department are of comparatively recent origin, only nineteen years having elapsed since the first electrical engineer and sixteen years since the first consulting architect was appointed. Since that time there has been an ever increasing demand for specialists, and all the major local Governments now employ their own architects and electrical engineers. There has also in the last decade been a great development of sanitary work, and although in most provinces the sanitary engineership is held by a public works department engineer, borne on the regular cadre, there is a growing tendency towards the formation of a separate sanitary branch, under the

buildings and roads chief engineer, as has already been established in the United Provinces.

As must always be the case while a service is still in its experimental stage, no definite system of recruitment to these specialist posts has, in the past, been adopted. The officers of the architectural and electrical branches in their entirety, and of the sanitary branch in part, have been engaged by the Secretary of State on short term covenants and on varying scales of pay and conditions of service as the necessity for each appointment became evident. Some of these officers have since joined the permanent establishment on terms peculiar to themselves, while others have been re-engaged for further periods of years on revised agreements. There are thus at present a considerable number of such specialists in the department, all drawing different rates of pay, borne on no particular cadre, some permanent and some temporary, some pensionable and some non-pensionable, some subject to one set of leave rules and some to another, some subscribing to one provident fund, some to another and some to none at all. This disparity of treatment naturally gives rise not only to discontent on the part of individual officers but at times to considerable administrative difficulty, especially as no uniform system for regulating the terms to be granted appears to have been adopted in the past. We therefore consider it desirable to lay down definite conditions of service which we recommend should be made applicable to all future holders of specialist posts the permanent necessity for which has been satisfactorily demonstrated.

54. *Pay.*—The most satisfactory method of fixing the pay of these specialist officers is, we consider, to grant them the same rates, age for age, as sanctioned for the engineer service of the department. As there will be no promotion to administrative rank, as in the case of the engineer service, we propose a continuous time scale throughout, the officer's pay rising by five annual increments from the maximum pay of an executive engineer to the minimum pay of a superintending engineer, and by five further annual increments to the maximum pay of that class. The maximum pay of a superintending engineer is, we consider, a sufficiently high rate of remuneration for the duties required from a specialist officer. We do not, however, desire to suggest that every specialist officer should be allowed to rise to the maximum rate proposed above. The maximum pay to be allotted to each post should be separately determined with reference to the responsibilities involved and the amount and nature of the work entailed. It is, for example, obvious that the post of consulting architect in a large presidency should carry higher emoluments than in a small province. The maximum for each post, architectural, electrical or sanitary having been fixed, the officer appointed to it will draw the pay which, age for age, he would have drawn in the general engineering branch of the department until he reaches that maximum, after which further increments will be inadmissible.

*Leave.*—In regard to leave we accept the general principles laid down by the Public Services Commission, *viz.*, that officers who, when they enter the department, are paid salaries at the higher rates specified for officers recruited in Europe should be subject to the European leave rules, while all others should be subject

to the Indian service leave rules throughout their careers. Public Services  
 We also endorse the Commission's recommendation that Commission  
 the rule prohibiting officers from taking furlough during Report, para. 79.  
 the first eight years of their service should be annulled.  
 This rule operates particularly harshly in the case of men  
 who join government service after a period of employment  
 in a private firm in this country. We further recommend  
 that the public works department should be included  
 amongst the services to which study leave should be 89(i).  
 admissible for further technical training and specializa-  
 tion under the recommendation made in paragraph 84  
 of the Commissions' report.

*Provident fund.*—We do not recommend that these  
 specialist appointments should be pensionable as there  
 is always difficulty in adapting the pension system to  
 services the officers of which are recruited at varying  
 and often advanced ages. We consider that it is pre-  
 ferable to give such officers the benefits of a special pro-  
 vident fund, on the lines proposed by the Public Services Public Services  
 Commission for the revenue establishment of the railway Commission  
 department, officers to subscribe one-twelfth of their Report,  
 salaries to the fund and government to add a bonus Annexure XIX,  
 of 100 per cent., interest at the rate of 4 per cent. or such para. 16.  
 higher figure as the Secretary of State may determine  
 being paid upon all subscriptions and bonuses thus  
 accumulated. A provident fund of this nature has the  
 advantage that it permits a man who desires to withdraw  
 from government service and take up private practice  
 to do so without incurring loss in the matter of prospective  
 pension (and, as we have already pointed out, we consider  
 that government should encourage the development of  
 private enterprise in India), while on the other hand  
 it facilitates the removal of officers whose work fails to  
 give satisfaction or becomes stereotyped, a matter of  
 great importance in the case of specialist services.

The above recommendations are of a general nature,  
 and we shall now proceed to deal separately with each  
 of the three main specialist branches and explain to  
 what extent we consider that these general proposals  
 should be made applicable to each.

*Architectural branch.*

**Duties and  
 responsibilities  
 of the consulting  
 architect.**

55. Under the present system the consulting archi-  
 tect is, in all provinces except Bombay, a designer,  
 and is not responsible in any way for the construc-  
 tion of buildings the plans for which are prepared  
 in his office. In several provinces we were informed 17(ix)  
 that he does, in practice, visit works during construction  
 and gives the engineer in charge the benefit of his advice,  
 but these visits are of an informal nature and involve  
 no responsibility on his part. It is urged that in this 17(vi).  
 way architects are cut off from one of the main functions  
 of their profession, namely the supervision of the con-  
 struction of their buildings, and that this divorcing of 17(ii).  
 design from execution is inimical to the best interests  
 of architecture in India, since design, if separated from,  
 construction, is apt to lose its vital relation to actualities,  
 its touch with material and with the appropriate and  
 economical use of it. It has also been urged that the 17(iii)-(iv).  
 efficiency of building work in general is reduced by  
 inserting between the architect and the work an inde-  
 pendent control which owes no allegiance or responsi-  
 bility to the former, and that the Indian system is  
 altogether opposed to the practice in force in more

advanced countries, where the architect retains complete control during the construction of his works.

17(viii). In Bombay a somewhat different system has been adopted, the consulting architect being not only responsible for the design of important buildings throughout the province, but also in charge of the actual construction in the presidency town of all government buildings designed by him, with a special staff for this purpose. This arrangement has proved satisfactory and we have no doubt that the combination of design and execution under a single agency is desirable wherever it can be

11(i). obtained. It has been suggested that, to make such combination possible, the department should be divided into two separate branches, one undertaking the supervision of roads and the other that of buildings. We cannot however recommend a measure which would lead to so serious a duplication of staff, necessitating as it would two separate agencies in the same area, and we realize that it is impracticable to entrust to a special service of architects the construction of small buildings scattered over large tracts of country where an engineering staff must, in any case, be maintained. We consider however that it should be recognized that the supervision of building construction is an important portion of the duties of an architect, and we recommend that, in large centres such as presidency towns or other places where public works department divisions exist for building purposes only, and where it is probable that sufficient work of this nature will continue indefinitely, a staff of architects should be maintained and entrusted with the executive charge of the work, the cadre of engineers being correspondingly reduced. A similar arrangement should be made elsewhere when a building is to be constructed of sufficient importance to justify a separate sub-divisional charge.

17(v). A further point which has been raised is the relative responsibility, under the present system, of the engineer and the architect for the structural stability of works designed by the latter. In some provinces the architect is considered as being primarily responsible, in others as having no responsibility whatever. We consider that the architect should take the same responsibility for structural stability as is taken by an executive engineer in the case of projects prepared by him. It is the officer who prepares the designs in the first instance who is in the best position to detect engineering defects, and the fact that the estimate and plans have to be approved by the superintending or chief engineer should not be held to relieve him of his duty in this respect. Although these latter officers are required to satisfy themselves of the soundness of any project before giving their approval, it is impossible for them personally to examine and check every detail, and while they should undoubtedly be required to bear their full share of responsibility, the primary responsibility should rest with the officer who prepares the original plans, be he engineer or architect.

56. The qualification for the post of consulting architect should, in our opinion, be a fellowship of the Royal Institute of British Architects, and candidates should, in the first instance, be recruited as at present on five-years' agreements, and on a scale of pay equal to that drawn by an officer of the civil engineering branch

of the same age. On the expiration of his covenant, provided the officer concerned has proved satisfactory and that there is sufficient work to justify the appointment of a permanent whole-time architect, he should be transferred to the permanent establishment on the terms enumerated in paragraph 54 of this chapter. During his five years' probation he should be permitted to subscribe to the special provident fund and his service during this period should count for leave in the event of his being confirmed in his appointment.

**Terms of  
appointment of  
assistant  
architects.**

57. The qualification for the post of assistant architect should, we consider, be a fellowship or associateship of the Royal Institute of British Architects, provided, in the latter case, that the candidate has in addition served for at least three years with a practising architect in Europe. In regard to the conditions of service of these officers we are not unanimous. The majority of us favour the present system of successive five years' agreements, with pay and provident fund on the same scale as recommended for consulting architects, on the grounds that this arrangement may result in inducing men, on the expiry of their agreements, to settle down in private practice in India, that it will ensure the periodical introduction of new blood and new ideas, that it will avoid the administrative difficulties which are inherent in a small cadre of permanent officers all of whom not unnaturally consider that they have a direct claim upon the higher posts, and finally that it will obviate the danger of the recruitment of a larger permanent staff than will be required if effect be subsequently given to our recommendations regarding the transfer of work to district boards. Our President, however, considers that satisfactory recruits will not be secured on five years' agreements with no right of renewal for even approved service, because no promising architect will sever his European connection for such temporary prospects; that experience of temporary appointments of specialists in other services has proved it to be unsuitable for India; and that the best hope for the establishment of an indigenous school of architecture in India lies in the formation of a permanent service identified with the country. The majority of us are of opinion that the balance of advantage lies in recruiting assistant architects on short term covenants as their services are required, dispensing with them or extending their engagements on the completion of each agreement. We are all agreed that the ultimate aim should be the recruitment of architects in India, as soon as suitable candidates can be obtained, and towards this end we recommend later on (paragraph 85) the immediate establishment of a good school of architecture in Bombay.

**Consulting  
architect to the  
Government of  
India.**

58. The Royal Commission on Decentralization dealt with the position of the consulting architect to the Government of India. Prior to that time all local Governments with the exception of Madras, Bombay and Bengal were required to send to the Government of India, for the approval and criticism of the consulting architect, the designs for all public buildings the cost of which was beyond the local Government's power of sanction or which were estimated to cost more than Rs. 50,000. The Decentralization Commission recommended that the monetary limit should be abolished, and that it should be left to local Governments to apply to the consulting

Decentralization  
Commission  
Report, para.  
207 (iii).

architect to the Government of India in cases in which they considered his advice desirable, and effect was given to this recommendation in 1909. Since then all the major local Governments have entertained their own consulting architects, and the number of detailed plans submitted to the Government of India has consequently greatly diminished, the powers of the major local Governments to accord technical sanction to estimates having also been raised to Rs. 20 lakhs in the case of provincial works and Rs. 2½ lakhs in the case of imperial works, including in both cases departmental charges for establishment and tools and plant. This latter limit has again been raised, in the present year, to Rs. 20 lakhs, and consequently the number of projects which will in future be submitted by major local Governments to the Government of India will be very small.

- 18(i). The consulting architect to the Government of India has suggested to us in his evidence that it would be advantageous to government to entrust him with the design of all imperial works, such as post and telegraph offices, customs houses, etc., costing more than Rs. 2½ lakhs on the grounds that an officer at the imperial headquarters is more in touch with the heads of imperial departments and that local Governments are apt to subordinate economy of design to the desire to obtain, at imperial expense, a building which will be an ornament to the locality and a credit to its designers. We are unable to accept this proposal, which strikes at the whole root of decentralization by assuming that local Governments are less careful of imperial than of provincial funds. With the appointment of provincial architects decentralization was inevitable, and we consider that, in a matter such as architecture, interference by the Imperial Government with local Governments is unnecessary. With the development of provincial autonomy the reasons which rendered it necessary for the Government of India to retain an architect are rapidly disappearing, and we are of opinion that the appointment is only justified for so long as the work received from minor administrations and other departments is sufficient to afford employment for a whole-time officer.

*Sanitary branch.*

59. Hitherto no separate sanitary service has been formed as a branch of the public works department, the posts being filled ordinarily by officers of that department, who may or more usually may not have any specialized training in sanitary engineering. A proposal has been made for an imperial sanitary service, liable to service throughout India, the members of which should be deputed to the different provinces. The strength of such a service has been estimated at 29 officers, with an ultimate number of 38 allowing for future expansion and leave vacancies. Against this proposal it has been urged that the administration of so small a service would present serious difficulties, that promotion would be irregular, that the dual control between imperial and provincial would be objectionable, and that to ensure anything like regularity of promotion would necessitate constant interprovincial transfers of deputy sanitary engineers to fill the sanitary engineer-ships as they fell vacant. It has also been urged that good officers would be deterred from joining such a branch,

Organization  
of the sanitary  
branch.

because they would be unable to aspire to the highest posts of the department, and that the formation of such a service would involve the maintenance of a staff of experts employed solely on design, with no practical experience of construction under Indian conditions. Finally it has been postulated that, as it has proved unnecessary to recruit separately for irrigation and railway work, there is no reason why an exception should be made in the case of sanitary engineers. These arguments are directed mainly against three of the proposed conditions of service, namely, that it will be an all-India service, that recruitment will be of junior officers for training in India, and that the staff will be maintained for design only, construction being entrusted to the general branch. The recommendations we are about to make involve however none of these, and consequently we believe that most of the objections stated above are not applicable. We are convinced that the time has come to provide India with a staff of sanitary experts with specialized training and able to devote their energies, to the exclusion of all other work, to the building up of a thoroughly organized scientific system in co-ordination with the results of European research. We deprecate, however, any idea of an imperial service, and recommend the formation of a branch on similar lines to that proposed by us for the architects, consisting in each province of a sanitary engineer and a number of assistant sanitary engineers, recruited specially for the purpose on the system detailed in the next paragraph, and responsible not only for the design, but also for the supervision of construction, of major sanitary projects. The fact that the chief engineership will not be tenable by officers of this branch will not, we consider, deter the right class of man from entering, any more than it has done in the case of the architects. We realize the difficulties involved in the administration of a very small cadre, but our recommendation that the sanitary branch shall undertake the construction of its own works will entail a larger staff than that hitherto contemplated. It would, in our opinion, be wrong in principle to entertain an establishment of experts for design alone; it is essential, as we have already explained in regard to the proposed architectural service, that design should go hand in hand with local knowledge and with the economical and appropriate selection and use of the labour and materials available. We would make it clear from the outset that officers recruited as assistant sanitary engineers have no claim upon the post of sanitary engineer; when that post falls vacant the local Government concerned will have the choice of three alternatives—to promote an assistant sanitary engineer on its own establishment, if a suitable officer is available, to obtain a recommended assistant sanitary engineer from another province or to recruit an outsider specially for the post. We do not consider that, on the scale of pay and conditions of service which we propose, there will be any lack of suitable candidates for the lower posts.

As regards the argument that it is no more necessary to recruit specially for the sanitary branch than it is for the irrigation or railway branches, it appears to us that the cases are in no way parallel. India is probably the finest school in the world for an irrigation engineer, and it would obviously be anomalous to import into India irrigation experts trained elsewhere, and similarly India



can compare with any European country as a field for training in railway engineering. But with sanitary engineering the conditions are very different. Sanitary science is still in its infancy in India and to rely on that country as a training ground would mean the risk of a stereotyping of ideas and failure to progress in line with the results of modern research. It is probable that it will be many years before India can compete with Europe as a school for sanitary engineers.

Another argument advanced against the proposed sanitary service is that it is not every young engineer who has the tact and patience required in dealing with local bodies, that to keep such an officer in the service would have serious disadvantages while to return him to England would speedily affect recruitment, and that it would be distinctly advantageous to be able to transfer an engineer, temperamentally unsuited to the sanitary service, to the general branch of which, under quite different conditions, he might prove a most useful member. We are not impressed by this argument. The position of the public works department engineer as professional adviser to the district officer necessitates a close touch between the former and the various local bodies of the district, and if the former lacks the tact and patience necessary for the sanitary service he is likely to be unsuited for employment in any branch of the department.

- 79(i). 60. Under the present system the majority of the **Recruitment** sanitary engineers are officers drawn from the general **of sanitary and** branch of the public works department, only three officers **assistant** having been specially recruited for the post. The **sanitary** sanitary engineerships are usually borne on the cadre of **engineers.** superintending engineers, and there are indications in some provinces that officers have been appointed to the post of sanitary engineer rather because they were ripe for promotion to administrative rank than because they possessed any special qualifications for sanitary work. We do not consider that this system is satisfactory. As we have already stated, sanitary engineering is a highly specialized branch of the profession, and in our opinion specialists should be recruited for specialist posts. We recommend that, in future, posts in the sanitary service should be filled by officers recruited specially for the purpose, the main qualifications being that candidates should have a sound practical training on sanitary works and should be conversant with the latest developments of modern sanitary science. We
- 79(iii). consider that this is of more importance than previous Indian experience, upon the necessity for which much
- 79(ii). stress has been laid by certain witnesses. If, however, a public works department officer undergoes special courses of study and obtains adequate training, we would not debar him from appointment, provided he is willing to be transferred definitely to the cadre of the sanitary service, and to take his place upon the time scale laid down for specialist branches. Such an officer should, however, retain his claim to pension and should not be admitted to the benefits of the special provident fund.

For sanitary engineers specially recruited we recommend that they should be engaged on probation on a five years' agreement in the first instance, on the pay which, age for age, they would have drawn had they entered the general branch at the age of 23, and that thereafter, if proved to be satisfactory, they should be

brought on the permanent establishment on the salary and conditions of service laid down in paragraph 54. We do not think that the reasons advanced against the permanent employment of assistant architects apply so fully to assistant sanitary engineers and we consider that they also, after completing satisfactorily a period of five years' probation, may be brought on the permanent staff. Once again we do not desire to lay down the maximum pay within the scale to which either the sanitary engineer or his assistants should be allowed to rise, which should vary from province to province and should be fixed strictly in accordance with the duties and responsibilities of each particular post.

Relation of the sanitary engineer to the chief engineer.

61. In all provinces except Bengal and Bihar and Orissa the sanitary engineer is directly subordinate to the chief engineer ; in Bengal and Bihar he works directly under the branch of the general secretariat which is responsible for local and municipal affairs. We favour the former system and consider that, like the architectural and electrical experts, the sanitary engineer and his staff should be members of the public works department and thus be under the general control of the chief engineer. 79(vii)

*Electrical branch.*

Functions of electrical engineers.

62. Every major province now employs its own electric inspector, and in Bengal and Bombay a second electrical engineer is entertained in addition. The main function of the electric inspector is to carry out statutory inspections under the Indian Electricity Act, while in all provinces except Bombay he is also adviser to the local Government in electrical matters ; in Bombay this latter duty is performed by the second electrical engineer. The second electrical engineer in Bengal is the executive officer in charge of the so-called electrical division. This division was formed temporarily in 1908 to undertake both original and maintenance work in connection with electrical installations in public offices and buildings in Calcutta which had, prior to that year, been entrusted on contract to private firms, and in 1913 was reconstituted on a permanent basis ; the officer in charge has no statutory duties, his work being of a purely executive nature. The second electrical engineer in Bombay is, as already stated, the responsible adviser of Government, and in addition erects and maintains all electrical installations pertaining to government buildings throughout the presidency. While we recognize the necessity for an electric inspector in each province, we are not convinced that the appointment of a second electrical engineer is justified. The work of the electrical division in Calcutta consists mainly of installation and repair work such as a private owner invariably gives out to a reliable firm. Considering the extent to which electricity is used in Calcutta it is obvious that reliable agencies for the execution of such work exist, and it is very doubtful whether government is justified in maintaining an expensive establishment for the purpose. The same remarks apply equally to Bombay. If the advisory duties, at present entrusted to the electrical engineer, are transferred to the electric inspector, we consider that the balance of the work, consisting mainly of the executive charge of small installations, could be taken over by a less highly trained and highly paid agency. This executive work does not, in our opinion, 36(i). 36(ii).

require the appointment of officers of the attainments of the present incumbents, and the maintenance of divisions such as that in Calcutta is detrimental to the legitimate claims of private enterprise. We therefore recommend that each province should confine itself to the employment of a single electrical expert, who should combine the duties of electric inspector and adviser to the local Government, all work except *bonâ fide* maintenance being entrusted to private firms where such are available. For the small amount of pure maintenance work which will remain a much less highly skilled agency will suffice.

63. Electrical engineers appointed to the department should possess an electrical or mechanical engineering degree and also considerable previous practical experience of electrical work and be fully qualified to act as advisers to government. They should be recruited on the same terms as consulting architects and sanitary engineers, namely on a five years' covenant in the first instance and thereafter, if found suitable, brought on the permanent establishment on the scale of pay and conditions of service enumerated in paragraph 54.

64. The exact position and responsibilities of the electrical adviser to the Government of India are by no means clearly defined. The administration of electrical matters was decentralized by the Indian Electricity Act of 1910 to such an extent that practically the only power remaining to the central Government is that of making rules under the Act. In the circumstances the necessity for an electrical expert at imperial headquarters is not evident. He possesses no statutory functions and local Governments are not required to apply to him for advice. In 1916 the Government of India issued a circular which laid down that local Governments were free to consult him should they desire to do so, and which, while authorizing him to tour in the various provinces, with the exception of those which signified that they did not wish him to do so, debarred him from making official inspections or from submitting inspection notes except at the special invitation of the local Government. We consider that the position of an imperial expert who can be (and we understand in the case of one local Government has been) requested to refrain from visiting any province, and who may at the best only "visit" but may not "inspect," is anomalous. Our inquiry shows that, so far as local Governments are concerned, there appears to be no justification for the appointment, and it would probably be more convenient for minor Administrations which maintain no electrical engineer of their own to call upon the services of the inspector in the nearest province rather than upon the electrical adviser to the Government of India. Certain instances have been referred to in which the interests of supply companies have been found to be in conflict with those of the local Government and it has been suggested that the electrical adviser's counsel is of great value in such cases, but the right of appeal from the local Government's decision to the Government of India under the Act is somewhat indefinite, and in any case we consider that matters of this nature could more appropriately be referred to a private consulting electrical engineer appointed *ad hoc*. Another branch of the activities of the electrical adviser upon which stress has been laid is the
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chairmanship of the annual conference of electric inspectors, and the preparation, for the orders of the Government of India, of the various questions discussed. We are not in a position to decide to what extent this preparation is necessary, or to what extent Government could, without further expert advice, accept the recommendations of the majority of the provincial inspectors. It seems to us, however, that there is not work enough for a whole-time officer, and that most of the questions referred to the electrical adviser could be settled by consultation from time to time with a qualified outside expert. Possibly no such expert is available in India at present, and hence the Government of India may desire to retain their own adviser, but we recommend that the matter should be reconsidered before another incumbent is appointed permanently to the post.

*Further specialized branches.*

**Necessity for further specialization in the public works department.**

65. Several witnesses have stated their opinion that 86(i). further specialization in the department is desirable, particularly in the case of bridge building and mechanical engineering. In favour of the former suggestion it has been urged that, under the present system, an officer is called upon to design and construct perhaps one large bridge in his career, and is hence necessarily handicapped, whereas greater economy and efficiency would be obtained by the employment of a specialist to undertake all major bridge work. We are unable to support this proposal; bridge design and construction are part of the ordinary work of the civil engineer, and the introduction of a specialist would merely lead to further duplication of staff. A local Government can always, if it so desires, transfer to a district where large bridging projects are contemplated an officer with previous experience of such work, and we consider that this is a better and more economical solution than the creation of a specialist branch.

In regard to mechanical engineers, it appears that the services of such officers are required not in connection with government work but with the mechanical installations and pumping plants belonging to municipalities. This being so, we are averse to the formation of yet another specialist branch of the department for the purpose, and consider that it would be preferable, where such an expert is necessary, to encourage municipalities either to combine together to employ a mechanical engineer if sufficient work exists in the province for a whole-time officer or, if not, to contract with a reliable firm for the periodical inspection and repair of their installations.

**Introduction of European quantity surveyors, clerks of works and foremen.**

66. It has also been suggested that the work of 74(i). the department would be improved by the introduction 15(i). from Europe of trained quantity surveyors, clerks of works 45(i). and foremen or master craftsmen in some branches of the building trades. This proposal also we are unable to accept. Not only are grave difficulties always inherent in the importation of European subordinates into India for any service in which only a small number are required, but we are by no means convinced that it is really necessary. It appears to us that progress can be made by a better training of the material available in India and particularly by improving the teaching of estimating in the engineering colleges and the training of foremen in the technical schools. We are opposed to any further increase in the Europe-recruited

staff of the department, especially in the subordinate ranks. We recognize that progress in the present low standard of several branches of the builder's trade is desirable, but believe that it can be better secured by insisting on gradually increasing standards of work under the supervision of architects and engineers.

#### 4. Improvements of procedure.

67. During our investigation a number of officers **Public works** of the public works department have stated in evidence **department** that the system of accounts and audit at present in force **accounts.**  
 1(xv). in the department is unnecessarily complicated, and that their accounts work is so heavy as to interfere seriously with their executive duties. After an examination of the existing procedure we agree that the executive engineer is required to devote too much time to his accounts and we recommend that steps should be taken to relieve him of the work of compilation, leaving him responsible only for the record of the initial transactions, and for the preparation of such statistics as are necessary either for his professional purposes or for the maintenance of adequate control over his expenditure. Our detailed recommendations on this subject will be found in Part I of Appendix B.

68. Under the existing system the powers of the **Decentraliza-** various classes of officers of the public works department **tion.** are, in our opinion, unnecessarily restricted, thereby extending the chain of responsibility, even in comparatively unimportant matters, to an undesirable degree, and we are convinced that the fact that officers are not allowed to exercise powers commensurate with their skill and experience has reacted unfavourably upon the efficiency of the department. To the same fact may probably be attributed part at least of the delay which at present often occurs in the commencement of works. We have already proposed that the powers of professional sanction now possessed by the local Government should be vested in the chief engineer, and we recommend that the corresponding powers of both superintending and executive engineers should be materially enhanced. We also recommend that limited powers of professional sanction should be delegated to sub-divisional officers and that both superintending and executive engineers should be given increased powers of control over the staff employed within their jurisdictions. Our recommendations are detailed in Part II of Appendix B.

Decentralization  
Commission  
Report, para.  
229.

69. The Decentralization Commission recommended **Public works** that the provisions of the public works department **department** should be confined to rulings necessary for general appli- **code.** cation in the interests of imperial finance and control and that the idea of making it an official *vade mecum* for engineer and accounts officers throughout India should be abandoned. Many witnesses have represented the difficulties of working caused by the numerous restrictions of this code, but as we understand that it is in process of revision on the lines indicated by the Decentralization Commission, it appears unnecessary for us to make any general recommendation on the subject. Certain specific rules have, however, been brought to our notice in which we consider that modification is desirable, and these are dealt with in Part III of Appendix B.

Intercommuni-  
cation between  
provinces in  
regard to  
works.

70. During our investigation we have had occasion to notice the apparent lack of intercommunication between provinces in regard to works. While realizing that considerable differences must necessarily exist between the rates in force and materials and specifications in use in the various provinces, it appears to us probable that economy could be effected by a more general interchange of information. There are wide differences, for example, between the standard plans adopted for the same class of buildings, differences too marked to be attributed merely to different climatic conditions, with the result that apparently, if the accommodation provided in one province is adequate, that provided in another is extravagant. We therefore advocate an increased interchange of information between the provinces such as that represented by standard plans, specifications, analyses of rates and the like, in order that each province may obtain the benefit of the experience of its neighbours, and thus enlarge the data available for the preparation of its own designs and estimates.

## CHAPTER VI.

### ENGINEERING EDUCATION.

The four major  
engineering  
colleges.

71. We now proceed to deal with the last of the subjects referred to us, namely the adequacy of the education imparted at the government engineering colleges.

There are four major engineering colleges in India, the Thomason College at Roorkee in the United Provinces, the Sibpur College near Calcutta, and the colleges at Madras and Poona. Each of these institutions is independently administered under the orders of the local Government within whose jurisdiction it lies, and for educational purposes the three last named are affiliated to the universities of their respective presidency towns. Three grades of education are imparted at each college, adapted respectively to the needs of engineers, upper subordinates and lower subordinates. We inspected all four institutions, and in addition to hearing the evidence of the principal and selected members of the staff, we held conferences at Poona, Sibpur and Roorkee, where we discussed with the staff of professors the more important issues arising from our inquiry. We confined our detailed attention to the civil engineering branches of these colleges.

Proposal to  
establish a  
single  
engineering  
college.

72. It was suggested that the maintenance of four colleges, each attempting to teach up to the highest standard, is in advance of the needs of the country and involves a dissipation of strength, and that it would be advantageous to centralize the more advanced engineering education in a single imperial college where a higher course could be given, leaving to the remainder the production of a lower grade of engineer. This proposal was considered by the Public Services Commission, who recorded the opinion that the objections to such a scheme were far stronger than any arguments that could be adduced in its favour. Not only did it appear to them that a single college would be inadequate to deal with the ever increasing number of engineers required by government, native states, municipalities, local boards

13(i).  
Public Services  
Commission  
Report,  
Annexure  
XVIII,  
para. 14.

and private firms, but they considered that it would tend to attract students mainly from the neighbouring provinces, and that the advancement of engineering science in more distant provinces would suffer accordingly. We agree with the Commissioners that the balance of advantage lies on the side of retaining the four existing colleges, each organized so as to be capable of teaching up to the highest standard, and are convinced that the centralization of higher engineering education would be a retrograde step and would affect adversely the industrial development of India, with which development the demand for engineers is certain largely to increase.

- 5(i). 73. An alternative recommendation made to us is Constitution that the control of the four existing colleges should be of an imperial centralized in the Government of India and an imperial advisory board. advisory board constituted, which should pay visits of inspection at stated intervals, examine and report on the procedure and courses of study, and generally tend to reorganize the colleges as four branches of a single institution. We do not, however, consider that there is any necessity for such centralization. We recommend, in the following paragraphs, more uniformity between the different colleges in certain matters such as age limit at entrance, length of courses, etc., but we consider it preferable that, in other respects, the management and administration of the colleges should remain with the local Governments concerned, who are the best judges of local requirements.

74. The following is the present arrangement of Present classes at the four major colleges. arrangement of classes at the four colleges.

(a). *Roorkee*.—There are three classes in civil engineering at the Roorkee college, the civil engineer class, the upper subordinate class and the lower subordinate class. The course for the civil engineer class extends over three years, that for each of the subordinate classes over two years, and in all cases admission is by entrance examination, subject to the production of satisfactory certificates of health and character and, in the case of the first two classes, to the possession of certain specified educational qualifications. There is also at Roorkee a department of technology, divided into classes in textile and in mechanical and electrical engineering, as well as classes for mechanical and industrial apprentices.

(b). *Sibpur*.—The college at Sibpur is divided into two main departments, the engineer department which prepares students for the Bachelor of Engineering degree of the Calcutta University, and the apprentice department for the training of subordinates. The course of study in the engineer department extends over four years, the first two years' courses being common to all students; thereafter they select the particular branch of engineering, civil, mechanical and electrical or mining, in which they propose to appear at the Bachelor of Engineering examination, and the courses bifurcate accordingly. The four years in college are followed by a year of practical training on works, and although the Bachelor of Engineering degree is awarded purely as a result of the theoretical training, the college diploma is not granted until the year's practical work has been satisfactorily performed. The full course of instruction in the apprentice department extends over five years, during the first three and a half of which the instruction is given at the college, the last year and a half being

spent entirely in practical training either in works or in the college workshop. Every apprentice passing the examination held at the end of the second year is entitled to a certificate stating that the holder possesses the theoretical qualifications required of a sub-overseer in the public works department, while those passing the final examination held at the end of three and a half years are entitled to a third grade overseer's certificate. On the completion of the full five years' course the apprentice is entitled to either a sub-engineer's or an upper subordinate's certificate, according to the marks obtained. A proposal has however lately been submitted to the local Government to separate the classes for upper and lower subordinates, and to introduce two distinct courses, one of three years for the former and one of two years for the latter. Classes in mining and in mechanical and electrical engineering are also attached to the apprentice department the courses in these subjects extending over three years, the college diploma being awarded to successful students at the end of the third year. In addition to the above classes boys, preferably the sons of artisans, are admitted for training in the college workshops as carpenters, blacksmiths, fitters, etc.

(c). *Madras*.—The Madras college contains an engineer class for the training of civil and mechanical engineers, an upper subordinate class, a lower subordinate class and a probationary subordinate class. The course of instruction in the engineer class extends over five years, of which four are spent in college and the fifth on works; the Bachelor of Engineering degree of the Madras University is not awarded until the students have performed satisfactorily their year of practical training. The students of civil and mechanical engineering follow the same course of study for the first two years, after which the courses bifurcate. All students taking the subordinate courses commence in the probationary subordinate class, and remain in it for two years. At the end of that period a certain number of students are promoted into the upper subordinate class, the course of instruction in which extends over three years, of which two are spent in college and one on works. The remainder pass into the lower subordinate class where they study for a further period of one year.

(d). *Poona*.—There are three separate branches represented at the Poona college, *viz.*, the civil engineering, the mechanical engineering and the apprentice branches, the last mentioned being sub-divided into three classes, for sub-overseers, mechanical apprentices and electrical apprentices respectively. The civil engineering course was, until the present year, common to both engineers and upper subordinates, the course of study extending over three years, at the end of which the students appeared at the Bachelor of Engineering examination of the Bombay University. The mechanical and civil engineers took the same course for the first year, bifurcation taking place at that stage. Sanction has, however, lately been obtained to the sub-division of the civil engineering branch into two courses, the higher course extending over four years during which students will be prepared for the Bachelor of Engineering examination, and the lower course, which will be of a more practical nature, lasting for three years only, and entitling the student to a college diploma. The course for sub-overseers



extends over three years, and the syllabus is separate throughout from that prescribed for the mechanical and electrical apprentices.

75. From the above description it will be seen that education in civil engineering is generally divided into three grades, engineer, upper subordinate and lower subordinate. In our proposals regarding the reorganization of the public works department we have advocated the abolition of the present upper subordinate class, and the retention of only two classes, engineers and subordinates. We recommend that the same principle should be applied to the engineering colleges also, since the upper subordinate appears to us to be an undesirable compromise between the engineer officer and the subordinate proper, and we believe that not only government, but public bodies and private firms also, would be better served by an engineer trained and recognized as such. There should, we consider, be only two departments of civil engineering in each college, for the training of officers and subordinates respectively, the engineers for both the superior and provincial government services, as also the district engineers contemplated in our reorganization scheme, being drawn in general from the former class. We recognize that there are objections of principle to the present system under which engineers and subordinates are trained together in the same institution and, while recognizing that no change may be possible in the immediate future, we consider that when the demand for engineers justifies the step the ultimate policy of government should be to eliminate all forms of subordinate education from the colleges and to provide for them in technical schools.

39(v). Arrangements recommended.

76. (a). *Engineers.*—The educational qualifications prescribed for entrance to the civil engineering courses of the four colleges vary considerably. Candidates for Roorkee are required to pass a competitive entrance examination, the qualification for admission being a Bachelor of Arts or Bachelor of Science degree of an Indian university, a school leaving certificate with certain subjects, or some equivalent qualification. Sibpur and Madras accept the intermediate arts or science standard of the universities provided that certain specified groups of subjects have been taken and, in the case of Sibpur, that the candidate passes a special drawing test, while at Poona a certificate from the principal of an affiliated arts college to the effect that the student has carried out satisfactorily the work appointed by the university for the first year after matriculation, with distinction in certain subjects, is recognized as sufficient. There is no entrance examination at Sibpur, Madras or Poona, selection being made by the principal if the number of candidates exceeds the number of vacancies. The maximum age limits laid down for entrance are 21 on the 1st June preceding the entrance examination in the case of Roorkee, 22 on the 1st January of the year of admission for Bachelors of Arts or Science and 20 on the same date for others in the case of Sibpur, 19 on the 30th of June of the year of admission in the case of Madras, while at Poona no age limit is prescribed.

(b). *Subordinates.*—To qualify for appearance at the entrance examination for the upper subordinate class at Roorkee, candidates must have passed the matriculation examination of the Punjab University or

the school final examination or possess some equivalent qualification. No educational qualifications are prescribed for the competitive entrance examination for admission to the lower subordinate class. The matriculation standard is accepted at Sibpur, the matriculation or school final examination at Madras, and the school final examination at Poona. In the case of Sibpur, students of certain affiliated *zilla* schools who have taken a two years' course in the so called B class at those schools are eligible for admission to the second year class of the apprentice department, while candidates from affiliated technical schools may, if accommodation is available, be admitted direct into the third year class. The maximum age limits at entry are 22 on the 1st June preceding the entrance examination for upper, and 21 on the same date for lower subordinates at Roorkee, 17 last birthday at Sibpur, 19 on the 30th June of the year of entrance at Madras while at Poona no age limit is prescribed.

**Recommendations in regard to age limit and educational qualifications.**

77. (a). *Engineers.*—There is considerable diversity of opinion among the witnesses who have given evidence before us as to the correct age at which a student should commence his specialized education in engineering. Those who favour the adoption of a high age limit urge 39(i). that students should not be debarred from taking their Bachelor of Arts or Science degree (upon the possession of which Indian opinion lays great value), before admission to the engineering college, and that the four years at an arts or science college ensures a good general education, including a sound grounding in mathematics. It is also urged that this secures a higher standard of knowledge of the English language, and so enables Indians to compete on more equal terms with students whose mother tongue is English but who are usually not so forward in mathematics as the university graduates. Stress was also laid on the fact that Indian parents usually postpone the decision as to their sons' future professions till the latest possible moment, with the result that the fixing of a low age limit would exclude many candidates who at present do not decide to take up engineering till towards the end of their university course, and so narrow undesirably the field for selection. In favour 39(ii). of a low age limit it is urged that it is to the benefit of the student to bring him into the atmosphere of his future profession as early as possible, and that there is a danger, if he spends four years at an arts college, of his acquiring sedentary and literary tastes which may unfit him for the work of an engineer. A low age limit will, it is also suggested, bar the admission of students who, having commenced their university course with the intention of entering a literary profession for which a degree is essential and having no real bent for engineering, find themselves unable to pass their final examinations and so fall back on engineering merely as an alternative method of earning a livelihood. The majority of us (Mr. Sly, Sir Noel Kershaw, Messrs. Cobb and Mackenzie) consider that the balance of advantage lies on the side of adopting a low age limit. Especially in the case of Indian students, whose early environ- 49(i). ment is usually unfavourable to the development of manual training, we consider it desirable that they should commence their specialized training, and particularly their workshop training, as soon as possible after the completion of a general school education. We should

have preferred to adopt the school-leaving stage and thereafter even to include, if necessary, a certain amount of general education in the engineering colleges, but we

56(i). are assured that the matriculation standard is so low, especially in some provinces, that the imparting of such general education would throw an undue strain upon the staff of the engineering colleges and that the knowledge of English connoted by it is inadequate to enable students to follow any but the most elementary courses of technical instruction in that language. We therefore recommend that the qualification for entrance should be the intermediate standard of an Indian university, with English, mathematics, physics and chemistry as compulsory subjects, or such European school standard as may be recognized as equivalent, certificates of character and health being also required. Selection should then be made from among the qualified candidates by means of an entrance examination in the four subjects mentioned above, by English being understood modern English, including a short essay and an oral test. We recognize that there is an educational objection to this system, in that the colleges teaching science will be educating boys in the same classes but with two different objects in view, some taking the intermediate examination as a preliminary to their degree, and some as a qualification for admission to the engineering college, and we have considered the alternative of prescribing a competitive entrance examination in general educational subjects, including those specially allied to engineering, without insisting upon any preliminary educational qualification. It appears to the majority of us that there are still more serious objections to this course. Not only would it prove uneconomical and undesirable, as rejecting the existing educational machinery of the country for testing the general education of candidates, but it would inevitably lead to the substitution of systematic "cramming" for the period now spent in the acquisition of a general education, and to the establishment of special coaching institutions for the purpose, and such a system would, in our opinion, be opposed to the best interests of the engineering profession.

We are convinced that the present age limits are

83(i). fixed too high. At Sibpur, for example, a student can join the college at the age of 23 years and 10 months (the course begins in November), spend six years in college, two failures being allowed by the rules, spend one year on practical training and thus gain his college diploma at the age of 31. We recommend that the age at entrance should not exceed 19 last birthday, which allows three years from the date of matriculation and permits, if necessary, of one failure in the intermediate examination. We realize that the age limit proposed definitely debars holders of university degrees,

100(i). and it has been stated that this fact will cause the best class of candidate to refrain from taking up engineering, but we are not convinced of this and doubt whether the student, whose heart is so set upon the acquisition of a degree that he will therefore renounce the engineering profession, would in any case have proved himself a satisfactory engineer.

Our colleague Rai Bahadur Lala Ganga Ram dissents from the opinion of the majority for the reasons given in his separate minute. We regret that, for the reasons

recorded above, we are unable to support his proposals.

(b). *Subordinates*.—We recommend that the same principles should be followed in the case of subordinates as in that of engineers, selection being made by means of an entrance examination from amongst candidates educationally, morally and physically qualified. The educational qualification necessary should, we consider, be the matriculation, school final or corresponding European school standard. The maximum age limits prescribed for entrance into the subordinate classes at Roorkee and Madras appear to us to be unnecessarily high; the minimum age at matriculation is 15 at both the Punjab and Madras Universities, yet the maximum age limits for entrance to the engineering colleges are 21 and 22 at Roorkee (for lower and upper subordinates respectively) and 19 at Madras. We recommend that the maximum age limit at entry to the subordinate classes should be 18 last birthday in all cases. We contemplate that students will ordinarily compete at the entrance examination at the end of the matriculation or school final course but this age limit will allow the exceptional student who desires to do so to spend two years at the university and sit for the intermediate examination.

Length  
of course.

78. (a). *Engineers*.—The committee appointed by the Minutes of the Institution of Civil Engineers in England in 1903 to inquire into the subject of the training of engineers recommended that such training should be divided into three parts, an introductory workshop course of one year, a college course of normally three sessions and two or three years' practical training subsequent to this course. These recommendations were endorsed by the whole engineering profession and may be accepted as an authoritative expression of professional opinion. Owing however to the paucity of mechanical workshops in India we believe that it would be impossible to insist on the introductory course in the case of every student entering the colleges and hence we are unable to advocate the adoption of this system in its entirety, but we shall in a later paragraph advise an increased amount of workshop practice during the college course. We recommend that the period of training should extend over five years, of which three should be spent in college and two on works, and that the present year's apprenticeship for students gaining guaranteed appointments in the public works department should be abolished, a period of two years' probation being substituted as recommended by the Public Services Commission, this period of probation being applicable to all recruits, whether appointed in India or in England. The conditions in India are unfavourable to the combination of college instruction and practical training throughout the course, generally known as the sandwich system, and we consider that the practical training on works, which will be referred to in greater detail in the next paragraph, should be taken after the college course, but should be looked upon as an integral part of the students' professional education, and that no diploma or degree should be awarded until it has been satisfactorily performed. Its importance is already recognized by the University of Madras, which withholds the grant of the Bachelor of Engineering degree till after the completion of the year's practical training on works, but both the Calcutta and Bombay Universities award their

Proceedings of  
the Institution of  
Civil Engineers,  
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1905-06, Part V.  
Public Services  
Commission  
Report,  
Annexure  
XVIII,  
para. 17.

69(x).

69(xi).

degrees on the result of a theoretical examination only ; we advise that these universities should be moved to adopt the system in force in Madras and so essential do we consider this principle, in view of the overwhelming evidence of all classes of witnesses as to the drawbacks of the present system owing to the lack of practical training, that should they refuse to recognize as a qualification for their degrees a course of practical training over which they will have little or no control, a contingency which certain witnesses have suggested as possible, we recommend that the engineering colleges should sever their connection with the universities and be administered as independent institutions, as is already the case at Roorkee.

(b). *Subordinates*.—For the subordinate classes we recommend a period of training extending over four years, three years being spent in college followed by one year on practical works. In this case also the apprenticeship year for subordinates gaining appointments in the public works department should be abolished.

69(xii). 79. As stated in the foregoing paragraph we place **Practical** the greatest importance on the practical training of **training of** engineering students, an opinion which is endorsed by **engineers.** every professional witness who has given evidence before us. We consider that it is both dangerous to the community at large and derogatory to the engineering profession that students should be permitted to practise as engineers on the strength of having passed a theoretical examination, and we have received evidence that some of them rely almost wholly on the practical experience of the *mistris* employed by their clients. We therefore consider that government should undertake to provide practical training, to the extent already indicated, for every student, whether engineer or subordinate, who passes through the engineering colleges, not only in the public works department but also, if arrangements can be made, in railways, port trusts, district boards, municipalities and private firms. We have no reason to doubt that in this way sufficient facilities for the practical training of all students can be provided and the principal of the college should be responsible for arranging such facilities. We do not think it necessary that a separate officer should be employed to supervise the practical training of students, for we doubt whether such supervision would lead to much result, and the college principal should be able to exercise the necessary amount of control. The first portion of this training should be spent on actual works, followed, in the case of engineer students, by a period spent in the drawing office, in order to give them the opportunity of co-ordinating their experience of practical conditions with design. The weight of evidence has convinced us that under existing conditions it is not only impracticable to require students to pay a premium for such training, but that many of the apprentices would be unable even to afford to maintain themselves during those years without some assistance from government. We therefore recommend that all students undergoing practical training should receive stipends at the rate of Rs. 50 per mensem for engineers and Rs. 25 per mensem for subordinates. The expenditure involved will be more than recouped by the improved standard of engineering, and when its value has been fully proved the necessity for such stipends can be reconsidered. We

are opposed to the proposal made by several witnesses that government officers undertaking the training of apprentices should receive special fees for this duty, and we are convinced that every officer will be ready to give to such apprentices, without extra remuneration, all the necessary advice and assistance in learning their work.

**Practical training of Indian engineers educated in England.**

80. The committee appointed by the Secretary of State to inquire into the system of state technical scholarships drew attention to the difficulty experienced by Indian engineering students in England in obtaining opportunities for practical training in that country, and recommended that the Government of India should consider whether facilities could not be given to such students to obtain practical experience in India. We consider it desirable that such facilities should be provided, and recommend that students, who have taken a recognized course of theoretical instruction in England, should be permitted to undergo practical training in India for the same period and on the same terms as those educated in the Indian colleges.

**Government scholarships.**

81. We have been unable to obtain reliable figures of the cost of education of each class of student but it is undoubtedly high compared with the fees, and in addition at all the government colleges and at most of the technical schools, scholarships are awarded by government to a substantial number of students. The amount of each scholarship is usually small; in the case of the engineer classes at the major colleges it varies from Rs. 30 to Rs. 40 per mensem at Roorkee, Rs. 20 to Rs. 40 at Sibpur. Rs. 15 to Rs. 20 at Madras and Rs. 5 to Rs. 12 at Poona. For subordinates it varies from Rs. 4 to Rs. 25 at Roorkee, Rs. 6 to Rs. 12 at Sibpur, Rs. 8 to Rs. 10 at Madras and Rs. 4 to Rs. 7 at Poona. The number of such scholarships is, however, large, and at Sibpur the amount thus awarded exceeds the amount of fees by Rs. 21,000 per annum. They are, in the majority of cases, tenable for one year only and are awarded on the result of the previous year's examination. We do not consider that this system is satisfactory; the scholarships are largely treated as prizes and hence are of little assistance to the indigent student who, even if granted a scholarship at the beginning of his course, has no guarantee that he will continue to hold it throughout. We recommend that, instead of these numerous petty scholarships, a smaller number of stipends should be awarded but of an amount which will cover at least the major portion of the student's expenses, and that they should be tenable throughout the course subject to satisfactory progress.

**Allotment of guaranteed appointments.**

82. -Under the present system the guaranteed appointments in the public works department are allotted in different ways by the different colleges. At Roorkee two students are posted as apprentices against each vacancy, and if the senior fails to prove his fitness for the post of assistant engineer the junior is appointed. This system has been condemned by the Public Services Commission who have recommended that in future only one apprentice should be posted to each vacancy. At Sibpur the guaranteed appointment is allotted partly on the result of a practical examination held at the end of the period of training on works, at which the six students passing highest in the Bachelor of Engineering examination compete, and partly on the marks obtained in the latter examination. At Madras the student is appointed who is

Report of the Committee to inquire into the system of state technical scholarships, para. 69.

81(i).

Public Services Commission Report, Annexure XVIII, para. 17. 48(i).

judged most suitable on the results of the examinations, the promise shown by him, and his general behaviour during the college course, the course being deemed to include the year of practical training. At Poona the appointment is awarded solely on the result of the Bachelor of Engineering examination. We recommend that in future guaranteed appointments in the department should be allotted at the end of the period of training, when a final practical examination should be held, on the lines of that followed at Sibpur. This examination should include tests in levelling and surveying, the practical design and setting out of works, the resources of the country (including the manufacture and use of materials and the analysis of rates), the elements of practical mechanical and electrical engineering, drawing, estimating, handicraft and riding. The proportion of marks to be allotted to this examination should be half of the total of the final theoretical examination. In awarding these appointments the reports received from the officers under whom the students have received their practical training should also be taken into consideration, and a satisfactory report should be an essential qualification for appointment.

- 40(ii). 83. Some witnesses have stated that students occasionally enter the engineering colleges without any intention of joining the profession but with the sole object of obtaining a degree and thus entering some other branch of government service as a graduate, and it has been suggested that the degree in engineering should not be considered as a qualification for entrance to government departments other than the public works. We agree with this suggestion; the education of an engineer is expensive to government and accommodation at the colleges is limited, and it is undesirable that the colleges should be utilized as a means of securing appointments in departments where technical qualifications are not required. We therefore recommend that a degree in engineering should not in itself be regarded as a qualification for entry into government departments other than the public works, although the possession of an engineering degree should not disqualify the holder for posts for which he is otherwise qualified. **Qualifications implied by engineering degree.**
- 41(ii). 84. The evidence received by us has in general tended to show that the standard of the theoretical education imparted at the government colleges is sufficiently high **Suitability of college curricula.**
- 41(iii). and that in the case of the subordinate classes it is possibly even higher than is necessitated by the work which the students are eventually required to perform. Opinion is however almost unanimous that both graduates and subordinates, on first taking up outside work, show lack of practical ability and it is with the intention of remedying this defect that we have advocated a compulsory training on actual works. The Committee appointed by the Secretary of State to inquire into the system of state technical scholarships laid stress on the advisability of giving all Indian engineering students a preliminary workshop training before the college course, but as already stated we consider that, in the present conditions of India, this is impossible; we recommend however that provision should be made in the curricula of the various colleges for an increased amount of workshop practice particularly during the first two years of the course, so as to remedy the want of the preliminary training as far as possible. We also recommend that a more

Report of the Committee to inquire into the system of state technical scholarships, para. 66 (i).

Specialization  
at colleges.

prominent place should be given to mechanical engineering 41(i). in the civil engineer's course, and that students should be instructed, as far as it can be arranged, in the care, hand- 41(iv). ling and repair of such machines as portable engines, steam rollers, etc., with which they are likely to have to deal in their every day work.

85. Several witnesses have recommended that further 85(i): specialization should be permitted during the college course, and that students should be encouraged to take up special branches of civil engineering such as irrigation, railway or sanitary engineering and devote themselves particularly to the branch selected. We are opposed to such specialization during the college course of three years, which will include elementary instruction in these subjects, and which is not too long a period to devote to the production of an all-round civil engineer. If any student desires to specialize in a particular branch 85(iii). he should be allowed to do so only after the completion of his general training. With the growth of a real demand for such specialization post-graduate courses might be introduced at the various colleges, one college providing for sanitary engineering, another for irrigation and so forth, and these courses might become extremely valuable if men could be persuaded to attend them after first putting in a year or two of practical work in the subject concerned. We consider however that some provision should be made for the separate training of architects. It is desirable that every civil engineer should have an elementary training in architecture, and with this object in view we recommend that, where it is not already the case, the elements of the subject should be added to the curricula of the engineering colleges. For the training of architects proper, as distinct from engineers, we recommend the institution of a separate college, and we endorse the proposal of the Bombay 82(i). Government to start such a school in connection with the present school of art, the courses to include such subjects as stresses and strains, quantity surveying, hygiene and electrical engineering, leading up to the award of a degree in architecture. We are convinced of the necessity for one good school of architecture in India, and Bombay is the most suitable centre and will probably meet all requirements for the time being. Provision should also be made, at places where a demand for such men exists, for the training of architectural draughtsmen in the various technical institutes and schools of art. We attach as Appendix C a memorandum kindly furnished to us by the Royal Institute of British Architects on Indian building, which may be read in connection with this paragraph.

Limitations on  
number of  
engineering  
students  
admitted to the  
colleges.

[86. The numbers of admissions to the engineering classes of the colleges are limited ordinarily to 20 at Roorkee, 40 at Sibpur, 20 at Madras and 50 at Poona, although we were informed that owing to lack of accommodation only 24 are usually admitted to Sibpur, while in practice as many as 30 are admitted at Madras, and it has been suggested by some witnesses that these 39(vi). numbers should be increased. We are not convinced, however, that the annual output of engineers is less than the existing demand, and this view receives support from the fact that 46 per cent. of the upper subordinate posts in Bengal are filled by Bachelors of Engineering, that 60 per cent. of the products of the engineering class at Madras accept subordinate positions, and that posts as upper



subordinates are guaranteed to and accepted by the students from Poona passing second and third in the Bachelor of Engineering examination. It is obviously uneconomical for government to provide, at considerable expense, an engineering education of the highest standard for a man who will remain for the greater portion of his life in an inferior position and will never have the opportunity of exercising the knowledge gained during his college course. If however our recommendations in regard to the formation of a provincial service are accepted and district boards are encouraged to employ qualified engineers it may prove necessary to enlarge the engineering classes of some of the colleges, particularly of Roorkee.

87. We consider that the four major engineering **Equipment** colleges are generally equipped with better apparatus **of colleges.** than is necessary for the purposes for which they are intended. The essential requirements for a college are simple machines of a suitable type and in sufficient number for the students to handle, rather than more elaborate apparatus. There seems to be a tendency on the part of the staff of some of these colleges to apply for more elaborate equipment than is actually required for instructional purposes, and in this connection we would particularly mention the equipment proposed for the new engineering college at Madras, which appears to us to be unnecessarily elaborate. The apparatus installed is often more suitable for post-graduate research and elaborate test experiments than for instructional purposes, but it should be remembered that the primary function of the college is to train engineers, and care is required that such research and testing are not allowed to interfere with the ordinary college course. For this reason we are averse to any further research work being undertaken by the professorial staffs, unless it is proved not to interfere with educational requirements, and we recommend that, in future, no fees should be charged for tests undertaken in the colleges.

39(vii). 88. The question of the sources from which the **pro-Recruitment** professorial staff should be recruited is one upon which **of staff.** we received a considerable amount of evidence and several witnesses have suggested that it would be advantageous to recruit a larger proportion of the professors of engineering from officers of the public works department with practical experience of engineering in India. We consider that such teaching appointments would not be likely to attract suitable officers, as the best engineers would probably be unwilling to abandon their practical work for professorial posts and that, even if good engineers were attracted, they would not necessarily make good teachers. In general the existing staffs appear to us to be satisfactory, and we recommend a continuance of the present system of direct recruitment; we would however make an exception in regard to the post of principal, leaving it to the local Government concerned to fill vacancies by the appointment of an engineer or of an educational officer, as may be most suitable. Subordinate posts in the college may be filled, as at present, by a proportion of subordinates of the public works department, but great care should be exercised in selecting them. It would also, in our opinion, be advantageous to arrange for senior officers of the department or distinguished private engineers to give from time to time courses or single lectures based on their

Special  
questions re-  
lating to  
Roorkee  
college.

experience of practical work. In time it may also be desirable to create honorary chairs to be filled by distinguished members of the profession, who would give a course of lectures on the lines followed at medical colleges.

89. (a). *Control*.—The Roorkee college is at present controlled by the branch of the secretariat dealing with industrial matters, with the assistance of a committee of management of which the chief engineer and the director of public instruction are members. We do not consider that this arrangement is altogether suitable; it appears to have been introduced owing to the inclusion of textile and industrial classes, but we have already advocated that all such subordinate instruction should, where practicable, be relegated to technical schools. The functions of the college are educational rather than industrial, and hence we recommend that, as in other provinces, it should be administered through the educa- 78(vi). tion department of the local Government, assisted by a board of visitors upon which the public works depart- 78(iv). ment should be represented. We also consider it advis- 78(iv). able that the present informal board of studies, consisting of the college professorial staff, should be officially recognized and its functions defined.

✓(b). *Affiliation to the University*.—Certain members 78(i). of the professorial staff of the college have urged that affiliation to the Allahabad University would be greatly to the advantage of both the college and the staff, as thereby the college would be established in its proper place in the educational system of the province and the professors brought into touch with other educational work. We consider, however, that Roorkee is so isolated by its geographical position that its association with Allahabad would in any circumstances be of little benefit, and that affiliation presents more disadvantages than advantages. It would, in the first place, be very difficult to form a satisfactory faculty owing to the paucity of private engineers in northern India, (such a faculty was formed in 1893 but died of inanition ten years later) 78(iii). and the admission to the syndicate of a representative of the faculty with little interest in general educational questions would be detrimental to the university. There would be a real danger of the formation of a faculty overburdened with representatives of pure science subjects, whose inclination would be to set a higher standard in those subjects than is necessary for an engineer, a difficulty that has already been experienced in some of the engineering colleges already affiliated. It has also been brought to our notice that affiliation 99(i). results in considerable delays in introducing desirable changes in the courses of instruction. Yet another danger is the possibility of the affiliation in future of institutions with totally different ideals to those of Roorkee and which might yet obtain a preponderating voice in determining courses which would apply to the latter college. It has been urged that a degree in engineering would 100(i). attract better students than at present, but we find that Roorkee already attracts a better class of student than any of the colleges which are so affiliated, and as already stated, the student who joins a college not with the desire to practise the profession of engineering but merely as a stepping stone to a degree is not the type required. Further, unlike the presidency colleges, Roorkee is not a territorial institution but draws candidates from and

provides engineers for the United Provinces, Punjab, Burma, Bihar and Orissa, Central Provinces and Assam, and there seems no reason for affiliating it to the Allahabad rather than to the Punjab University. This point will be further intensified if universities are instituted, as proposed, at Rangoon, Patna and Nagpur. For all these reasons we recommend that the Roorkee college should not be affiliated to any university. A possible alternative would be to empower the Roorkee college to grant its own degree instead of a diploma, which would have some advantages, but we have not been able to examine the important educational issues involved in this suggestion.

- 78(v). (c). *Curriculum*.—It has been suggested by certain members of the college staff that the curriculum at Roorkee would be improved by the reduction of the courses in estimating and surveying, which subjects are said to possess little real educative value. As we have
- 42(i), already stated, evidence has been given by some engineering witnesses that the standard of estimating in India is lower than in Europe, and it has been suggested
- 74(i). that trained quantity surveyors should be imported. We, therefore, deprecate any reduction of the standard of instruction in estimating. Surveying is universally considered a subject of great importance in the training of an engineer, in which it is difficult to acquire correct methods after leaving college. The present course in this subject appears satisfactory and we recommend that no change should be made. It has also been suggested that the preparation of the engineering project, which all students of the civil engineer class are required to undertake at the end of their third year's course, occupies an undue amount of time to the detriment of their general engineering education. The object of this project is to give the students an opportunity of putting into practice the principles learnt during the course, but we doubt whether, until they have some knowledge at least of the practical side of engineering, it is of much use to demand from them a complete project for a canal or railway. To the intelligent preparation of such a project a knowledge of the actual conditions under which works are executed is essential and with the introduction of the system of practical training which we have advocated we consider that the project will no longer be necessary as a portion of the college course, and that it can suitably be discontinued.

90. In addition to the four major engineering colleges, Government there are also five government technical schools for the technical training of subordinates, at Dacca in Bengal, Patna schools in Bihar, Insein in Burma, Nagpur in the Central Provinces and Rasul in the Punjab. Of these the first four mentioned have classes for both overseers and sub-overseers, the school at Rasul training lower subordinates only. We recommend that our general proposals in regard to the training of subordinates, contained in paragraphs 77 and 78 above, should be made applicable to these schools. There should be only one subordinate class, educating boys up to the same standard as those of the major colleges, selection of students for admission being made by means of a competitive entrance examination from amongst candidates educationally, morally and physically qualified, the matriculation, school final or corresponding European school standard being accepted

as the necessary educational qualification. The age at entrance should not exceed 18 last birthday, and the period of training should extend over four years, three years being spent in college, and one on practical work, government being responsible for providing facilities for the latter and no certificate being given until it has been satisfactorily performed. During the year spent on works students should receive stipends of Rs. 25 per mensem, as proposed for subordinates from the major colleges. Our recommendations in regard to government scholarships, contained in paragraph 81, apply equally to these technical schools.

We have already, in paragraphs 35 and 66, recommended that increased facilities should be provided in the technical schools for the training of *mistris* and foremen. The provision of such training should, we consider, be regarded as an important function of these institutions, classes being started with this object in view where they do not exist.

During our tour we visited the schools at Patna, Insein and Nagpur. The school at Patna is provided with suitable accommodation and equipment to meet present requirements, but we consider that the workshop staff is inadequate and that it is impossible for a single foreman to undertake the training of 200 boys; we recommend therefore that it should be strengthened. At the Nagpur school we advocate the addition of further workshop practice to the curriculum. The school at Insein in Burma is much below the standard of other schools; the accommodation in the class rooms and hostel is inadequate, the mechanical workshops are badly designed and not nearly large enough, and the equipment is poor. The headmaster has succeeded in the last few years in attracting a superior type of student to the school and, as more boys apply for admission, the class of entrant will doubtless continue to improve. We attach great importance to the Insein school, which is the only institution of its kind in Burma, as tending to encourage industrial enterprise among the Burmans, and we recommend that its condition should receive a thorough investigation at the hands of the local Government and that it should be so improved, enlarged and equipped (and some portions, including the mechanical workshops, entirely rebuilt) as to fit it properly for the work which it is designed to perform. As the Burman has only lately begun to adopt engineering as a profession, we consider that everything possible should be done to attract him to it, and in the case of Insein we agree that the rigid age limit which we have recommended for entrance to the subordinate classes elsewhere might be relaxed, students of more advanced age being permitted to enter, provided that accommodation is available and that they are not allowed to compete with other candidates for government service.

F. G. SLY,  
*President.*

N. T. KERSHAW,  
C. S. COBB,

\* GANGA RAM,  
A. T. MACKENZIE,

D. G. HARRIS,  
*Secretary.*

*Members.*

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\* Signature subject to the remarks contained in the minute appended.

MINUTES RELATING TO THE REPORT BY  
MEMBERS SIGNING THE REPORT.

*Minute by Rai Bahadur Lala Ganga Ram.*

I have signed the report as I am in full agreement with my colleagues as to the suitability of the main lines of advance indicated therein. There are, however, two points of importance in regard to which I do not concur in the recommendations of the majority, and, being apprehensive lest the acceptance of these recommendations in all their details may be detrimental to the success of our main scheme of reorganization, I append this minute to explain the grounds upon which my apprehensions are based and to indicate more clearly than has been done in the report the objections to which, in my opinion, the majority proposals are open.

*Paragraph 17: Organization of engineering staff after transfer of public works to district boards.*

2. In this paragraph are detailed the terms upon which it is proposed that engineers shall be employed by the district boards. The essential feature of this scheme is that such engineers shall be, in all respects, the servants of the board employing them. They will be subject to no superior technical control in regard to the details of the execution of works, it being specifically laid down in sub-paragraph (b) that the proposed inspector of works will exercise no direct authority over the district boards or over their engineering staff, his duty being merely to call the attention of the boards, through the medium of inspection reports, to such instances of negligence or inferior work as may come to his notice, and to report to the commissioner any case of a district engineer whom he considers unfit for his appointment. While agreeing with my colleagues as to the main principle that in future the administration of all public works, whether imperial, provincial or local, should as far as possible be entrusted to local bodies, I believe (and this belief is based on a practical experience of local boards and municipalities extending over 20 years, during which I served as an *ex officio* member of all such as fell, from time to time, within the limits of my charge) that to give to such bodies full powers of control over their technical staff and over the actual details of the execution of work will endanger the success of the whole scheme and subject it to a risk of failure such as attended the same experiment in the United Provinces in 1882 and in Bengal ten years later.

3. In the first place, so long as district boards are constituted as at present, the system advocated will tend, in my opinion, to lower the status of the district engineer, particularly in the less advanced provinces, and to deter the best class of man from competing for such posts.

939 Considerable stress was laid on this aspect of the case by  
949 certain witnesses in the Central Provinces, which may per-  
1123(6) (ii) haps claim to be the most advanced of all in the matter of  
and note local self-government, inasmuch as every district board in  
1183 that province has a non-official chairman. It was stated  
1195(3) in evidence that the members of the local bodies did not  
1321 occupy a sufficiently strong social position to permit of  
1335 their dealing directly on terms of personal authority with

NOTE.—The figures in the margin refer to the paragraphs in Volume II of the Minutes of Evidence.

qualified engineering officers, that they were not in a position to decide upon matters of professional detail and that any attempt to relegate the engineer to the position of a servant of the local board could only lead to friction and failure. This opinion was shared by the Hon'ble Mr. 1144. (now Sir James) Walker, Commissioner of the Nerbudda Division, who advocated that, although the remainder of the district staff might be placed under the control of a board of works with the deputy commissioner as chairman, the district engineers should, for the present, be excluded from that control and formed into a service for the whole province. I am convinced that the subordination of the engineer to the district boards in their present state of development would deter large numbers of suitable candidates from adopting engineering as a profession.

4. The absence of superior executive technical control is also, to my mind, a weak point in the scheme. As already stated the proposed inspectors of works are to exercise no authority over the district engineers, and in the case of a large government work, such as might conceivably be required even in a third class district, the whole details of its execution will be in the hands of an officer drawing Rs. 300 a month, possibly a newly joined recruit from the engineering college. The inspector will be debarred from giving him direct orders and, if his advice is not followed, the most he will be able to do will be to report him to the works sub-committee of the board, which will presumably meet only at intervals, and by that time the mischief will have been done and the money wasted. In the interests both of efficiency and economy I consider that the inspector should possess powers of direct executive control over the district engineers within his division analogous to those exercised by the superintending engineer over the executive engineers within his circle under the present system. He should also be an *ex officio* member of all district boards within his jurisdiction, and vice-chairman of their works sub-committees, presiding over their meetings, in the absence of the deputy commissioner.

5. There are in my opinion other defects inherent in the scheme, upon which I will only touch in passing, such as the inevitable canvassing for the votes upon which every issue, from the appointment of an engineer to the giving of a contract, will depend, and the difficulties which will arise owing to communal and religious differences especially in the northern provinces. I apprehend also that the withdrawal from the engineering colleges of the guaranteed appointments at present allotted to them in the buildings and roads branch of the department will lead to deterioration in the class of candidate entering those institutions. The evidence taken by the Committee left no doubt but that these appointments formed the principal attraction of the colleges and, without going into the question of whether this is or is not as it should be, I have no hesitation in stating that, in Indian eyes, the creation of a number of temporary appointments under district boards, even with the prospects now proposed, will not be looked upon as compensating for the withdrawal of the government posts.

6. The main objects which the Secretary of State and the Government of India had in view when appointing this Committee were apparently the introduction of a more economical system of working than that at present in

force, the abolition of the existing duplication of staff, the establishment of closer relations between the engineer and the civil authorities, and the development, as a result, of private enterprise and local autonomy. I consider that all these objects could be more suitably and economically obtained by less drastic means than those proposed by my colleagues. They have, I think, underrated the difficulties which will arise during the protracted transition stage which they contemplate. They suggest, in paragraph 23, three alternatives for the disposal of the existing staff, namely transfer to local bodies, transfer to other provinces or to the irrigation branch, or failing these, premature retirement. In regard to the first if the appointment of engineers is left to the district boards they will probably in most cases prefer to select their own nominee rather than to take an official of the public works department, nor do I consider it likely that any government engineer will accept service with a local body on the terms proposed. The feasibility of the second alternative must depend upon the development of irrigation work, a somewhat doubtful factor in view of the present restriction of funds which may be expected to continue for some time after the war; there are also difficulties in the way of the transfer of senior officers from buildings and roads to irrigation divisions if they have had no previous experience of irrigation and revenue work. I agree with my colleagues that the adoption of the third alternative except in isolated cases is highly undesirable. Were it known abroad that government was about to retire prematurely, purely for the purpose of the proposed reorganization, any considerable proportion of the permanent staff of a great department it would undoubtedly have a most injurious effect on recruitment in India to the sister branches of irrigation and railways and would probably kill recruitment in England altogether, not only for these branches but for other services also. In my opinion any system of reorganization, to be suitable for its purpose, should be capable of introduction without jeopardizing the interests of the existing staff.

7. For all these reasons it appears to me that the majority recommendations, if accepted, will entail an excessive sacrifice being made at the altar of local self-government and, without desiring in any way to belittle the importance of the latter aspect of the case, I am of opinion that the experiment, involving as it does the summary abolition of a great department and the transfer of works costing nearly Rs. 6½ crores per annum to a more or less untried agency, is both too drastic and too expensive a one to be justifiable on this ground alone.

8. I now proceed to formulate an alternative scheme which, in my opinion, would attain the principal objects aimed at but be free from the objections set forth above. The organization which I advocate would provide for an engineer in every district and an inspector of works in each-commissioner's division, and would entail the maintenance of two separate services, an imperial or superior service, from the ranks of which the inspectors would be drawn, and a provincial or second service, on the lines of the provincial civil service, which would furnish the majority of the district engineers. The chief engineer, his personal assistant and the inspectors of works would be members of the imperial service, the strength of which would be so regulated that a sufficient number of officers

of over 15 years' service would always be available to fill these posts. The officers of this service of less than 15 years' standing would be regarded as in training for inspectorships, and would be employed, some in charge of special works directly under the inspectors and some in ordinary district charges. They would thus obtain a thorough knowledge of executive matters before the time for their promotion arrived, and the provision of this training reserve would obviate the necessity for the employment of temporary staff upon the works carried out under the direct supervision of the inspectors, which, although advocated in paragraph 17(c) of the report, has in the past invariably proved to be an unsatisfactory arrangement. Officers should be recruited to this service at about the same age as at present, 40 per cent. of the appointments being guaranteed to the Indian engineering colleges, 40 per cent. being reserved for Royal Engineer officers and for engineers appointed by the Secretary of State in England, and 20 per cent. being filled by the promotion of provincial service engineers. The provincial service in its entirety should be recruited from the Indian colleges; its organization should be largely on the lines detailed in paragraph 34 of the report with the special provident fund described in paragraph 54 in lieu of the existing pension arrangements. There should be no promotion from the subordinate to the provincial service, such promotion tending, in my opinion, to affect adversely the status of the engineer. There are, however, particularly in the more backward provinces, a certain number of districts in which, even if government and local works were combined under one agency, the resulting quantity would be insufficient to justify the appointment of a district engineer on Rs. 300—400 and such districts might suitably be reserved for members of the subordinate service, who should receive a pay of Rs. 150—250 a month while so employed.

9. This scheme appears to me to possess considerable advantages over that recommended by the majority. While leaving the administrative and financial control of public works in the hands of the local bodies, and bringing the organization of the engineering department into a close relationship with that of the district and division, it obviates all the difficulties to which I have referred as inherent in the majority proposals. Its introduction would be a comparatively simple matter; indeed, were the department first reorganized as contemplated in Chapter V of the report, the whole framework of the system would be ready to hand and it would need only a redistribution of charges and a slight change in the methods of recruitment to introduce it in its entirety. If the majority proposals are to be accepted, however, it seems questionable whether it is worth while to undertake so elaborate a reorganization of a department which lies under sentence of abolition.

*Paragraph 77. Age limit and educational qualifications to be prescribed for admission to the engineering colleges.*

10. The second point upon which I differ from my colleagues is in regard to the age of admission to the engineering colleges. The age advocated by the majority is 19 last birthday, with the intermediate standard as the compulsory educational qualification. I consider that these



proposals are open to two objections. In the first place the intermediate standard is no definite educational landmark ; it is merely a stage on the road to the degree and it seems to me undesirable to require a student to break off in the middle from the course of study upon which he has embarked, and to utilize the preliminary portion of that course for a purpose entirely different from that for which it was designed. I would also emphasize the argument adduced in paragraph 77 (a) of the report, that the Indian student has the disadvantage of having to prosecute his studies in a foreign language and that if he is to hold his own both in college and in after-life with his English confrères, he must have a thorough grounding in the language at the start, a grounding which, in my opinion, is not connoted by the intermediate standard. While acquiring this grounding he would also have the opportunity of studying higher mathematics and science, a knowledge of which can be as readily obtained in an arts or science as in an engineering college, thereby allowing of more time being allotted in the latter to practical subjects.

For these reasons I should be inclined to recommend that the age of admission should be fixed at 21 last birthday with the Bachelor of Arts or Science degree as qualification but, in deference to the views of my colleagues, I am willing to agree to an age limit of 20 last birthday so as not to debar a brilliant student from obtaining his degree before entrance, which he would be able to do if he failed in none of the intermediate stages. I recognize, however, that this proposal does not meet the main argument upon which the majority recommendation is based, namely that students should be brought into the atmosphere of their future profession at as early an age as possible. I am personally convinced that the reduction of one year in the age of admission will make little difference, and that the advantages to be obtained by the adoption of the higher limit will more than outweigh other considerations. If, however, so early an initiation is to be insisted upon, and 19 last birthday is to be fixed, it appears to me unnecessary to require the student to waste two years in passing the intermediate examination. In that case I would recommend that the matriculation or school-leaving standard should be fixed as the minimum educational qualification and, in order to give facilities for preparation and to enable the students to obtain a good grounding in mathematics, science and English, the educational authorities should be moved to allow such boys to attend college classes in these subjects as casual students.

11. There is, moreover, the probability that special training institutions will spring up for the purpose of preparing boys for admission to the engineering colleges. My colleagues have laid considerable stress on the dangers of cramming but I consider that these have been somewhat exaggerated ; several of the principal European schools have special classes for training boys for the engineering colleges (those at the La Martinière College, Lucknow, and at the old Mussoorie School have provided no less than two-thirds of the total number of Europeans who have passed through the engineer class at Roorkee) and the evils of cramming have not been apparent in connection with them. There will be time for a three years' course after matriculation, and such a course could

be adapted to meet the special needs of the students. If, as I believe would be the case, suitable institutions sprang into being, the result would be the attainment of the object which as already stated my colleagues declare to be their real desire, namely to bring the student, at the school-leaving stage, into the atmosphere of his future profession.

GANGA RAM.

STATEMENT I.

*Expenditure incurred on works executed under the direct executive supervision of the public works department in India.*

Province.	GOVERNMENT WORKS.														
	45.—CIVIL WORKS—IMPERIAL.						45.—CIVIL WORKS—PROVINCIAL.						Military works.	Other works executed by public works department, e g., Famine relief but excluding Irrigation.	Total government works.
	Buildings.		Communications.		Other works (Miscellaneous public improvements)	Total	Buildings.		Communications.		Other works (Miscellaneous public improvements).	Total			
	Original works.	Repairs.	Original works.	Repairs.			Original works.	Repairs.	Original works.	Repairs.					
1	2	3	4	5	6	7	8	9	10	11	12	13			
	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Madras . . . . .	1,69,041	55,115	..	..	..	2,24,156	36,19,342	5,59,091	2,88,660	2,39,203	5,94,737	53,01,033	54,902	2,56,802	53,36,893
Bombay . . . . .	4,38,488	1,64,701	..	..	22,438	6,25,627	34,26,047	7,17,280	8,27,230	12,16,672	11,09,742	72,96,971	64,544	83,905	80,71,047
Bengal . . . . .	11,52,396	2,01,465	6,105	45,553	..	14,05,519	32,99,845	8,24,378	1,92,569	7,59,104	1,52,269	52,23,165	30,460	..	66,64,144
United Provinces . . . . .	3,30,627	1,00,622	..	..	..	4,31,249	22,65,579	4,87,579	4,85,889	15,80,990	3,28,515	51,43,552	11,977	1,53,782	57,45,560
Punjab . . . . .	3,20,719	77,421	748	..	237	3,99,125	24,39,605	3,61,530	5,68,625	11,34,237	2,74,701	47,78,698	1,01,528	..	52,79,351
Burma . . . . .	2,11,643	64,612	..	..	..	2,76,255	18,50,208	7,81,790	9,56,026	23,23,596	5,73,499	64,85,119	3,77,471	..	71,38,845
Bihar and Orissa . . . . .	1,03,055	40,043	..	..	..	1,43,098	33,09,623	2,93,378	4,77,691	3,91,230	49,359	45,21,281	14,683	..	46,79,062
Central Provinces . . . . .	1,52,306	20,296	..	..	..	1,72,602	20,16,423	2,68,800	10,67,521	15,91,128	1,38,880	50,82,752	2,598	..	52,57,952
Assam . . . . .	27,563	14,319	..	..	..	41,882	6,55,361	1,80,980	14,70,467	9,69,626	1,35,629	34,12,063	40,181	..	34,94,126
<b>TOTAL . . . . .</b>	<b>29,05,838</b>	<b>7,38,594</b>	<b>6,853</b>	<b>45,553</b>	<b>22,675</b>	<b>37,19,513</b>	<b>2,28,82,033</b>	<b>44,74,806</b>	<b>63,34,078</b>	<b>1,02,05,786</b>	<b>33,57,331</b>	<b>4,72,54,634</b>	<b>6,98,344</b>	<b>4,94,489</b>	<b>5,21,66,980</b>

STATEMENT I—(concl.)

Expenditure incurred on works executed under the direct executive supervision of the public works department in India—(concl.)

Provinces.	LOCAL BOARD WORKS.							Grand total works.	DEPARTMENTAL CHARGES.				Suspense.	Grand total expenditure.	Percentage "estab-lishment" to "works."	Percentage "direc-tion" to "works."
	WORKS EXECUTED BY THE PUBLIC WORKS DEPARTMENT ON BEHALF OF LOCAL BOARDS (EXCLUDING MUNICIPALITIES).								TOTAL COST OF PUBLIC WORKS DEPARTMENT ESTABLISHMENT.							
	Buildings.		Communications.		Other works (Miscellaneous public improvements).	Total.	Contribu-tion works.		Direction.	Construc-tion.	Total.	Tools and plant.				
	Original works.	Repairs.	Original works.	Repairs.												
—	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	R	R	R	R	R	R	R	R	R	R	R	R	R	R		
Madras . . . . .	366	..	8,729	31,000	10,793	50,888	5,26,677	64,14,458*	2,19,536	11,31,249	13,50,785	1,45,091	43,687	79,54,021	21 05	3 42
Bombay . . . . .	2,41,291	7,147	5,92,866	7,86,411	30,994	16,58,709	13,13,807	1,10,43,563	3,47,630	13,02,825	16,50,455	2,45,286	49,939	1,29,89,243	14 95	3 14
Bengal . . . . .	..	..	..	..	2,00,995	2,00,995	7,706	68,72,845	3,19,721	8,25,203	11,44,924	77,205	—14,616	80,80,358	16 65	4 65
United Provinces . . . . .	4,71,028	88,127	6,81,245	11,94,029	13,118	24,47,547	11,11,748	93,04,855	3,51,910	11,12,660	14,64,570	76,814	—1,32,444	1,07,13,795	15 73	3 78
Punjab . . . . .	15,778	168	8,694	1,935	338	26,913	10,06,750	63,13,014	2,99,848	6,54,010	9,53,858	70,624	—55,465	72,82,031	15 11	4 74
Burma . . . . .	74,309	13,559	3,83,586	5,26,089	4,51,020	14,48,563	10,03,541	95,90,949	5,68,469	17,05,801	22,74,270	2,01,427	—13,520	1,20,53,126	23 71	5 92
Bihar and Orissa . . . . .	..	..	..	..	..	..	29,726	47,08,788†	2,38,226	5,11,013	7,49,239	1,61,798	95,389	57,15,214	15 91	5 05
Central Provinces . . . . .	6,290	..	34,327	14,490	210	55,317	5,65,449	58,78,718	2,65,362	7,40,482	10,05,844	1,60,556	—15,506	70,29,612	17 11	4 51
Assam . . . . .	9,017	54	2,33,170	14,464	1,06,487	3,63,192	10,312	38,67,630	1,89,731	4,91,552	6,81,283	63,567	—7,913	46,04,567	17 62	4 90
Total . . . . .	8,18,079	1,09,055	19,42,617	25,63,418	8,13,955	62,52,124	55,75,716	6,39,94,820	28,00,433	84,74,795	1,12,75,228	12,02,368	—50,449	7,64,21,967	17 62	4 38

\* Includes Rs. 1,34,655 on works executed by civil officers acting as public works disbursers.  
 † Average for the two years 1912-13 and 1913-14.

STATEMENT II.

Expenditure incurred on works executed under the direct executive supervision of district board establishment in India.

Province.	LOCAL WORKS.										GOVERNMENT WORKS.						Grand total works.	OTHER CHARGES.			Grand total expenditure.	Percentage "establishment" to "works."	Number of districts.
	45.—CIVIL WORKS—WORKS IN CHARGE OF DISTRICT AND LOCAL BOARDS.										45.—CIVIL WORKS—WORKS EXECUTED BY DISTRICT AND LOCAL BOARDS ON BEHALF OF GOVERNMENT.							Total cost of local fund engineering establishment.	Tools and plant.	Suspense.			
	Buildings.		Communications.		Other works.	Repairs.	Works executed on behalf of municipalities by local fund establishment.	All other contribution works executed by local fund establishment.	Other works executed by local fund establishment.	Famine relief but excluding irrigation.	Buildings.		Communications.		Other works.	Repairs.							
	Original works.	Repairs.	Original works.	Repairs.							Original works.	Repairs.	Original works.	Repairs.									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹	₹
Madras . . .	5,24,660	1,79,579	18,82,425	44,82,121	5,79,138	4,28,463	..	..	..	..	..	..	..	..	..	78,76,436	9,43,972	1,02,968	..	89,23,370	11.98	25	
Bombay . . .	82,778	1,18,607	2,79,309	6,67,352	3,83,576	..	..	9,927	5,944	13,538	15,149	..	1,061	5,605	..	15,82,906	1,83,800	23,336	..	17,90,042	11.61	25	
Bengal . . .	92,234	25,023	10,73,239	8,42,730	2,85,110	51,332	..	..	..	20,859	12,862	33,299	1,87,902	..	..	36,24,590	4,81,290	41,048	..	41,40,928	13.28	25	
United Provinces .	3,08,243	1,53,380	80,156	3,08,335	7,227	3,431	..	2,562	..	..	..	..	..	..	..	8,58,334	85,230	1,904	..	9,45,513	9.94	48	
Punjab . . .	6,02,363	1,82,415	2,50,707	07,468	63,600	34,947	1,01,514	6,984	..	4,241	18,810	..	33,074	661	3,754	22,16,328	2,36,230	19,495	1,132	24,73,185	10.66	28	
Burma . . .	17,502	7,942	38,122	24,803	49,808	25,194	..	..	..	..	..	..	..	..	..	1,63,371	59,810	700	..	2,23,861	36.61	36	
Bihar and Orissa	1,04,779	34,234	11,89,614	14,16,498	96,390	35,023	25,871	1,41,735	..	33,831	3,537	24,361	23,879	..	..	31,29,352	5,06,733	53,589	..	36,89,724*	16.19	20	
Central Provinces .	3,36,493	1,09,049	1,07,008	1,82,963	65,738	35,225	10,115	6,336	..	1,875	456	2,904	12,972	167	..	3,71,301	1,75,463	10,807	5,049	10,12,620	14.40	22	
Assam . . .	3,438	5,353	3,06,359	3,96,265	1,23,610	26,013	..	..	..	..	..	..	..	..	..	8,61,533	59,870	9,018	15,776	9,46,252	6.95	19	
Total . . .	20,68,040	8,15,642	50,07,529	1,02,23,535	16,59,447	6,39,623	1,37,300	1,67,544	5,944	74,344	50,814	60,564	2,58,688	6,433	3,754	2,11,84,206	26,82,498	2,62,365	21,957	2,41,51,526	12.66	243	

\* Average for the two years 1912-13 and 1913-14.

STATEMENT III.

Comparative cost of public works department establishment and the establishment required after transfer of government works to district boards, in the United Provinces.

COST OF EXISTING PUBLIC WORKS DEPARTMENT ESTABLISHMENT.				COST OF PUBLIC WORKS DEPARTMENT ESTABLISHMENT REORGANIZED ACCORDING TO THE RECOMMENDATIONS OF THE PUBLIC SERVICES COMMISSION.			COST OF PUBLIC WORKS DEPARTMENT ESTABLISHMENT REORGANIZED ACCORDING TO THE RECOMMENDATIONS CONTAINED IN PARAGRAPH 34 OF OUR REPORT.			COST AFTER TRANSFER OF GOVERNMENT WORKS TO DISTRICT BOARDS.					
No.	Name of appointment.	Pay	Cost per mensem.	No.	Name of appointment.	Pay.	Cost per mensem.	No.	Name of appointment.	Pay.	Cost per mensem.	No.	Name of appointment.	Pay.	Cost per mensem.
		Bs.	Rs.			Bs.	Rs.			Bs.	Rs.			Bs.	Rs.
1	Chief engineer . . . .	2,500-2,750	2,625	1	Chief engineer . . . .	2,500-50-2,750	2,625	1	Chief engineer . . . .	2,500-50-2,750	2,625	1	Chief engineer . . . .	2,500-50-2,750	2,625
1	Superintending engineer, 1st class (provincial).	1,600	1,600	4	Superintending engineers .	1,500-100-2,000	7,333	4	Superintending engineers .	1,500-100-2,000	7,333	12	Inspectors of works . . .	1,250-50-1,750	18,667
2	Superintending engineers, 2nd class (imperial).	1,750	3,500									7	District engineers, 1st class	800-40-1,000	6,533
1	Superintending engineer, 3rd class (imperial).	1,500	1,500									11	District engineers, 2nd class	500-40-700	6,967
15	Executive engineers (imperial)	800-50-1,250	16,500	11	Executive engineers (imperial).	700-50-1,250	12,500	8	Executive engineers (imperial).	700-50-1,250	8,350	30	District engineers, 3rd class	300-20-400	11,000
7	Executive engineers (provincial).	535-85-850	5,215	10	Executive engineers (provincial).	500-50-1,050	8,500	9	Executive engineers (provincial).	500-50-1,050	7,500	[5]	Acting allowances to officers officiating as district engineers.	160, 100, 60, 60, 60	440
13	Assistant engineers (imperial).	380-40-700-50-750	7,110	7	Assistant engineers (imperial).	380-40-660	3,580	6	Assistant engineers (imperial).	380-40-660	3,160				
5	Assistant engineers (provincial).	250-25-475	1,825	6	Assistant engineers (provincial).	300-25-450	2,300	5	Assistant engineers (provincial).	300-25-450	1,900				
12	Sub-engineers . . . .	800-375-450	4,275	12	Sub-engineers . . . .	800-375-450	4,275	5	Provincial service officers .	600-20-700	3,333				
20	Supervisors . . . .	175-225	3,900	20	Supervisors . . . .	175-225	3,900	45	Provincial service officers .	250-15-550	18,000				
3	Overseers . . . .	120	360	8	Overseers . . . .	120	960	[1]	Acting allowance to executive engineer.	300	300				
[1]	Acting allowance to executive engineer.	245	245	[1]	Acting allowance to executive engineer.	275	275	[3]	Acting allowances to assistant engineers.	40-50-80	170				
[2]	Local allowances to subordinates.	50	1,600	[36]	Local allowances to subordinates.	50	1,800								
80	TOTAL . . . .		50,255	79	TOTAL . . . .		48,048	83	TOTAL . . . .		52,671	61	TOTAL . . . .		46,232
Total cost per annum		Rs. 6,03,060		Total cost per annum		Rs. 5,76,576		Total cost per annum		Rs. 6,32,052		Total cost per annum		Rs. 5,54,784	

These statements exclude the cost of specialist officers and of staffing special divisions. In the first three cases they include the establishment required to fill one chief engineership, an under-secretaryship, four circles, sixteen divisions, and forty-eight districts; in the fourth case one chief engineership, one post of personal assistant, ten inspectorships (each extending over one commissioner's division), and forty-eight districts.

## APPENDIX A.

## NOTE BY SIR NOEL T. KERSHAW ON THE FUNCTIONS OF THE LOCAL GOVERNMENT BOARD, ENGLAND AND WALES, IN RELATION TO PUBLIC WORKS.

It seems to be desirable to sketch, very briefly, the main principles which underlie the system under which the Local Government Board for England and Wales exercises its powers in regard to the control of the execution of public works and the expenditure thereon, to explain shortly what those powers are, and thus to draw attention to some of the main differences between the position in India and that in England and Wales.

2. The Local Government Board for England and Wales consists of a President and various other Ministers of the Crown but, as a matter of fact, the Board has never met and exists only on paper, the powers being exercised by the President, the Parliamentary Secretary, the Permanent Secretary and five Assistant Secretaries. Beside the Secretariat there is a clerical establishment and an audit establishment and there are numerous technical officers who act in an advisory capacity, such as engineering inspectors, medical officers and inspectors, architects, etc. These are not administrative officers.

3. So far as public works are concerned the main powers of the Board arise from the fact that their sanction is, speaking very generally, necessary to all loans for most classes of these works raised by local authorities outside London, except where Parliament, by means of local Acts, has given express power to borrow a limited sum for certain specified works without further sanction by the Board. In some instances, *e.g.*, loans for tramway or harbour works, undertaken by local authorities, the sanction required is that of the Board of Trade, but the great bulk of the loans raised without direct sanction of Parliament requires the sanction of the Local Government Board. The Board's power to sanction or refuse sanction to loans is absolute and, as local authorities seldom carry out works of any magnitude without resort to a loan, the power to refuse sanction to a loan is, in fact, more important than it would appear to be to those whose acquaintance is mainly with Indian practice. This will be appreciated when it is stated that out of a total expenditure by local authorities otherwise than out of loans amounting to just over 134 million sterling for the year 1911-12, nearly 31½ million sterling represents the charges for principal and interest in respect of loans raised, the balance being mainly maintenance and other revenue charges in respect of which loans could not be authorized. The second check on expenditure on public works arises in certain cases in connection with the Government audit which is dealt with briefly at the end of this sketch.

4. Attention should be drawn to the fact that the Local Government Board have, speaking generally, no concern with or control over local works constructed for and belonging to the Crown but only over works carried out by, and belonging to, local authorities. Public works belonging to the Crown outside London are few in number in England and Wales and consist mainly of such buildings as post offices, custom houses and such like which are provided by the Office of Works, and certain buildings on Crown lands managed by the Office of Woods, Forests and Land Revenues. These buildings are usually provided, in accordance with plans prepared by the Central Department concerned, by contractors for a lump sum or, in certain cases, on a schedule of prices or both. The Office of Works have a staff of architects and surveyors who supervise the execution of the works as well as prepare the plans. In some cases the works are carried out by direct administration, but this is usually where the work is a small one.

5. The principal local authorities are —

(a) County Councils ;

- (b) Poor law authorities, with which we are here very little concerned,
- (c) Urban authorities, namely, the Councils of Municipal Boroughs and Urban Districts;
- (d) Rural authorities, namely Rural District Councils;
- (e) Joint Boards or other similar authorities set up for special purposes, e.g., sewerage and sewage disposal, water-supply or the provision of hospital or asylum accommodation;
- (f) London, where the position is very exceptional and with which it is consequently not proposed to deal;
- (g) Parish Councils, which exist only in Rural Districts and mainly in Parishes which have a population exceeding 300.

6. England and Wales are divided for purposes of *County Administration* into Counties and County Boroughs. County Boroughs are those set out in the Third Schedule to the Local Government Act, 1888, and consist generally of Boroughs having a population exceeding 50,000 according to the Census of 1881, certain smaller Boroughs which had jurisdiction independent of the County Justices prior to 1888 and other Boroughs which have attained a population of 50,000 since the Act and have been made County Boroughs by Provisional Order of the Local Government Board confirmed by Parliament or by Local Act of Parliament. Counties for the purposes of the Act of 1888 are referred to as "Administrative Counties" and consist generally of the old geographical counties excluding County Boroughs and are governed for the purposes of that Act by County Councils. Some large Counties, such as Yorkshire and Lincolnshire; have a County Council for each "Riding" as it is termed in Yorkshire and for each "Part" as it is termed in Lincolnshire.

7. The powers of County Councils are concerned principally with main roads and important bridges (called County bridges), lunatics, feeble-minded persons and asylums for these, the provision of sanatoria under the National Insurance Act, 1911, police, small holdings, education (subject to the exceptions referred to in the note on page 95) and the provision of hospitals in certain cases. They also have certain powers in regard to the alteration of local areas (*cf.* section 57 of the Local Government Act, 1888). It may be taken that County Borough Councils are entirely independent of County Councils and have practically similar powers as regards their own area to those possessed by County Councils in the rest of the geographical county, in addition to the powers which the Council of the County Borough possess as a Sanitary Authority and a Municipal Authority. Further, certain Boroughs which are not County Boroughs continue to maintain their own police force and are independent of the County Councils in this respect also.

8. The powers of supervision by County Councils over District Councils — including Boroughs other than County Boroughs — are not very great. The County Council must appoint a Medical Officer of Health who receives the annual and other reports made by District Medical Officers of Health and advises the County Council upon them. He also makes his own independent investigations in his area and upon his reports or other information received the County Council can make a representation to the Local Government Board under section 19 of the Local Government Act, 1888, or a complaint under section 299 of the Public Health Act, 1875. The County Council have also powers of complaint of default against all District Councils under the Housing of the Working Classes Acts and in the case of Rural District Councils they can in certain circumstances take over and exercise the powers of the District Council for the provision of houses. It may be stated generally that County Councils are seeking to establish themselves as the superior Sanitary Authority in their County with general supervision over all District Councils and that the District Councils on their part resent the movement and have organized themselves against it. Nevertheless the policy



has made some progress, the tendency in recent years being to subordinate the areas governed by Rural District Councils and the smaller Urban District Councils to the County Council.

9. Turning now to administration by District Councils. These are divided into two main classes:—

- (1) Urban District Councils (including Boroughs governed by Town Councils);
- (2) Rural District Councils.

The whole of England and Wales, excluding the areas of County Boroughs, is divided into *Urban Districts* consisting usually of a single town or in a few cases of towns closely associated and nearly adjacent to one another and *Rural Districts* consisting of an aggregation of villages, or small towns which have not been made Urban Districts by the County Council under section 57 of the Local Government Act, 1888. The unit in the case of the Rural District is the Parish which consists of the village or town with the neighbouring lands. Some Parishes contain more than one village and practically every Parish in a Rural District having a population of 300 has a Parish Council. Urban Districts include Boroughs other than County Boroughs.

10. An ordinary Urban District (not a Borough) is now constituted and extended by Order of the County Council of the County in which it is situate, confirmed by the Local Government Board. A Borough is constituted by Charter granted by His Majesty in Council and can only be altered or extended by Provisional Order made by the Local Government Board and confirmed by Parliament or by Local Act. Apart from County Government the Borough is regarded as the highest form of Local Government in England and Wales and the highest form of Borough is, of course, the County Borough. All Boroughs have certain powers in regard to the administration of justice not possessed by other Urban Districts and as already pointed out some maintain a separate police force. In other minor matters also they have greater powers than other Urban District Councils. Urban and Rural District Councils are, speaking generally, the Sanitary Authorities of the County; they provide the water-supply (where it is not provided by private enterprise), sewerage, scavenging, public lighting, pleasure grounds, fire appliances and infectious disease hospitals, and they maintain the roads and streets in their district. They are the main authorities for looking to the housing of the working classes and providing new houses where required. They make bye-laws as to the construction of new buildings and the provision of open spaces about buildings, nuisances and many other matters. (These bye-laws require confirmation by the Local Government Board.) The powers conferred on Rural District Councils by Statute are much less than those conferred on Urban District Councils, but under most Acts there is a power for the Local Government Board to confer upon Rural District Councils any power of an Urban District Council either in respect of their whole district or any Parish within it. This does not apply to powers exclusively belonging to Boroughs and not possessed by other Urban District Councils.

11. County Councils and Urban and Rural District Councils have, generally speaking, their own resources as well as Government grants. The expenditure of County Councils is defrayed out of the County Rate. The expenses are referred to as general or special according as they are levied over the whole administrative county or over a limited area of it. Special expenses, for example, will include expenses for police purposes where the Administrative County includes a Borough which maintains its own police. The expenses of an Urban District Council other than a Borough are defrayed out of the general district rate. In a Borough they are usually defrayed partly out of a borough rate, which provides for the expenses of administration of justice and most of the establishment charges, and partly out of the general district rate, out of which sanitary expenditure (including that on roads) and housing expenditure is defrayed, but in some Boroughs only one rate is levied.

12. In England and Wales roads repaired at the public expense practically all vest in and are repaired by some local authority. Such roads are divided at present into two classes :—

- (a) Main roads ;
- (b) Other highways repairable by the inhabitants (of the district) at large.

Prior to the operation of the Local Government Act, 1888, there was a Government grant in respect of the cost of the maintenance of main roads, but that Act abolished any specific grant for the purpose of main road maintenance although an equivalent sum continued to be paid as an unappropriated grant so that the local authorities should not receive less from Government in the shape of Imperial grants than they had previously received. Main roads vest in County Councils who can declare ordinary highways to be "main" roads and with the concurrence of the Local Government Board may "dismain" what have been "main" roads.

13. The cost of the maintenance of main roads is defrayed by County Councils who either repair the roads themselves or contract with the District Council in whose area the road is situate to maintain it. In many cases, however, Urban District Councils exercise the right conferred by the Local Government Act, 1888, to retain in their own hands the maintenance of the main roads in their area, being repaid by the County Council the cost properly incurred in so doing. In case of dispute the amount to be paid is settled by the Local Government Board, usually after a public hearing in the locality at which all persons interested can attend and give evidence. A County Council may not make any payment to a District Council in respect of the cost of maintenance unless they are satisfied by the report of their surveyor that the road has been properly maintained and repaired. Although main roads at the time of the passing of the Local Government Act, 1888, were generally important means of through communication, this was by no means always the case and there were many anomalies both because important roads were not main roads and because unimportant ones were. This was due to the arbitrary nature of the definition of the term "main road" in the Highways and Locomotives (Amendment) Act, 1878. The then existing anomalies were made worse by the diversity of action taken by the various County Councils since 1889. In some Counties practically every through road has been "mained" so that the cost of highway maintenance has been diverted from the District to the County. In others practically no roads have been "mained" since 1889. County Councils can also contribute to the cost of maintenance of roads which are not main roads if they so desire.

14. The Departmental Committee on Local Taxation which sat in 1912-13 drew attention to these anomalies and proposed a scheme under which roads repairable by the public would be divided into three classes:—

- (1) National roads,
- (2) County roads,
- (3) Other roads ;

and that the State should contribute largely to the cost of maintenance and improvement of the first class and to a less extent to the cost of maintenance and improvement of the second. The classification was to be done by the Road Board, which was set up by the Development and Road Improvement Funds Act, 1909, and was in progress at the beginning of the war. The Road Board was set up to administer funds arising from motor spirit duties and carriage licenses, handed over to them by the State, for the improvement of existing roads and the construction of new ones. So far the Road Board have expended their funds almost exclusively upon the improvement of road surfaces and foundations and only about £538,000 out of the total receipts of over £4,242,000 had been paid for the construction of new roads (Report of Road Board

for 1915-16). The contributions given by the Road Board take the form of—

- (a) grants,  
(b) advances free of interest or at a reduced rate of interest.

They are given to encourage local authorities to undertake works which would not otherwise be undertaken or would be deferred, and are usually conditional upon considerable expenditure by the local authorities out of rates for the object for which the grants or advances are given. Thus the system is used to encourage the expenditure of money by local authorities on the strengthening and improvement of road foundations and surfaces. This system certainly results in the putting in hand of such works years before they would otherwise be undertaken and on possibly more substantial lines.

15. The total amount of loans sanctioned by the Local Government Board to be raised by Urban and Rural District Councils alone during the year 1913-14 exceeded 10½ million sterling. Of this sum over 1 million was sanctioned for the purposes of the Education Acts, viz., the erection, improvement and equipment of schools of various descriptions.\* The main objects for which these loans were sanctioned, apart from education, will be gathered from the list of Acts under which the sanctions were given set out below, except so far as loans under the Public Health Acts and Local and Confirmation Acts are concerned. These are analysed in the Table immediately below the list of Acts.

*Urban Councils.*

	England (excluding Monmouth- shire).	Wales and Monmouth- shire.
	£	£
Baths and Wash-houses Acts . . . . .	84,199	305
Burial Acts . . . . .	16,811	1,000
Electric Lighting Acts . . . . .	1,932,258	120,600
Housing of the Working Classes Acts . . . . .	638,050	38,858
Military Lands Act, 1892 . . . . .	1,000	..
Museums and Gymnasiums Act, 1891 . . . . .	..	526
Public Health Acts and Local and Confirmation Acts . . . . .	5,170,122	372,798
Public Health (Interments) Act, 1879 . . . . .	37,403	15,237
Public Libraries Acts . . . . .	7,484	330
Small Dwellings Acquisition Act, 1899 . . . . .	61,440	39,277
Small Holdings and Allotments Act, 1908 . . . . .	28,577	2,608
Total . . . . .	7,977,344	591,539

*Rural District Councils.*

	£	£
Electric Lighting Act, 1882 . . . . .	..	8,360
Housing of the Working Classes Acts . . . . .	179,844	14,925
Public Health Acts and Local Acts . . . . .	538,413	105,940
Small Dwellings Acquisition Act, 1899 . . . . .	7,000	-9,000
Total . . . . .	725,257	138,225

*Analysis of Public Health Acts and Local Act Loans.*

	£	£
Street improvements, making up private streets and constructing new streets and bridges . . . . .	1,610,556†	158,400†
Sewerage and sewage disposal . . . . .	1,606,524	114,453
Waterworks . . . . .	523,774	88,107
Public walks and pleasure grounds . . . . .	413,588	21,426
Gas works . . . . .	383,586	33,913
Telephonic communication . . . . .	192,423‡	..
Hospitals and mortuaries . . . . .	176,841§	1,880
Public offices . . . . .	127,362	5,754
Refuse destructors . . . . .	89,164	39,838
Fire stations, engines and appliances . . . . .	97,443	7,347
Conversion of privies into water closets . . . . .	60,885	..
Depôts . . . . .	49,270	1,920
Paying off existing loans . . . . .	41,023	..
Sea defence . . . . .	27,707	..
Public sanitary conveniences . . . . .	20,272	2,166
Steam road rollers and motors for highway purposes . . . . .	15,373	515
Slaughter-houses . . . . .	11,988	..

\*NOTE.—(It should be remarked here that the Councils of Boroughs are local authorities for the purposes of Elementary Education where their population according to the Census of 1901 exceeded 10,000 and the Councils of other Urban Districts where their population according to the same census exceeded 20,000. In other areas the County Council are the education authority both for elementary education and for education other than elementary. The total amount sanctioned by the Local Government Board to be borrowed by County Councils in 1913-14 for elementary education was £871,855 and for education other than elementary £317,179.)

†The cost of making up private streets is, generally speaking, repayable to local authorities by frontagers.

‡This was the amount of a loan sanctioned to the Town Council of Kingston-upon-Hull for the purchase from the Postmaster-General of the telephone plant in the Hull Area.

§ These figures do not include the loans sanctioned for hospital purposes to Joint Boards and County Councils.

|| These figures are approximate only, works of sea defence being frequently combined with improvements to the sea front which are not wholly necessary for protective purposes

16. The loans raised by Joint Boards, which are combinations representing several districts for a particular object, are mainly for works of sewerage and sewage disposal, water-supply, gas-supply, hospitals and cemeteries. The total amount sanctioned to be raised by these bodies in 1913-14 was only £167,000. These figures exclude Poor Law loans.

17. The loans sanctioned to be raised by Parish Councils are trivial, amounting only to £31,819 in 1913-14. The powers of these bodies are very small and need not here be further referred to. As regards most of these powers the Rural District Councils of the area in which the Parish is situate possess parallel powers. Parish Councils require the sanction of County Councils as well as that of the Local Government Board before they can raise a loan.

18. A local authority requiring to raise a loan must submit to the Board the necessary particulars to enable the proposal, in respect of which the loan is required, to be investigated from the point of view of —

- (a) necessity or desirability in itself ;
- (b) cost having regard to the other commitments or necessities of the district ;
- (c) technical attributes.

For these purposes plans and other drawings, detailed estimates, a report on the scheme from the points of view indicated above and a return of existing indebtedness are required to be supplied, the drawings being signed by the architect or engineer as the case may be. In the majority of cases the schemes are prepared by the local authority's own surveyor who is frequently a more or less competent engineer, but in the case of large works of a complicated character the services of a private consulting engineer or of an architect are sometimes called in to prepare the scheme. The application for sanction is made by resolution of the local authority under seal.

19. When the application has been registered in the Local Government Board's office it is referred to the administrative branch which deals with the particular class of project concerned, and the papers are referred by them with the plans to the technical staff of the department usually consulted in regard to similar proposals. Before the reference is made the statements in the report on the scheme are verified, any relative papers are annexed and attention drawn to the need for other works of importance in the District concerned and to the possibility of alternatives for the proposed works so far as the information is available in the office.

20. Schemes for water-supply, sewerage or sewage disposal are referred to the Chief Engineering Inspector who is the head of the Engineering Department and decides which of his assistants shall look into the scheme at head-quarters. If the latter, on examining the scheme, finds that medical or architectural details arise which need expert consideration he will suggest a reference to the Medical Officer or Architect as the case may be

and even if he makes no such suggestion the Administrative Officer dealing with the case can, if he thinks it desirable, make such a reference. The Engineering Inspector to whom the scheme is referred for examination at head-quarters looks into it from the technical point of view and if he finds it *prima facie* generally satisfactory says so and notes any points upon which he thinks improvements can be made or explanations are desirable. If the scheme is a bad one he explains on the papers why this is so and, if this is apparent from the drawings and other information supplied, suggests that the local engineer or other officer responsible is not fit to be entrusted with the design of such a scheme. Where the last is the case it is explained to the local authority that the scheme won't do and they are advised to employ a man accustomed to the design and execution of similar works. The Engineering Inspector at head-quarters also looks, with the assistance of any papers referred to him, into the question of possible alternatives to the scheme. For example, if the scheme is one of water-supply from a new source, he sees how neighbouring districts are supplied and whether they have water to spare which is satisfactory and which it is likely could be taken to the district needing a supply at a cheaper rate than under the proposed scheme. He would also see whether there are adjoining districts or villages needing supply to which it would be feasible, from an engineering point of view, to extend the proposed supply and notes his views on these points upon the papers. He next decides whether he can recommend sanction to a loan without local inquiry or whether such inquiry is desirable. If the loan is required merely for an extension of mains to an area where the plans show that such a supply is necessary he would usually recommend sanction without inquiry, particularly if the supply was known to be a good one and the engineer a capable man. On the other hand he would not usually suggest that a local inquiry should be dispensed with where the scheme was for a supply of water from a new source or the scheme involved points of engineering importance.

21. In ordinary times the head-quarters work of the Engineering Staff is divided between the Chief Inspector, the Deputy Chief Inspector and the Second Deputy. These men are all specialists in different lines of engineering and they have under them a travelling staff of Engineering Inspectors who are selected for appointment on account of their eminence as specialists in some branch of engineering which happens at the time to be, or to be likely to become, inadequately represented on the staff. Thus there are, on the staff of 16 travelling inspectors, specialists on gas, electricity, sea defence works, reinforced concrete, etc., and what are called in India sanitary engineers. These specialists are available to advise the head-quarters staff on any points upon which expert knowledge of a specialized character is desirable.

22. Assuming that the head-quarters engineer recommends a local inquiry and that the case is otherwise ready for such inquiry the case is sent to the Chief Engineering Inspector to fix a date for the inquiry and to allot it to a travelling Engineering Inspector to hold the inquiry. In selecting the travelling Inspector regard is had to the nature of the proposal and where a specialist is desirable he is selected to hold it. Every effort is made to group inquiries so as to save time and travelling expenses, but the need for assigning the inquiries in certain cases to specialists sometimes militates against this. The inquiry is advertised by printed placards posted in the district wherever public notices are usually posted, and sometimes in a more extensive area, and any persons interested are invited to attend and be heard. In certain more important cases notice of the inquiries is given by advertisement in a local newspaper. The posting and advertisement are done by the local authority. Usually a fortnight's notice is given. The inquiries are so arranged that, as far as possible, each Inspector shall take a week's inquiries followed by a week's reporting of the proceedings at the inquiries and the recommendations of the Inspector. Inquiries last from one to fourteen days or even more

but an inquiry does not often last more than one day and very seldom more than three.

23. At the inquiry the clerk to the local authority usually explains the object and nature of the proposal and calls the expert responsible as a witness, the Inspector taking part in the examination. Any other persons interested can ask questions in an order arranged by the Inspector and it is to be observed that these local inquiries are often attended by rate-payers' associations as well as owners of property and other rate-payers and advantage is taken of them to give expression to local public feeling and to indicate—often rather strongly—that a considerable body of the rate-payers and the Council of the District concerned are not quite at one in their views of the project. In some cases so strong is the feeling that the opponents go to the expense of retaining expert witnesses to oppose the project and even brief counsel with that object. The Inspector also goes into all points which he finds noted on the paper by head-quarters, whether they are of a technical nature or not, and discusses amendments of the proposals and any alternative plans which may occur to him, but is careful, in doing so, not to commit the Local Government Board to any approval of such alternatives or amendments. He calls for any additional evidence he may require and after the inquiry visits the site of the proposed works and any alternative sites which may have been suggested at the inquiry, inviting all persons interested, or their representatives, to accompany him.

24. Where the proposal is to build a sanatorium or hospital the procedure is on somewhat similar lines, but the case is referred to the Medical Officer and Architect instead of the Chief Engineering Inspector, and the inquiry is held by a Medical Inspector, a member of the Architect's staff or an Engineering Inspector being sometimes associated with the Medical Inspector as the case requires.

25. After the inquiry the Inspector makes his report. He deals first with the project as a whole in an explanatory way. He gives an abstract of the evidence at the inquiry, deals particularly with any points raised at head-quarters either on the administrative or the technical side and follows with his own criticisms and recommendations. In most cases some modifications are found necessary in the scheme as presented either in the interests of economy or efficiency, and in some cases the recommendation is that the scheme be rejected altogether either as unnecessary or not the best means of meeting what is required. For example, a local authority may submit an electrical scheme with a view to sanction being obtained to a loan. The scheme may include a generating station, but the evidence at the local inquiry or his own investigations may have convinced the Inspector that it would be more economical to obtain power from a neighbouring local authority or from a company and he will recommend refusal of sanction on this ground. The travelling Inspector's report goes to his technical superior, who, after conference if necessary with the Inspector, states his own views, if he does not concur with the Inspector in all respects.

26. The application then goes to the Administrative Branch for decision. If that decision is adverse, the local authority cannot raise a loan and though nominally they can proceed with the scheme and pay for it out of revenue (*i.e.*, current rates), this is most unlikely to happen where it would mean an addition exceeding 1*d.* in the £ to those rates. Rate-payers' Associations exist in many districts and the increase of rates to pay for a scheme which has been rejected after local inquiry would usually be most unpopular and probably lead to the defeat, at the next local election, of the members who advocated it. Although, therefore, there is not, speaking generally, any actual limit to the rate in the £ which a County Council or Urban District Council (including a Borough) or a Rural District Council may raise or levy to meet the cost of any object which they are authorized by Statute to provide, they will seldom be prepared to pay the cost of that object out of revenue if the rate-payers are likely to take the view that it is one the expense of which might properly be extended over a term

of years by means of a loan raised with the sanction of the Local Government Board.

27. If, on the other hand, the decision is favourable to the local authority, the Board give their sanction by means of a formal document, signed by a Secretary or Assistant Secretary, which is usually impounded by the lender of the money. Some loans to local authorities are advanced by the Public Works Loan Commissioners, a body of financial and other experts appointed by Parliament to lend State funds provided for that purpose by the National Debt Commissioners. The greater part of the sums advanced by the Public Works Loan Commissioners have been advanced to small local authorities or for objects for which the Commissioners are allowed to give exceptional terms as regards rates of interest and the period for repayment, *e.g.*, loans for housing the working classes or for the provision of small holdings. The greater proportion of local loans have in the past been raised in the open market either by means of Corporation or County Stock, or mortgages of rates. Large sums have been lent to local authorities by Insurance Companies and Friendly Societies and, prior to the war, a very favourite system of obtaining money was on short term loans repayable at six months' to three years' notice. The sums advanced on short term mortgage were usually advanced in small sums and at low rates of interest—some are outstanding even now at less than 4 per cent.—but the issue of Exchequer Bonds bearing higher rates of interest brought this style of borrowing almost to a standstill and there was some difficulty in obtaining the moneys necessary to provide for renewing the short term mortgages called in. It has been estimated that at the end of 1915 the short term mortgages (up to three years) still represented about £70,000,000 out of a total debt of about £400,000,000 (excluding London).

28. The Local Government Board have power in nearly every case in which they sanction loans to fix the period within which the loans shall be repaid subject to a maximum, usually 60 years. The period actually allowed is fixed with the object of limiting it as far as possible to the probable useful life of the work and with considerable regard to the principle that each generation should bear its own burdens. Consequently the most usual period for the repayment of loans in respect of works likely to have a useful life of at least 30 years is 30 years. In calculating the probable useful life of a work regard is had to the prospect of obsolescence as well as mere decay. Thus in the case of a comparatively newly-developed industry like electricity the periods allowed are shorter than the probable life of the work.

29. Loans are almost always repayable by one of three methods—

- (1) Equal annual instalments of principal, interest being paid meanwhile on the balance of the loan from time to time outstanding.
- (2) Equal annual instalments of principal and interest combined—practically a terminable annuity.
- (3) Equal annual payments into a sinking fund which is invested in Trustee Securities and accumulated. The payments are calculated at a rate which will secure that at the end of the term allowed for the repayment of the loan the sum in the fund will be sufficient to effect repayment.

30. The growth of local debt under this system has been considerable. Thus in 1884-85 the local debt including London was approximately £171,000,000 or 24·0 per cent. of the then National Debt; in 1911-12 it was nearly £522,000,000 or 72·0 per cent. of the then National Debt. Looking at the matter from another point of view it may be stated that in 1884-85 the local debt was equivalent to £1 3s. 10d. per pound of rateable value and £6 8s 8d. per head of population. In 1911-12 it was equivalent to £2 11s. per pound of rateable value and £15 7s. 9d. per head of population.

31. As regards the income of local authorities (including London) this, excluding receipts from loans, amounted to about

£149,000,000 in 1913-14. Of this sum about £71,000,000 was from rates levied on the annual value of property assessed to rates, and about £22,600,000 was from Government Grants (including local taxation licence duties). The balance consisted mainly of receipts from property and remunerative undertakings, such as water-works, electricity works, gas works, tramways, markets, etc. In the same year the rates per pound of assessable value varied in the different Boroughs from 4s. 6d. to 11s. 3d. In one small Urban District the rates were at one time as high as 12s. 6d. in the pound.

32. Valuation for rating purposes outside London is generally conducted in the first instance by the Overseers of the Poor in each Parish. These officers are unpaid and in large Parishes the actual work is usually done by Assistant Overseers who are paid for their services. They value each new property on the basis of the rent which it is likely that the most suitable tenant would be willing to pay for it using it for the most suitable purpose, not necessarily the purpose for which it is in fact occupied or the rent at which it is in fact let. This value is called the gross estimated rental which is entered in the valuation list with particulars of the owner and occupier. The rateable value is the gross estimated rental less deductions for repairs, insurance and certain other outgoings, usually amounting to about one-sixth of the gross estimated rental. This is the value upon which the Poor Rate is levied, but under the provisions of the Agricultural Rates Act, 1896, agricultural land pays in respect of Poor Rate and other rates collected with the Poor Rate—such as the Borough Rate in Boroughs and the County Rate—a rate equivalent to a levy on half its rateable value. The rateable value is also the value upon which the General District Rate is levied, but agricultural land, wood lands, railways and canals or other land covered with water are rated for the purposes of this rate at one-fourth of their rateable value. In ordinary cases the rates are paid by the occupier of the rated premises.

33. It is out of the general district rate that the main expenditure of Boroughs and almost the whole of the expenditure of Urban Districts is usually paid. In Rural Districts the expenses are paid mainly out of the Poor Rate, which covers many other things besides the relief of the poor, but in cases where material expenditure for sanitary purposes, *e.g.*, water-supply, sewerage or scavenging, is incurred, there is a special expenses rate on the same lines as the general district rate in Urban Districts and with similar reductions in rateable value on agricultural land, etc., but limited to the Parishes in the District in respect of which the expenditure is incurred. The above is a very rough outline of the rating system intended merely to give a general impression of the system in force. It is subject to various modifications and qualifications in many directions.

34. It will be understood from what has been said that there is a powerful tendency on the part of those who pay rates to see that these rates are not unnecessarily increased. This tendency would be still more powerful if it were not for the fact that many large rate-payers have no voice in the election of the members of the local authority, *e.g.*, limited liability companies, railway companies, canal companies and so forth. On the other hand in the case of small dwelling houses the owner in certain cases pays the rates instead of the occupier and the occupier has consequently no direct incentive to economy in expenditure out of rates. He does not usually realize that rises in rents are frequently the result of rises in rates, and is not, therefore, averse to expenditure out of rates. Naturally the occupier of small dwelling houses is a numerous class and has much influence in local elections where he chooses to exert it.

35. There are from time to time cases in which a local authority refuses to do works which are necessary to put their district in proper sanitary condition or otherwise to carry out works which they ought to carry out. Provision has been made by Statute to meet some of these cases. Thus as regards default in keeping ordinary



highways in repair the remedy is by indictment of the local authority concerned or by complaint to the County Council under section 10 of the Highways and Locomotives (Amendment) Act, 1878. As regards sewerage and water-supply and certain other matters complaint may be made to the Local Government Board by any person interested that the local authority have made default in providing their district or any part of it with sufficient sewers, or with a proper water-supply where danger arises to the health of the inhabitants and a proper supply can be obtained at a reasonable cost. On receipt of such a complaint the Board hold a local inquiry and if satisfied of the default may make an order, limiting a time for the completion of the necessary work, which is enforceable by writ of *Mandamus* from the High Court, or they may employ some person to do the work and collect the money as a receiver of the rates. This latter course is never resorted to in England. It would be very inconvenient and the remedy by *Mandamus* has been found simple and effective in the few cases in which resort to it has been necessary. Usually the issue of the Board's formal order or even the threat of it is sufficient. There are also a few cases in which the Board can issue an order requiring work to be undertaken without complaint from persons interested in the locality. Thus the Public Health Act, 1875, provides that Urban and Rural District Councils may, and if required by the Local Government Board shall, undertake the scavenging of their district, *e.g.*, the cleansing of closets, privies, cesspools, etc. In this case also the order is enforceable by *Mandamus*. There are many other matters, *e.g.*, housing of the working classes or the clearance of slum areas or town planning, which in certain circumstances may become duties of local authorities enforceable by order of the Board and if necessary by *Mandamus*.

See the Housing Acts and particularly the Housing, Town Planning, etc., Act, 1909.

36. It is generally recognized, however, that it is difficult to exercise successfully any powers of compulsion in respect of local authorities unless there is a certain amount of public opinion in favour of progress in the particular direction to be enforced upon the local authorities. The suggestion so frequently made in Parliament and the newspapers that all that is required to secure progress, of a character for which public opinion is not ripe, is to turn the word "may" in Acts of Parliament into "shall" is based upon a serious misapprehension of the possibilities of local and central government in England and Wales. The Departmental Committee on Local Taxation which has already been referred to no doubt recognized this, for they thought that, in addition to the remedy of default orders, dealt with above, it might be well to have a stimulus in the way of an Imperial grant for sanitary purposes—including housing of the working classes—the whole or part of which could be withheld in the event of a serious failure on the part of a local authority to fulfil the statutory duty in any of these respects. The matter was under consideration when the war began and it was at that time proposed to give effect to the main principle of this recommendation of the Committee.

37. The last question to be touched on is that of Audit. All the accounts of all County Councils, all Urban Districts other than Boroughs, all Rural District Councils, all Boards of Guardians (Poor Law Authorities), nearly all Joint Boards and all Parish Councils and the Education accounts of all Boroughs, including County Boroughs, are audited by an officer appointed by the Local Government Board and styled a District Auditor. For the purpose of these audits England and Wales is divided into Audit Districts, the District Auditor for a district being required to live in his district or in some adjacent centre convenient for working his district. The County Council Audits are at present assigned to a group of District Auditors who practically confine themselves to this work. The audits are held yearly or half-yearly as the accounts are made up yearly or half-yearly. Thus

Urban District Councils accounts are made up yearly and those of Guardians of the Poor half-yearly.

38. The District Auditor gives public notice of the date and place fixed for the audit of accounts by him and any rate-payer or owner of property can attend and object to any item in the accounts. The accounts must be presented to the District Auditor duly made up and balanced and they must have been open to inspection of all persons interested for seven clear days before the Audit. The District Auditor may require the production of all books, and any rate-payer or owner of property in the district may be present at the audit and may make any objection to such accounts before the Auditor, such rate-payers and owners having the same right of appeal against allowances by the Auditor as they have by law against disallowances. The District Auditor is required to disallow every item of account contrary to law and surcharge the same on the person making or authorizing the making of the illegal payment and to charge against any person accounting the amount of any deficiency or loss incurred by the negligence or misconduct of that person or of any sum which ought to have been but is not brought into account by that person. He is to certify in every case the amount due from such person and, if required, to state his reasons for his decision, whether it be an allowance or a disallowance. Sums so certified are required to be paid to the Treasurer of the local authority within 14 days of the date of the District Auditor's certificate unless an appeal is made against the decision. An appeal can be made either to the High Court, on a writ of *certiorari*, or to the Local Government Board, who can, if they think fit, remit any surcharge if they find that the surcharge was legal but that the circumstances are such that remission would be justified. Naturally appeals are seldom made unless—

- (1) it is considered that the Auditor's view was wrong in law or in fact; or
- (2) the circumstances are such that the Local Government Board are likely to remit the surcharge.

There were over 2,000 disallowances and surcharges during the year ended March 1914. The number of appeals dealt with by the Local Government Board during that year was 593. In the case of 457 of these the Board confirmed the Auditor's decision but remitted, where a surcharge had been made. In 42 cases they confirmed but refused to remit. In 20 cases the Auditor's decision was reversed. The other cases were variously dealt with according to merits.

39. The general statutory provisions as to the audit of accounts of Boroughs other than Education accounts are contained in the Municipal Corporation Act, 1882. These provide merely for an audit of the Treasurer's accounts by two auditors, one appointed by the Mayor of the Borough and the other by the Burgesses (or rate-payers). These auditors have no power of surcharge and the audit is naturally rather perfunctory. To such an extent is this the case that in a few cases Boroughs have promoted private bills in Parliament or applied to the Local Government Board for the issue of Provisional Orders, to be confirmed by Parliament, putting them under the Government audit by District Auditors. The procedure by provisional order is only possible where there is in existence a local Act which can be amended under section 303 of the Public Health Act, 1875. In other cases Boroughs appoint professional auditors to audit those of their accounts which are not subject to audit by the District Auditor. This non-Government audit is generally very thorough, but these auditors have no statutory position as a rule and cannot surcharge.

## APPENDIX B.

## IMPROVEMENTS OF PROCEDURE.

*Part I.—Public works department accounts.*

1. Under the existing system the executive engineer is the officer responsible for the detailed accounting of all expenditure on public works within his jurisdiction. In some provinces he even disburses payments for works executed by his sub-divisional officer, while in others the sub-divisional officer maintains the primary records of account which are submitted by him to the executive engineer for incorporation in the accounts of the division. The divisional accounts are compiled in the executive engineer's office with the help of an accountant, and are sent to the audit officer by a specified date in the month following that to which they relate. It is laid down that, unless the circumstances are very exceptional, the executive engineer in charge of the division shall always sign the monthly accounts himself after thorough examination of the books and documents from which they have been compiled, but that should the requirements of his work render the presence of the executive engineer at his head-quarters when the accounts are due for despatch a matter of inconvenience, they may be signed by the accountant. In such cases the executive engineer, as soon as he can examine the books and papers, forwards a certificate of responsibility to the audit officer, and until this is received the latter cannot finally pass the accounts.

P. W. D. Code,  
Vol. I, para.  
1357.

P. W. D. Code,<sup>1</sup>  
Vol. I, para.  
1359.

- This system of accounts has been criticized by the majority of the officers of the public works department who have given evidence before us. It is urged that the time which the executive engineer is required to devote to his accounts work is excessive, and that the monthly compilation interferes seriously with the executive work of the division. Since the amalgamation of the public works accounts with the civil accounts the time allowed for compilation has been reduced, and it is stated that the simplification of procedure has not been commensurate with this reduction of time. It is also urged that the majority of forms submitted with the monthly accounts are of no practical utility to the executive engineer as regards the control of expenditure within his division. We are convinced as a result of our investigation that the executive engineer and his office staff are required at present to devote too much time to the accounts work and that, in the interests of executive efficiency, some measure of relief is needed. We agree that the divisional officer must be responsible for all disbursements within his division, but we do not consider that he should necessarily be called upon to compile the records of these disbursements in such a form that they can be directly incorporated in the general accounts of the province. This latter duty appears to us to be that of the audit office rather than of the engineer. Three proposals have been made in order to provide a remedy. The first involves the creation of a separate accounts branch of the divisional office in the independent charge of the accountant, which would compile all documents relating to the accounts and for the working of which the executive engineer would have no responsibility. We consider, however, that the creation of a separate and independent branch in the executive engineer's office, over which that officer would have no control, would be objectionable in principle, and in addition the scheme would entail the employment of accountants of superior status to those at present entrusted with the work under the general control of the executive engineer. The second proposal contemplates the transfer of the accounts from the executive engineer's to the superintending engineer's office. This scheme also appears to us unsuitable since, as pointed out by the comptroller-general, while the executive engineer must necessarily continue responsible for his expenditure and that of his sub-divisional officers, he would be deprived of the immediate control of the sub-divisional accounts
- 1(xi).
  - 1(x).
  - 1(ix).
  - 1(v).
  - 1(vii).
  - 1(viii).

and also of important accounts records which he requires to enable him to exercise the necessary financial check on his outgoings. It also appears very doubtful whether the superintending engineer is in a position to exercise as close a check over works accounts as the executive engineer, and whether the system would not result in an increase of work all round owing to the numerous references to the executive engineer which would probably be entailed. From the executive point of view the scheme appears to possess no special merit, while the comptroller-general opposes it from that of audit. The third system is that now in force in Bengal, under which the compilation takes place in the central audit office. In framing this system two objects were kept in view, to abolish the submission to the accountant-general of all accounts and returns which were not essential to audit and compilation, and to transfer as much of the work as possible to local audit on the spot. A large number of forms were abolished and now merely the payment vouchers and book entries are submitted to the accountant-general. In consequence the executive engineer is enabled to forward his accounts for audit on the 5th of the month following that in which the expenditure is incurred, and the number of forms required is reduced to five or six as compared with the twenty or thirty necessitated in other provinces. We have been told both by the accountant-general, Bengal, and by the executive of the public works department, that the scheme is working satisfactorily and that the apprehensions originally expressed that the reduction of forms was too drastic and that local audit would prove unsatisfactory have been shown to be groundless. The comptroller-general informs us that a scheme for general introduction throughout India is in course of preparation and that the general lines of the Bengal system are being followed, except that certain returns and books, abolished or relegated to local audit in Bengal, are being retained. These returns and papers appear, however, to us to be exactly those the compilation of which involves the most labour on the part of the divisional staff, including as they do the rent returns, cash and stock abstract books, account current, and schedule of expenditure, and we cannot but feel that their retention will deprive the Bengal system of some of its chief merit. As both the accountant-general, Bengal, and the chief engineer assure us that the experience of five years' working has shown that the system at present in force in that presidency satisfies the requirements both of audit and of the executive, we recommend that it be made of general application throughout India and deprecate the addition of any forms to those now maintained, or the submission to monthly audit of any returns now audited locally.

**Pre-audit.**

2. Our attention has been called to the procedure at present in force in connection with the accounts for the construction of the new capital at Delhi, under which the bills for work executed are sent, before payment, to the audit officer who checks them, enters them in the registers, and himself makes the necessary disbursements. Under this system the executive engineer is relieved from all accounts work, receiving such information as may be necessary for the control of his expenditure, or for professional purposes, from the audit office. While we realize that this arrangement would prove impossible where works are scattered over large areas, there would appear to be no obstacle to its adoption in connection with works in the presidency towns or at the headquarters of local Governments where audit offices already exist, and it might also prove possible to institute temporary offices for this purpose at the site of large works, as was done in the case of the Sara bridge project. In view of the relief afforded thereby to the executive we recommend that, wherever possible, the preaudit system should be introduced.

**Maintenance of accounts by sub-heads.**

3. Under the existing system the accounts for works are, in P. W. D. Code, most cases, maintained by sub-heads, the only exception being Vol. I, para. that the outlay on works costing less than Rs. 5,000 need not be kept by sub-heads unless specially ordered by the sanctioning officer, and that no sub-head need be separately detailed in the

- 1(xii). register the amount of which is less than Rs. 500. The object of the maintenance of accounts by sub-heads is stated, from the point of view of the executive, to be twofold, firstly to enable the executive engineer to watch the progress of each work, and secondly to assist him in the revision of the standard schedule of rates. It appears to us that, in the case of small works, the advantages obtained from this procedure are incommensurate with the labour involved, since in such cases the executive engineer can control his expenditure by comparison with the total of the estimate, while the rates obtained from the register of works, which should agree fairly closely with those entered in the contract documents, can hardly affect those obtaining in the divisional schedule. We therefore recommend that no sub-heads should be maintained in the case of works costing less than Rs. 10,000 and that in the absence of special orders to the contrary by the executive engineer no sub-head amounting to less than Rs. 1,000 should be separately detailed.
- 1(xiv).

4. As stated in Chapter IV we have, during our inquiry, attempted to investigate the financial status and prospects of certain quasi-commercial government undertakings such as brick-fields, workshops and stores. We have experienced great difficulty in this respect in that no regular profit and loss accounts are maintained and hence it is impossible to tell accurately to what extent they are successful from a commercial point of view. In many cases no regular debit is made for charges such as interest, depreciation, direction and the like, and the success or otherwise of the undertaking is judged by a comparison between the value of the output and the direct working expenses, which often gives but little idea of the real financial position. While realizing that the preparation of annual profit and loss accounts would throw a considerable amount of extra work on both the executive and the accounts department, we consider it desirable that government should from time to time ascertain the financial position of such of these undertakings as it may be considered desirable to maintain, and we recommend that such profit and loss accounts should be periodically supplied, say at five year intervals, and that the advisability, from a commercial stand-point, of continuing the particular undertaking should be reconsidered.

- 72(i). Profit and loss accounts of quasi-commercial undertakings.
5. Our attention has been called to the large proportion of public works expenditure which is held in objection in audit. In the year 1914-15, of a total expenditure in the buildings and roads branch of Rs. 9½ crores, Rs. 3½ crores or 35 per cent. were held in objection. The main classes of objections are want of or excess over estimate, want of or excess over appropriation, and miscellaneous irregularities. The majority of cases of want of estimate are due to works, informal approval to which has been obtained, being commenced before the estimate is officially sanctioned and we anticipate that, when enhanced powers are delegated to superintending and executive engineers, and the delay at present necessitated in obtaining superior sanction consequently obviated, there will be a large decrease in the number of such objections. Similarly the adoption of our recommendation that executive engineers should be empowered to reappropriate funds should dispose of most of the objections under excess over appropriations.
- 7(ii). In regard to miscellaneous irregularities it had been stated by the executive that the percentage is swelled by reason of the fact that objections are raised in audit with reference to items which would have been passed without comment by an accounts officer with any professional knowledge, that expenditure is challenged the necessity for which can only be determined by the executive, and that the compilation of replies entails unnecessary labour on the part of the officers concerned. We realise the necessity for a proper audit, and we therefore refrain from making any detailed recommendation on this point. The comptroller-general informs us that efforts are being made to reduce this class of objection, and that orders have been issued that objectionable item statements shall in every case be scrutinized by a responsible officer. If this scrutiny is properly carried out, and if it is
- 7 (iii).

impressed on all officers engaged in audit that objections should only be raised where there is genuine reason to believe that the expenditure was objectionable, and that the raising of unnecessary objections will reflect unfavourably upon the officer responsible, we do not consider that any further action is necessary.

**Peripatetic  
audit.**

6. It has been suggested that large numbers of the objections 66(i). raised in audit would be rendered unnecessary by the introduction of a system of peripatetic audit, since this would afford opportunity for personal discussion between the audit and executive officers and thereby obviate correspondence and explanation. While realizing the advantages of the travelling audit system we are not 66(ii). convinced that, in this particular case, they would be commensurate with the extra expenditure involved. It would often be inconvenient for an executive engineer on tour to return to headquarters to meet the auditor, and the majority of the questions would probably necessitate reference to sub-divisional officers and subordinates, who in many cases would be stationed at considerable distances from headquarters. It appears improbable that any very appreciable number of objections would be finally disposed of at such a meeting, while in all other cases a record of objections would be required as at present to ensure the necessary action being taken. We consider that it will be sufficient if, as is now the case in Bengal, the monthly submission of certain registers and returns to the accountant-general is discontinued and these returns relegated to local audit.

**System of  
treasury pay-  
ments.**

7. Certain officers of the public works department have stated 98(i). in evidence that the system of treasury payments of personal claims introduced into the department at the time of the amalgamation of the public works with the civil accounts, is inconvenient and unnecessary, and that the old public works system of direct payment by the executive engineer was preferable. We cannot agree with this contention. The system of treasury payments is in force in every other department, and we consider that it should be retained in the public works department also, the differentiation between payment of personal claims and payments for works appearing to us to be desirable.

**Lapses of  
grants and  
suitability of  
the date of the  
financial year.**

8. Considerable stress has been laid by the officers of the public works department on the inconvenience arising from lapses of grants at the end of the financial year. It has been represented 44(ii). that the present date of closing the financial year is unsuitable, so far as the department is concerned, since it falls in the middle of the working season and it is extremely difficult to forecast how much of the season's expenditure will be incurred before, and how much after, the 31st of March. A further disadvantage of the 44(i). adoption of this date is that the department is not aware until April at earliest what works will be included in the budget, with the result that little or no progress can be made before the commencement of the monsoon and that hence the commencement of work is delayed and all allotments cannot be fully expended. Whilst we consider that from the departmental point of view the date is undoubtedly unsuitable, we recognize that, from the standpoint of general imperial finance, wider interests are involved, and hence we recommend no change. The recent orders of the Government of India in regard to the regrant of lapses should effect a considerable improvement, and no further action in the matter appears to us to be necessary.

#### *Part II.—Decentralization.*

**Powers of  
technical sanc-  
tion.**

9. In dealing with the general question of financial and technical Decentralization control, the Decentralization Commission reported that the dis- Commission cretion given to local Governments in regard to the delegation of Report, para. powers of technical sanction to public works department officers 210 (VI). had been very sparingly exercised, and that there had been well founded complaints as to the unnecessarily rigid limits imposed, and they recommended that local Governments, in making such delegations, should bear in mind that the position of a superintending engineer should rightly be that of a local chief engineer for most engineering matters within his circle, the functions of

P. W. D. Code, Vol. I, paras. 283 and 321.

the chief engineer being to deal only with the more important estimates and to exercise general control over the department. With this object in view they proposed that local Governments should be allowed full discretion in delegating powers of professional sanction to their subordinate officers. The Government of India however, decided to fix maximum limits of Rs. 50,000 and Rs. 2,500 for superintending and executive engineers respectively, at the same time expressing their willingness to reconsider the former limit should enhancement prove to be desirable. We consider that some local Governments have still neglected to delegate adequate powers. In one province, where powers are delegated individually to superintending engineers, we found two such officers exercising powers of technical sanction limited to Rs. 20,000 up to the very date of their promotion to chief engineerships, and in some other provinces the powers of officers are restricted to sums much below the maximum limit. It has been suggested to us that this system favours the less efficient, since it permits of a local Government promoting an officer not fully qualified and protecting itself from the natural results of its action by restricting his powers, and that it also gives rise to unnecessary references by executive and superintending engineers to higher authority. We are convinced by our inquiry that officers have not hitherto been allowed to exercise powers commensurate with their professional skill and experience, that this has prejudicially affected the efficiency not only of the department but also of its officers, and that this evil will be intensified by a more rigid system of promotion. We therefore recommend that the powers of technical sanction of these classes of officers should be raised to the limits given in the statement attached to this appendix. We consider that every officer should exercise the powers allotted to his class, or to the class in which he may be officiating, unless for reasons recorded they are withheld by the local Government in the case of any particular individual. The rule should be that no officer should be considered fully qualified for promotion to a higher class until he can safely be entrusted with the full powers allotted to that class. The large difference between the powers proposed for superintending engineers and for executive engineers is based not only on the relative seniority of these officers, but also on the fact that in the case of a work sanctioned by a superintending engineer two professional opinions are recorded, whereas in the case of a work sanctioned by an executive engineer there is usually only one.

- 93(i).  
93(iii).  
93(ii).

10. As we have already pointed out in our report, the import- **Delegation of**  
ance of the sub-divisional officer does not appear to have been suffi- **powers to sub-**  
ciently recognized in the past, with the result that some of these **divisional**  
posts have been filled by men of inadequate status and attainments, **officers.**  
and the main responsibility for the detailed management of works  
has been thrown on the executive engineer. We believe that  
the introduction of a better type of sub-divisional officer will lead  
not only to greater efficiency but to greater economy, and also  
relieve the divisional engineer of much of the petty work which  
now devolves upon him. To attain this latter object we recom-  
90(i). mend that certain limited powers should be delegated to assistant  
engineers and sub-engineers when in charge of sub-divisions, which  
powers should be extended to all officers of the proposed second  
service if our recommendation in regard to the formation of such  
a service is accepted. In the case of assistant engineers we consider  
it particularly desirable that they should be given this measure of  
responsibility before being called upon to exercise the higher  
powers which will vest in the executive engineer.

Decentralization  
Commission  
Report, para.  
209 (V).

11. The Decentralization Commission recommended that local **Powers of**  
Governments should have full powers to accept tenders and pass **acceptance**  
contracts so long as the estimate sanctioned for the work by com- **of tenders.**  
petent authority was not exceeded, and should be authorized to  
delegate such powers as they thought fit to authorities subordinate  
to them, subject to the general principles that the power of any  
officer should be limited to his power to deal with estimates pro-  
fessionally, that the contract did not involve indefinite legal  
liabilities, and that great caution should be shown in regard to

any delegation of power to make a departure from the ordinary rule that tenders should be publicly called for and the contract given to the lowest satisfactory bidder. As a result of these recommendations, provincial Governments have been empowered to P. W. D. Code, accept tenders up to the limits of the estimates sanctioned by Vol. I, para. competent authority in the case of works charged to provincial 757. funds, but their powers to accept tenders are still restricted to the limit fixed for their powers to sanction estimates technically in the case of works charged to imperial funds. Superintending engineers are authorized to accept tenders up to the limit to which those officers are empowered to sanction estimates technically, and executive engineers up to a limit of Rs. 5,000. We consider that these powers should be considerably enhanced. There appears to us to be no adequate reason why the power to enter into contracts 20(i). should be restricted to that of technical sanction, and there are indications that the preference shown by the department for piecework agreements as opposed to legal contracts is partly due to the delay entailed in obtaining sanction to the latter. Until the present year every contract for an imperial work costing more than Rs. 2 lakhs had to be submitted to the Government of India for acceptance, and consequently, after a suitable contractor had been found and his tender approved by the local authorities, it was necessary for the executive engineer either to postpone commencement of the work until the tender had been passed, through the superintending engineer, the chief engineer, and the local Government to the Government of India and back again through the same channel, or to start work without a contract at all, substituting a temporary piecework agreement and running the risk of the contractor throwing up the work if alterations in the contract were made by the higher authorities. The enhancement of the powers of local Governments to sanction estimates professionally will materially reduce the number of such references, but we would go further and recommend that, provided the estimate sanctioned by competent authority is not exceeded, the superintending engineer should, subject to the statutory rules, P. W. D. Code, have the final disposal of all contracts. This will enable con- Vol. III, tractors' tenders to be accepted without delay and will, we believe, App. 18. lead to a more general use of the contract system. We recommend also that the powers of executive engineers in this respect should be enhanced and that powers should be delegated to assistant engineers and to sub-engineers in charge of sub-divisions. The details of our recommendations are given in the statement attached to this appendix. The question of calling for tenders and the choice of bidders, referred to by the Decentralization Commission, has been dealt with in Chapter IV of our Report.

**Purchase of tools and plant.**

12. We also recommend an increase in the powers of superintending and executive engineers to sanction the purchase of tools and plant as detailed in the statement attached, their present 97(i). powers being unnecessarily restricted. Assistant engineers and sub-engineers in charge of sub-divisions should also be given such limited powers in this respect as will enable them to purchase such articles as may be required for works sanctioned by themselves.

**Payments by sub-divisional officers.**

13. In some provinces the sub-divisional officer is not entrusted 90(iii). with the duty of a disbursing officer, his power to make payments being restricted to petty items costing less than Rs. 10, all payments exceeding this amount being made by the executive engineer. We consider that such restriction is unnecessary and causes inconvenience to small contractors on works situated at a distance from the executive engineer's head-quarters. The sub-divisional officer should be looked upon as the primary disbursing officer of the department and should be responsible for all payments on running bills and also for all final bills except those for large and complicated works the checking of which by a more competent agency than the sub-divisional clerical staff may be considered desirable.

**Reappropriation of budget allotments.**

14. The question of simplifying the existing procedure in regard to the reappropriation of budget grants is one upon which a considerable amount of evidence has been received. At present,



- if an item is specifically entered in the budget estimate, the allotment made cannot be reappropriated without the sanction of the local Government, so that if the executive engineer finds towards the end of the year that he is unable to expend in full the grant for any particular work he is unable to transfer funds from it to another on which progress may be possible without government sanction, intimation of which will often not be received until the money has lapsed. In order to avoid such lapses it is not uncommon for the executive engineer, finding it impossible to spend upon a work the grant allotted for it, to overspend on another in anticipation of sanction to a reappropriation of funds, the expenditure being meanwhile held in objection in audit as excess over allotment. As
- 10(i). a remedy for this state of affairs the accountant-general, Bengal, has proposed the abolition of allotments to executive engineers. Under his proposed scheme lump sum allotments would be made to superintending engineers for civil works within their circles. The superintending engineer would not allot money to each division or work, but would keep it in lump, booking the outlay against this lump sum and watching the rate of expenditure by means of monthly progress reports from the divisions. If he found himself running short of funds he would either ask the chief engineer for more or direct his executive engineers to retard operations; if he found the rate of outlay too slow he would sanction further works, or endeavour to expedite progress on existing works. The executive engineer would thus not be responsible for keeping his expenditure within the limit of the allotment for each work, but merely for getting work done; having no allotment he would not have to make efforts to spend it nor, on the other hand, would he have to curtail progress to avoid a technical objection to a small excess. Whilst this proposal has several features to recommend it, we are
- 10(ii). not prepared to support it in its entirety. The comptroller-general has pointed out some of its difficulties—the danger of excess expenditure on unimportant works at the beginning of the year, the tendency to convert the superintending engineer's office into an audit office, and the difficulty in which the superintending engineer would find himself in regard to works sanctioned during the year by the executive engineer; and we concur with the comptroller-general's opinion that the divisional, and not the circle, officer should be responsible for exercising financial control over the expenditure on works, as being the officer more closely connected with the initial accounts. The lack of elasticity inherent in the present system is, however, undoubtedly prejudicial to efficient working, and we recommend the following modification which we believe will secure most of the advantages claimed for the scheme outlined above but without the concomitant disadvantages. Allotments should be made to the executive engineer as at present against individual works, but that officer should be empowered, if he finds that it is impossible to spend economically the grant sanctioned for any work in full, to reappropriate and transfer it to some other work, reporting the transfer and his reasons for making it to the district officer and to the superintending engineer (who will inform the heads of the departments concerned). The executive engineer will thus obtain much greater freedom than he has at present in the matter of adjusting his work to the varying conditions of labour throughout his division, while at the same time remaining responsible that the total sum available for expenditure within his jurisdiction is not exceeded. It will probably, however, be found advisable in practice to restrict this power to reappropriations within the four main heads buildings original, buildings repairs, communications original and communications repairs, and to prohibit the executive engineer from transferring money from one of these main heads to another without the sanction of the superintending engineer with whom the final decision in such matters should rest.

15. Under the existing system the control of the staff of the **Disciplinary public works department** is almost entirely centralized in the local **powers of Government**. No officer is authorized to dismiss any servant **officers** of government whose appointment requires the sanction of higher of the **P.W.D.**

authority, and the upper subordinate establishment in every province, and in many provinces the lower subordinate establishment also, is appointed by the local Government. Under the present rules an executive engineer cannot punish in any way a lower subordinate employed in his own division. We have received much evidence to the effect that this procedure is detrimental to the efficiency of the department. We consider that larger disciplinary powers should be delegated to officers of the department and recommend that executive engineers should have powers of punishment, including dismissal, over the lower subordinates employed within their divisions, subject to a single appeal to the superintending engineer, and that superintending engineers should have similar powers over the upper subordinates employed within their circles, subject to a single appeal to the chief engineer. We believe that the adoption of this proposal will lead to greater efficiency in the subordinate ranks, and see no reason to believe that any hardship to the individual will be involved thereby, if it is laid down that in every case strict attention should be paid to the general rules regulating the dismissal of government servants.

Increase in the five per cent. limit allowed in estimates for contingencies.

16. It has been represented to us that the limit of 5 per cent. which may, under the existing rules, be added to the estimate for a work to cover unforeseen and contingent charges might with advantage be raised, in order to avoid the necessity for explanations of excesses and for revised estimates in many cases. We are unable to support this recommendation, which might lead to less accurate preparation of the detailed estimate and to less careful control of expenditure. No explanation nor revised estimate is necessary unless the original estimate, including contingencies, is exceeded by more than 5 per cent. so that the engineer has already a margin of 10 per cent. for unforeseen charges and this, in our opinion, should suffice for any ordinary work.

*Part III.—Modifications recommended in certain orders of the public works department code.*

Advances to contractors.

17. It has been represented to us that in many cases the rates at which work is done for the public works department by petty contractors are unduly enhanced by the fact that payments in advance are prohibited by rule and that hence the petty contractor, who possesses no capital of his own, is forced to borrow from money-lenders at exorbitant rates of interest, which is eventually paid by government in the rates for the work, and it has been suggested that the executive engineer should be empowered to grant advances. This proposal would affect only the smallest and poorest class of contractors, in whose case the risk of loss to government would naturally be greatest, and we are hence unable to recommend its adoption. A further suggestion which has been put forward is that the executive engineer should be authorized, even when the contract is for finished work, to make payments against the security of materials actually brought to site. There is less objection to this proposal, and we recommend that executive engineers should be permitted to make payments of part value of materials on site, provided they are of an imperishable nature and that the agreement is so drawn up that government secures a lien on the materials paid for and is safeguarded against losses due to the contractor postponing the execution of the work after receiving payment for the materials, against losses due to their shortage or misuse, and against the expense entailed for their proper watch and safe custody. The monetary help so given should be treated, not as payment for the materials, but as advances made on the security thereof.

Payments on account.

18. A question somewhat allied to the above, although standing on a completely different footing, is that of payments on account for work actually done. The present rules prohibit any payment being made without detailed measurements being recorded so that, if the engineer desires to pay on account for half the work executed, he is debarred from doing so unless he actually measures half the work in detail and enters the measurements in the measurement book. This appears to us to be an unnecessary restriction,

and we recommend that payments on account for work actually executed should in ordinary circumstances be permissible without the formality of detailed measurements, on the certificate of a responsible officer (not below the rank of sub-divisional officer) that not less than the quantity of work paid for has actually been done.

19. It appears to us that, under the present system, a great deal of unnecessary time and labour is devoted to the preparation of the estimates for the annual repairs to buildings. These estimates are, in many cases, drawn up before the officer concerned knows what repairs will actually be required, and are in practice not closely followed. In some provinces standard measurement books are maintained, containing the detailed measurements of each building, from which these estimates are prepared, but even in this case each separate estimate (and there may be hundreds pertaining to a single division) has to be submitted to the executive engineer for formal sanction. It does not appear to us that this procedure affords any real control over expenditure and hence we recommend the abolition of these repair estimates. A lump sum should be fixed for each building, based on the average expenditure of the previous five years, and up to this limit expenditure should be permissible without the formality of further sanction.
- 76(ii).  
76(i).  
76(iii).

P. W. D. Code,  
Vol. I, para.  
645.

20. As defined in the public works department-code the placement of any portion of an existing structure by work in material essentials is not the same as the work dismantled is an original work, and funds for the same must be provided from the minor works grant and not from the repairs grant, and it has been suggested that the definition might advantageously be made less rigid. An extreme case quoted to us was that of a church in Assam which the local Administration was empowered to re-roof with similar materials to those originally employed, whereas the sanction of the Secretary of State was required to its re-roofing with cheaper and more satisfactory materials, the former being a repair and the latter an original work within the meaning of the code. We agree that the present rule is unnecessarily restrictive and recommend that it should be revised so as to permit of renewals and replacements being classed as repairs, even if executed with different materials from those employed in the original work (such as the substitution of a flagged for a concrete floor), provided that the cost is not more than that for which the renewals could have been carried out in the materials used in the original work. The present rule appears to us to deter the department from taking advantage of the more recent developments in materials and economical constructional methods.
- 76(v).  
76(iv).

P. W. D. Code,  
Vol. II, para.  
1885 (V).

21. When the public works department executes work on behalf of local funds, or undertakes contribution works for municipalities or other public bodies, it is open to the local Government to reduce the usual percentage charges for establishment and tools and plant, or to remit them altogether. It appears from the evidence we have received that the establishment charges on contribution works are often remitted, while a fixed percentage, usually considerably below the actual cost, is charged on works executed on behalf of local funds. This system has two unsatisfactory features. In the first place it entails charging against ordinary provincial works a much higher percentage of establishment than they should rightly bear. For example, during the three years ending 1913-14, the percentage borne by the cost of establishment to the cost of construction in the United Provinces was 20 per cent. in the case of provincial, 13 per cent. in the case of local fund and 2 per cent. in the case of contribution works, the average cost of work done under each head being Rs. 51, 24 and 11 lakhs respectively. These percentages are wholly fictitious, that chargeable against provincial revenues being unduly inflated to cover the remissions made under other heads. In the second place this procedure prejudices private enterprise, as no municipality or public body is likely to invoke the services of a private firm so long as government is willing to do the work at cost price without charging for supervision or plant. In the interests both of
- 22(i).

**Definition of original works and repairs.**

**Charges for establishment and tools and plant.**

good accounting and of private enterprise we recommend that the power of local Governments to remit or reduce departmental charges should be withdrawn and that these charges should invariably be levied at the average percentage obtaining on government works. Should the local Government desire to render assistance, it should take the form of a grant-in-aid without any accompanying restriction as to the agency by which the work is to be carried out. We deprecate the present system under 47(i) which government may insist on executing, through the public works department, any work towards which it contributes a grant. Their functions should be limited to seeing that the grant contributed is not wasted.

**Percentage charges on stores.**

22. In regard to government stores, it has been suggested that 87(i) the rule which prohibits the sale of government stores unless a percentage charge of 10 per cent. is added to their value to cover the cost of supervision, storage and contingencies results in the accumulation of surplus stock and a consequent locking up of capital in that the sale price of the materials is usually above the price at which they can be purchased in the open market. This contention appears to us to be well-founded, and we recommend that, when stores are surplus and otherwise unsaleable, the officer empowered to sanction their sale should also be authorized to remit the percentage charge.

P. W. D. Code, Vol. I, para. 1222.

**PRESENT AND PROPOSED POWERS OF PUBLIC WORKS DEPARTMENT OFFICERS.**

Class of officer.	POWER TO ACCORD TECHNICAL SANCTION TO ESTIMATES.		POWER TO ACCEPT TENDERS.		POWER TO PURCHASE TOOLS AND PLANT.	
	Present.	Proposed.	Present.	Proposed.	Present.	Proposed.
Chief engineer . . . . .	<i>Nil.</i>	Rs. 16,00,000, as now exercised by local Governments.	Rs. 16,00,000 . . . . .	<i>Nil.</i>	<i>Tools and Plant . . . Nil</i> <i>Office furniture . . . Full</i> <i>Live stock . . . . Nil</i>	Full powers under all heads as now exercised by local Governments.
Superintending engineer . . . . .	At the discretion of the local Government, subject to a maximum of Rs. 50,000.	Rs. 1,00,000	As for technical sanction . . . . .	Full powers . . . . .	<i>Tools and Plant—At discretion of local Government subject to a maximum of Rs. 10,000.</i> <i>Office furniture—At discretion of local Government subject to a maximum of Rs. 500.</i> <i>Live stock . . . . Nil</i>	<i>Tools and Plant . . . Rs. 15,000</i> <i>Office furniture . . . Rs. 1,500</i> <i>Live stock . . . . Nil</i>
Executive engineer . . . . .	At the discretion of the local Government, subject to a maximum of Rs. 2,500.	<i>Works designed on standard plans . . Rs. 25,000</i> <i>Other works . . . Rs. 15,000</i>	Rs. 5,000 . . . . .	Rs. 1,00,000 . . . . .	<i>Tools and Plant—At discretion of local Government subject to a maximum of Rs. 500.</i> <i>Office furniture . . Nil</i> <i>Live stock . . . . Nil</i>	<i>Tools and Plant . . . Rs. 2,000</i> <i>Office furniture . . . Rs. 500</i> <i>Live stock . . . . Nil</i>
Assistant engineer or sub-engineer in charge of sub-division.	<i>Nil.</i>	<i>Works designed on standard plans . . Rs. 2,500</i> <i>Other works . . . Rs. 1,500</i>	<i>Nil.</i>	Rs. 25,000 . . . . .	<i>Tools and Plant . . . Nil</i> <i>Office furniture . . . Nil</i> <i>Live stock . . . . Nil</i>	<i>Tools and Plant, and stores forming part of a sanctioned estimate . . Rs. 250</i> <i>Office furniture . . . Nil</i> <i>Live stock . . . . Nil</i>

These limits refer to expenditure on works only, exclusive of tools and plant and establishment charges.

## APPENDIX C.

*Memorandum from the Royal Institute of British Architects.*

The Viceroy outlined a policy of decentralization in respect to the design and supervision of official buildings by which much of this work would be in charge of the District Boards instead of the Provincial Public Works Department.

The reference to the committee suggests that the matter has been visualized primarily from the administrative standpoint.

Now though this aspect is important it is by no means the only one to be taken account of. The assumption that the present highly centralized control of buildings does not give the best results may be unhesitatingly accepted. Those qualified to produce good designs are not able to see that they are properly carried out, while those entrusted with the latter duty, having many other classes of work to attend to, are not sufficiently experienced in buildings.

Apart from this there is another point namely that India is sadly in need of those capable of designing and constructing buildings. Except in a few favoured districts, where the craftsmen still maintain the old traditional methods of building, these traditions have lapsed and nothing of equal value has taken their place, nor even where the tradition is well maintained does it quite meet all the requirements of modern developments. It may therefore be affirmed that much of the building work, public and private, is deplorably bad.

The concentration of public work has discouraged many competent men from taking up building from the professional or the business aspect, and both municipalities and private individuals find the greatest difficulty in getting building works artistically and skilfully carried out.

It may be assumed that one of the objects of the proposed scheme is to provide that every district shall be provided with capable designers and skilled constructors, but it does not seem to be fully realized that a mere revision of administrative methods will be of little use without active measures for the provision of qualified men. Without these no advance can be made. Such a body does not exist at the moment, it would have to be imported or trained. We need not go into the question as to whether recruits to it would be mainly European or Indian. The European would probably be required at first on account of the small number of Indians that have qualified themselves for this work, but it must be remembered that while the Indian may require training in architecture and construction, the European requires training in Indian conditions.

The success of the Indian in Law and Medicine suggests that given the necessary incentive he would master the art of Architecture. That so few have done so in recent times is partly due to the fact that no suitable training is provided. Almost the only form of education open is on strictly European lines and these cut so sharply across the Indian conception of building that the student becomes confused and baffled. If this education could start from the knowledge possessed by the *Mistri* of Southern India and from that basis could be built up the wider knowledge demanded by modern requirements and materials we might expect to secure the best type of exponent of a genuinely Indian Architecture.

This procedure would naturally be only practicable in the case of one bred in India, and we must also consider the case of the European prepared to qualify for practice in the east. In his case he would probably have acquired his knowledge by means of the methods accepted here in England, and would need to supplement these by a sound study of Indian conditions and how these express themselves in building.

If his training had been on broad lines he should be capable of this adaptation, but some direction should be given him before-

hand by one experienced in Indian requirements so as to save him time in his Indian career. In either case a bare mechanical knowledge of building can do nothing towards vitalizing methods of design in India.

Under any circumstances it would be desirable to strengthen the training in Architecture in the principal centres of India by the development of existing schools and the establishment of chairs of architecture in the Universities, with a curriculum including not only the scientific basis of structure but also the principles of design, for which illustrations may be drawn from the history of Indian art quite as profitably as from that of European countries.

Assuming that a number of well-qualified men were thus made available, it would only be fair that there should be some reasonable guarantee for their employment, and it may be suggested that this should be met by appointing them as consultants, etc., to District Boards and Municipalities with moderate retaining fees or other suitable methods of remuneration in return for services required by these authorities, but leaving them free to take up private work to an extent that did not interfere with their public duties.

The success of an administrative change such as this depends so largely on the means to be employed to meet its requirements from the technical point of view that a sound system of training, which cannot be said to exist at present, is an essential factor in the achievement of the results aimed at.

H. V. LANCHESTER,  
*for the Royal Institute  
of British Architects.*

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 (iii) Opposed, *Turner*, 491; *Prait*, 710; *Desmond*, 987; *Lechmere-Oertel*, 1,675; *Roddie*, 1,811 (4), 1,819; *Birley*, 1,851; *Thomson*, 2,803; *Hardiman*, 3,051; *Bishun Swarup*, 3,189; *Ryland*, 3,347 (2), 3,355; *Oldham*, 3,473; *Campbell*, 3,920; *Maynard (H)*, 4,644.
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 (v) Alterations due to changes in views of administrative officers, *Framji*, 74; *Thomson*, 824; *Mitra*, 1,309; *Cowley*, 1,434; *Dey*, 1,453; *Lacey*, 2,134; *Oldham*, 3,472.  
 (vi) Alterations due to transfer of officers, *Dey*, 1,453; *Lechmere-Oertel*, 1,707; *Birley*, 1,839, 1,854; *Campbell*, 3,921.  
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- 5. Advisory board for engineering colleges :**  
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- 6. Architectural work :**  
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- 9. Brickfields :**  
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 (i) Maintenance of government brickfields at —, *Cowley*, 1,380, 1,406; *Zorab*, 1,776-1,777; *Martin*, 1,952; *Pears*, 2,503; *Lacey*, 2,096; *Spring*, 2,417-2,418.
- 10. Budget allotments :-**  
**PROPOSED ABOLITION OF—**  
 (i) Advocated, *Tomkins* . . . 2,037-2,045, 2,058  
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## 11. Buildings branch :

- (i) Formation of separate — advocated, *Wittet*, 117 (4), 126; *Lalubhai Samaldas*, 773; *Foster*, 1,916 (1) (a); *Munnings*, 3,267 (a); *Walford*, 3,310, 3,337; *Lashman*, 3,954; *Sullivan*, 4,421, 4,434; *Begg*, Appendix I (b).

## C

## 12. Central designing office :

- (i) Institution of a — advocated, *Verrieres*, 3,822 (4); *Wood*, 4,125; *West*, 4,265, 4,274, 4,299; *Keeling*, 4,794; *United Provinces Government*, 8 (i) (3), 8 (v) (1), p. 308, Vol. III.

## 13. Central engineering college :

- (i) Proposal to establish a —, *Vacha*, 1,088 (3); *Heaton*, 1,881; *Walford*, 3,315; *Wood*, Annexure I (2) (ii), 4,109; *Budh Singh*, 4,727 (1), 4,737, 4,744; *Chatterton*, 4,891 (5) (7) (8), 4,899-4,901.

## 14. Chief engineer :

- (i) Limited powers as head of department, *Chief Commissioner, Delhi*, 9, p. 316, Vol. III.

## POSITION AS SECRETARY TO GOVERNMENT :

- (ii) Suitable, *Thomson*, 908; *Cowley*, 1,426; *Wollaston*, 2,711; *Stanley*, 3,127, 3,149; *Tillard*, 3,711.  
 (iii) Unsuitable, *Moss King*, 1,039 (10), 1,052, 1,054, 1,058; *Venkatesar Aiyar*, 2,632 (2), 2,643; *Oldham*, 3,494; *Gavin Jones*, 4,041, 4,049; *Chief Commissioner, Central Provinces*, 20, p. 336, Vol. II.  
 (iv) Tenure of office of —, *Lechmere Oertel* . . . 1,713

## 15. Clerks of works :

- (i) Importation of European — advocated, *Foster*, 2,916 (1) (e), 2,921; *Munnings*, 3,272, 3,282; *Lishman*, 3,953, 3,981; *Sullivan*, 4,426, 4,438.

## 16. Code, Public Works Department —

- (i) Difficulties due to restrictions of —, *Stuart Menteth*, 189 (3), 201; *Gebbie*, 423; *Thomson*, 823 (4); *Moss King*, 1,039 (4); *Taylor*, 1,573, 1,582; *Lechmere-Oertel*, 1,660 (vi), 1,679, 1,708; *Meares*, 1,721; *Peters*, 2,739; *Eastgate*, 4,466 (2) (3); *Dorman*, 4,689 (2), 4,690 (1) (2); *Keeling*, 4,750, Annexure A; *Begg*, Appendix I (j); *Bihar and Orissa Government*, 6-7, p. 306, Vol. III; *Chief Commissioner, Delhi*, 11, p. 316, Vol. III.

## 17. Consulting Architect :

- (i) Cost of, *Wittet*, 133; *Crouch*, 1,529; *Lishman*, 3,969, 3,991; *Sullivan*, 4,454.  
 (ii) Divorce of construction from design detrimental to efficiency of —, *Wittet*, 117 (6); *Begg*, 4,823 (d).  
 (iii) Indian system opposed to home practice, *Munnings*, 3,253; *Lashman*, 3,946; *Sullivan*, 4,418; *Begg*, 4,819.  
 (iv) Insertion of engineer between architect and work reduces efficiency of building work, *Wittet*, 117 (12)-(14); *Crouch*, 1,562-1,563; *Foster*, 2,913-2,914; *Munnings*, 3,258; *Sullivan*, 4,419; *Begg*, 4,823 (a).  
 (v) Relative responsibility of — and engineer for structural stability of buildings, *Crouch*, 1,527; *Pullar*, 2,864, 2,874; *Foster*, 2,934; *Munnings*, 3,296.

## RESPONSIBILITY FOR CONSTRUCTION OF BUILDINGS :

- (vi) Architect should exercise executive control, *Wittet*, 117 (4)-(7); *Gebbie*, 424; *Cowley*, 1,373; *Crouch*, 1,518, 1,537; *Pullar*, 2,869; *Foster*, 2,916 (2), 2,919, 2,920; *Munnings*, 3,258-3,264; 3,277; *Tillard*, 3,671, 3,979; *Sullivan*, 4,422, 4,434; *Dorman*, 4,687 (i), 4,699, 4,712; *Begg*, Appendix I (a), 4,828; *Punjab Government*, IV (b), p. 314, Vol. III.  
 (vii) Architect should not exercise executive control, *Hansoti*, 352; *Zorab*, 1,786; *Lacey*, 2,080 (b), 2,089; *Wollaston*, 2,692; *Stanley*, 3,115.  
 (viii) Executive functions of the consulting architect, *Bombay*, *Wittet*, 117 (8), 125; *Begg*, 4,822, 4,847.  
 (ix) Visits work during construction and advises, *Cowley*, 1,353, 1,373; *Crouch*, 1,526; *Wollaston*, 2,691; *Stanley*, 3,115; *Munnings*, 3,262; *Sullivan*, 4,412.

## 18. Consulting Architect to the Government of India :

- (i) Proposal to entrust designs of all major imperial works to —, *Begg*, Appendix II (4), 4,841-4,842.

## 19. Contingencies :

- (i) Increase in limit of 5 per cent. allowed for — in estimates advocated, *Shoubridge*, 5, 25; *Behari Lal*, 3,735 (a); *United Provinces Government*, 8 (v) (2), p. 310, Vol. III.

## 20. Contracts :

- (i) Enhanced powers of acceptance of tenders for — recommended: *Stuart Menteth*, 189 (3); *Hansoti*, 353; *Advani*, 801 (2); *Srinivasa Aiyengar*, 2,144 (c), 2,168; *Tillard*, 3,696; *Kanhaiya Lal*, 4,385 (25), 4,401; *Keeling*, 4,749 (2) (f); *Bombay Government*, (v) (2)-(3), (11), pp. 325-326, Vol. II; *United Provinces Government*, 8 (v) (2), p. 310, Vol. III.  
 (ii) Tendency of departmental officers to condone breaches of —, *Shoubridge*, 13; *Pears*, 2,489 (2), 2,516.

## 21. Contractors :

- (i) Classification of — according to professional qualifications, financial status, etc., recommended, *Kamat*, 753; *Abhyankar*, 1,162 (5), 1,172; *Kelkar*, 1,249; *Amar Nath Das*, 1,485, 1,500; *Venkatesar Aiyar*, 2,629 (a) (b), 2,639; *Verrieres*, 3,821 (3), 3,832; *Gavin Jones*, 4,054; *Lane Brown*, 4,198; *West*, 4,266 (1) (2); *Keeling*, 4,757.  
 (ii) Classification of — according to staff, with proportionate increase in rates, *Currie*, 4,673; *United Provinces Government*, 4, p. 308, Vol. III.  
 (iii) Government supervision will not be materially decreased by employment of large —, *Shoubridge*, 2, 14; *Frampton*, 69; *Wittet*, 118 (7); *Sprout*, 165; *Hansoti*, 383; *Maughan*, 576; *Walker*, 1,125; *Zorab*, 1,781, 1,802; *Bannerjee (K. C.)*, 1,913; *Banerjee (J. C.)*, 1,985; *Srinivasa Aiyengar*, 2,141 (4), 2,183; *Fraser*, 2,454; *Chetty*, 2,468; *Parry*, 4,145; *Yeoman*, 4,631.  
 (iv) Majority of public works department works unattractive to large —, *Hansoti*, 350 (2); *Gill*, 429 (2); *Ormsby*, 740; *Thompson*, 840; *Abhyankar*, 1,162 (2); *Cowley*, 1,358; *Birley*, 1,829; *Martin*, 1,960; *Gopala Ayyar*, 2,355; *Nowroji*, 2,527 (4); *Verrieres*, 3,819 (9); *Dorman*, 4,686 (5); *Government of Bengal*, 3, p. 343, Vol. II.  
 (v) Petty — tender at low rates in hope of increases later, *Dey*, 1,445; *Tillard*, 3,659 (2), 3,727.

## PROPOSAL TO ENTRUST ALL WORKS WITHIN A SPECIFIED AREA TO A CONTRACTOR FOR A TERM OF YEARS :

- (vi) Advocated, *Turner*, 479; *Godbole*, 599 (4), 611, 623; *Kamat*, 753; *Vacha*, 1,094; *Abhyankar*, 1,162 (4), (5), 1,172; *Kelkar*, 1,249; *Abbott*, 4,153 (2), 4,156-4,159.  
 (vii) Opposed, *Hansoti*, 350 (3); *Lalubhai Samaldas*, 789; *Mitra*, 1,316.  
 (viii) Should be allowed to supply all imported stores required for their work, *Srinivasa Aiyengar*, 2,141 (11).  
 (ix) Should be entrusted with works subject only to inspection of completed work, *Copleston*, 458, 475; *Vacha*, 1,094; *Abbott*, 4,162, 4,164, 4,174; *Lane Brown*, 4,214, 4,220; *Marris*, 4,303 (4).  
 See also Advances to contractors, Lump sum contracts, Piecework system.

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## 22. Departmental charges :

- (i) Reduced or remitted on contribution works, *Thomson*, 902; *Dey*, 1,478; *Lechmere-Oertel*, 1,677; *Mullings*, 2,549, 2,575; *Wollaston*, 2,668; *Peters*, 2,750; *Stanley*, 3,159; *Tillard*, 3,658, 3,684; *de la Fosse*, 3,880; *Campbell*, 3,924; *Dorman*, 4,685 (10); *Gamble*, 4,862, 4,887; *Government of Bombay*, (i) (6), p. 323, Vol. II.

## 23. Departmental labour :

- (i) Extent of employment of — in Madras, *Lacey*, 2,078 (4); *Chetty*, 2,487.

## 24. Direction charges :

- (i) Excessive, *Kelkar*, 1,219-20, 1,224, 1,226-1,227, 1,240  
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- (iii) Should be increased, *Stanley*, 3,143; *Tillard*, 3,698; *Verreres*, 3,843; *Kanhaiya Lal*, 4,402; *Budh Singh*, 4,734; *Keeling*, 4,785.
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## 26. District :

- (i) Should be public works department unit of administration, *Baggwith*, 2,827 (2), 2,841; *Chief Commissioner, Central Provinces*, 14, p. 355, Vol. II.

## 27. District boards :

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- (i) Boards will welcome —, *Godbole*, 608; *Pratt*, 717; *Kamat*, 754; *Lalubhai Samaldas*, 778; *Muhammad Noor*, 3,595.
- (ii) Boards will not welcome —, *Birley*, 1,856; *Paddison*, 2,271, 2,282; *Schmidt*, 2,322.
- (iii) Proposals for transfer, *Framji*, 58 (5); *Godbole*, 599 (?), 608, 609; *Kamat*, 754; *Thomson*, 848; *Patuck*, 1,064 (1); *Vacha*, 1,083 (4), *Srinavasa Aiyengar*, 2,142, 2,160; *Stanley*, 3,122, *Morrison*, 3,402; *Maynard (F.)*, 3,433; *Oldham*, 3,462; *Beckett*, 3,519; *Muhammad Noor*, 3,595; *Tillard*, 3,660 (1), 3,686-3,687; *West*, 4,266 (5), 4,276; *Kanhaiya Lal*, 4,335 (16), 4,392; *Maynard (H. J.)*, 4,532, 4,555; *Kitchin*, 4,604; *Keeling*, 4,747 (4)-(5), 4,773; *United Provinces Government*, 4, 8 (ii) (3)-(5), pp. 308-309, Vol. III, *Punjab Government*, II, p. 312, Vol. III.
- (iv) Transfer of provincial roads not advocated, *Kamat*, 754, 769; *Lalubhai Samaldas*, 772; *Abhyankar*, 1,180; *Mitra*, 1,300, 1,319, 1,321; *Tillard*, 3,686; *Hira Khan*, 4,025.
- (v) Necessity for inspectors of works, *Hansoti*, 394; *Thomson*, 848; *Morrison*, 3,402; *Maynard (F.)*, 3,434, 3,436; *Oldham*, 3,467; *Muhammad Noor*, 3,598; *West*, 4,276; *Maynard (H. J.)*, 4,537.
- (vi) Transfer recommended only if deputy commissioner is chairman of board: *Framji*, 81; *Birley*, 1,845; *Oldham*, 3,502; *Bengal Government*, 10, p. 344, Vol. II.
- (vii) Proposed public works sub-committee, *Walker*, 1,153

## FINANCIAL ARRANGEMENTS FOR TRANSFER :

- (viii) Fixed annual grant should be given: *Birley*, 1,831 (1)
- (ix) Impossibility of surcharging individual members, *Walker*, 1,152; *Damle*, 1,202; *Morrison*, 3,397.
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- (xi) Surcharge of district funds unsatisfactory, *Damle*, 1,202; *Morrison*, 3,402.  
 See also District board engineering schemes, District board engineers, District board expenditure, District board staff, District board works.
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## 28. District board engineering schemes :

- (i) Bengal scheme of 1892, *Cowley*, 1,393, 1,404, 1,433; *Birley*, 1,833, 1,848, 1,868; *Banerjee (K. C.)*, 1,922; *Maynard (H. J.)*, 4,512; *Bengal Government*, 10, page 344, Vol. II.
- (ii) Central Provinces local fund engineering scheme, *Moss King*, 1,029-1,030; *Walker*, 1,123(5), (6) (ii); *Abhyankar*, 1,163(1)-(4); *Chief Commissioner, Central Provinces*, 8-10, p. 334, Vol. II; *Central Provinces Administration*, Appendix V, p. 340-341, Vol. II.

## 28. District board engineering schemes—cont'd.

- (iii) United Provinces scheme of 1882-1887, *United Provinces Government*, 4, p. 308, Vol. III.

## 29. District board engineers :

## POWERS OF GOVERNMENT REGARDING APPOINTMENTS, EMOLUMENTS, ETC. :

- (i) Existing powers, *Patuck*, 1,078; *Walker*, note; *Abhyankar*, 1,176; *Damle*, 1,200; *Paddison*, 2,256-2,257; *Schmidt*, 2,309; *Stanley*, 3,119; *Oldham*, 3,462; *Maynard (H. J.)*, 4,565(4); *Bengal Government, Annexure B*, p. 348, Vol. II; *Punjab Government*, III, p. 313, Vol. III.
- (ii) Proposed powers, *Pratt*, 732, *Kamat*, 755; *Lalubhai Samaldas*, 778, *Patuck*, 1,068-1,069, *Vacha*, 1,109; *Walker*, 1,147; *Damle*, 1,202; *Kelkar*, 1,248; *Morrison*, 3,402; *Keeling*, 4,747(2).
- (iii) Difficulty of obtaining suitable staff, *Paddison*, 2,248; *Asbury*, 4,347, 4,379; *Maynard (H. J.)*, 4,506; *Kitchin*, 4,608.
- (iv) Inferior qualifications of majority of —, *Dey*, 1,439(10); *Hutton*, 2,198(2); *Maynard (H. J.)*, 4,506; *Kitchin*, 4,604, 4,608; *Budh Singh*, 4,722(4).
- (v) Provincial cadre of — recommended, *Godbole*, 616, 624, 633; *Pratt*, 722; *Vacha*, 1,111; *Walker*, 1,145, *Damle*, 1,207; *Mitra*, 1,320; *Cowley*, 1,413, *Temple*, 3,215, 3,234, 3,249-3,250; *Maynard (F.)*, 3,435; *Kanhaiya Lal*, 4,385(6), 4,395; *Maynard (H. J.)*, 4,514, 4,535; *Punjab Government*, III, p. 313, Vol. III.
- (vi) Separate allowances given to — for undertaking government work in Bengal and Bihar and Orissa, *Cowley*, 1,404; *Stanley*, 3,121; *Bishun Swarup*, 3,206; *Temple*, 3,231; *Morrison*, 3,401; *Maynard (F.)*, 3,430; *Oldham*, 3,460; *Blaber*, 3,613 (14).

## 30. District board expenditure :

- (i) Insufficient to permit of employment of competent staff, *Turner*, 490; *Godbole*, 610; *Dube*, 930(7); *Walker*, 1,123(4) *Lechmere-Oertel*, 1,676; *Kitchin*, 4,616; *Chief Commissioner, Central Provinces*, 8, p. 334, Vol. II.

## 31. District board staff :

- (i) Burma. Absence of district boards, *Wollaston*, 2,663; *Martindell*, 2,726; *Thompson*, 2,798.
- (ii) Establishment entertained in the various provinces, *Framji*, 77; *Hansoti*, 386; *Godbole*, 608, 630; *Pratt*, 731; *Thomson*, 821(7), 847; *Cowley*, 1,392; *Lechmere-Oertel*, 1,651; *Lacey*, 2,090; *Paddison*, 2,255; *Stanley*, 3,118; *Tillard*, 3,685; *Maynard (H. J.)*, 4,505; *Bombay Government*, (ii) (5), p. 325, Vol. II, *Central Provinces Administration*, Annexure B to Appendix V, p. 342, Vol. II, *Bengal Government*, 10 and Annexure B, pp. 344 and 348-349, Vol. II, *Bihar and Orissa Government*, 5, page 305, Vol. III.

## 32. District board works :

- (i) Absence of control by superior supervising staff, *Thomson*, 905; *Macmichael*, 2,367; *Kitchin*, 4,604; *Yeoman*, 4,621(3); *Dorman*, 4,698; *Budh Singh*, 4,722(4), 4,733.
- (ii) Inadequacy of supervision exercised over — by inspectors of works, *Thomson*, 905; *Macmichael*, 2,367; *Bishun Swarup*, 3,215; *Temple*, 3,235.
- (iii) Proposal to transfer all — to the public works department, *Dube*, 939; *Walker*, 1,123(8), 1,137, 1,140-1,141; *Lacey*, 2,092; *Dorman*, 4,686(12), 4,698; *Budh Singh*, 4,722(10), 4,733.

## 33. District officer :

## EXECUTIVE ENGINEER SHOULD BE ASSISTANT TO —

- (i) Advocated, *Copleston*, 448(7) (8), 457, 463.
- (ii) Opposed, *Thomson*, 861, 889; *Walker* 1,123(9); *Hardman* 3,038(4).
- (iii) Executive engineer should submit diary through —, *Turner*, 481, 492, 495.

## 34. Duplication of staff :

- (i) Extravagance of, *Thomson*, 821(8), Note (a); *Patuck*, 1,070; *Walker* 1,123(8), *Abhyankar*, 1,164(8); *Birley*, 1,830; *Schmidt*, 2,299; *Venkatesa Aiyar*, 2,636(i); *Kanhaiya Lal*, 4,382(2); *Maynard (H. J.)*, 4,502; *Narain Singh*, 4,569(3); *Kitchin*, 4,603; *Chief Commissioner, Central Provinces*, 12, p. 335, Vol. I.

- E**
35. **Electrical Adviser to the Government of India :**  
 (i) Duties of —, *Meares* . 1,727(2), 1,737, 1760  
 (ii) Importance of functions of — as chairman of electrical conference, *Meares*, 1,735, 1,754; *Bell*, 4,264.  
 (iii) Value of counsel in dealing with commercial undertakings, *Meares* . 1,724, 1,727(3)  
 (iv) Debarred from visiting Bombay, *Meares* . 1,739  
 (v) Appointment not justified from standpoint of local Governments, *McIntyre*, 3,567; *Bell*, 4,244.
36. **Electrical engineer :**  
 (i) **Bombay.** Duties of —, *Stuart Menteth* . 193  
 (ii) **Bengal.** Duties of executive engineer, electrical division, *Taylor* . 1,571(1), 1,577, 1,578
37. **Electrical works :**  
 (i) Departmental work advocated for —, *Stuart Menteth*, 186; *Taylor*, 1,600; *Bell*, 4,235(2), 4,238.  
 (ii) Departmental work advocated for repairs only, *Raikes*, 2,775; *McIntyre*, 3,560; *Eastgate*, 4,463(4)-(5), 4,476.  
 (iii) Executed by contract, *Taylor*, 1,578-1,579; *Greenwood*, 2,224(1); *McIntyre*, 3,555; *Eastgate*, 4,463(1)(3), 4,475.
38. **Electricity Act :**  
 (i) Decentralization effected by —, *Meares* . 1,726
39. **Engineering Colleges :**  
**AGE LIMIT AT ENTRANCE :**  
 (i) Present age limit suitable, *Framji*, 87; *Allen*, 234; *Kamat*, 757; *James*, 2,610.  
 (ii) Present age limit too high, *Sprott*, 166; *Dawson*, 270(4); *Messent*, 579(2), 588; *Heaton*, 1,886; *Lacey*, 2,128; *de la Fosse*, 3,896; *Wood*, 4,098(2), 4,110; *Chatterton*, 4,891(6), 4,897, 4,916.  
**EDUCATIONAL QUALIFICATION :**  
 (iii) Intermediate standard advocated, *Lacey*, 2,128; *James*, 2,611; *Typple*, 3,794; *de la Fosse*, 3,897; *Budh Singh*, 4,738; 4,741, 4,743.  
 (iv) Matriculation standard advocated, *Dawson*, 270(5), 277; *Nowroji*, 2,640.  
 (v) Elimination of subordinate education from — recommended, *Chatterton*, 4,891(4), 4,898; *United Provinces Government*, 8(vii) (2), p. 310, Vol. III, *Punjab Government*, VII, p. 314, Vol. III.  
 (vi) Limitations on numbers entering should be removed, *Framji*, 63(3), 90; *Vacha*, 1,088; *Hira Khan*, 4,017(3).  
 (vii) Staff. Larger proportion should be recruited from the public works department, *Vacha*, 1,095; *Abhyankar*, 1,167; *Gopala Ayyar*, 2,333(6), 2,343; *Nowroji*, 2,541; *James*, 2,622; *Hira Khan*, 4,017(2); *Chatterton*, 4,904.  
*See also* Engineering degree, Engineering education, Roorkee College, Scholarships, Sibpur College, Technical Schools.
40. **Engineering degree :**  
 (i) Should qualify for admission to other services, *Hansoti*, 398; *Srinivasa Aiyengar*, 2,172; *Spring*, 2,411.  
 (ii) Should not in itself so qualify, *Turner* . 483, 493
41. **Engineering education :**  
 (i) Importance of mechanical engineering not sufficiently recognized, *Chatterton* . 4,894-4895, 4,913  
**THEORETICAL STANDARD :**  
 (ii) Sufficiently high, *Shoubridge*, 7; *Framji*, 63(3), 86; *Sprott*, 155; *Stuart Menteth*, 202; *Allen*, 217; *Dawson*, 270(2); *Hansoti*, 354; *Messent*, 579(2); *Mawson*, 678; *Ormsby*, 739; *Kamat*, 748, 757; *Lalubhai Samaldas*, 775; *Dube*, 945; *Desmond*, 996; *Abhyankar*, 1,167; *Amar Nath Das*, 1,501; *Taylor*, 1,589; *Williams (G. B.)*, 1,621; *Lechmere-Oertel*, 1,665, 1,695; *Meares*, 1,753; *Zorab*, 1,771, 1,784; *Lacey*, 2,083; *Hutton*, 2,196; *Maynard (F.)*, 3,423; *Beckett*, 3,509; *Blaber*, 3,618; *Verreries*, 3,819(11); *Wood*, 4,100(1) (2). Annex. I (1) (vii); *Lane Brown*, 4,191; *Budh Singh*, 4,727(5); *Bombay Government*, (vii) (2), p. 327, Vol. II.
41. **Engineering education—contd.**  
**THEORETICAL STANDARD—contd.**  
 (iii) Too high for subordinates, *Shoubridge*, 7; *Framji*, 86; *Sprott*, 170; *Gebbe*, 411; *Mackison*, 557; *Messent*, 587; *Godbole*, 629; *Thomson*, 876; *Mitra*, 1,301(4); *Cowley*, 1,399; *Mullings*, 2,554; *James*, 2,615; *Bishun Swarup*, 3,197; *Blaber*, 3,638; *Chatterton*, 4,819(5).  
**PRACTICAL STANDARD :**  
 (iv) Lack of knowledge of practical machinery, *Thomson*, 891, 924; *Mullings*, 2,554; *Kankaiya Lal*, 4,389(2).  
 (v) Passed students show lack of practical ability, *Stuart Menteth*, 190, 202; *Dawson*, 270(2); *Gill*, 430, 434; *Mackison*, 524(1); *Mawson*, 678; *Ormsby*, 734, 739; *Kamat*, 757; *Amar Nath Das*, 1,501; *Taylor*, 1,589; *Paddison*, 2,253; *Spring*, 2,411; *Hira Khan*, 4,028; *Eastgate*, 4,467(1).  
*See also* Specialization in colleges.
42. **Estimating :**  
 (i) Low standard of — in India, *Lishman*, 3,980; *Dorman*, 4,687(2); *Keeling*, 4,780.
- F**
43. **Famine relief :**  
 (i) District board staff could be entrusted with, *Thomson*, 853; *Walker*, 1,146; *Campbell*, 3,928; *United Provinces Government*, (ii) (8), p. 309, Vol. III.  
 (ii) Already theoretically duty of district board, *Campbell* . 3,926  
 (iii) Importance of public works department as agency for, *Desmond*, 968(3); *Mitra*, 1,301(3); *Verreries*, 3,828; *Bombay Government*, (ii) (6), p. 325, Vol. II.
44. **Financial year :**  
**DISADVANTAGES OF DATE OF CLOSING —.**  
 (i) Allotments unknown till April at earliest, *Moss King*, 1,039(i); *Mullings*, 2,562(b).  
 (ii) Falls in middle of working season, *Thomson*, 918; *Milne*, 1,281; *Mitra*, 1,299(5); *Dey*, 1,442(3); *Lechmere-Oertel*, 1,660(i) (c), 1,687; *Mullings*, 2,564; *Thompson*, 2,790(3), 2,811; *Verreries*, 3,825; *Chief-Commissioner, Central Provinces*, 21, p. 336, Vol. II; *United Provinces Government*, 8(vi) (2), p. 310, Vol. III.
45. **Foremen :**  
 (i) Importation of European — advocated, *Raikes*, 2,764, 2,778; *Pullar*, 2,867; *Foster*, 2,915, 2,916(1) (f); *Morris*, 3,098; *Munnings*, 3,272, 3,289; *Walford*, 3,327; *Lishman*, 4,953; *Sullivan*, 4,426, 4,439; *Punjab Government*, IV(b), p. 314, Vol. III.
- G**
46. **Government work :**  
 (i) Proportion of — to private work in Calcutta and Madras, *Crouch*, 1,546; *Lacey*, 2,117; *Fraser*, 2,454; *Pears*, 2,507.
47. **Grant-in-aid :**  
 (i) Government executes work for which it gives —, *Shoubridge* . . . . . 23
48. **Guaranteed appointments :**  
 (i) Practical examination for — at Sibpur, *Cowley*, 1,402; *Heaton*, 1,891; *Walford*, 3,321.
- I**
49. **Indian engineers :**  
 (i) Early environment disadvantageous to practical work, *Lechmere-Oertel*, 1,664; *Wood*, 4,086; *Chatterton*, 4,896.
50. **Insein school of engineering :**  
*See* Technical Schools.

**61. Irrigation branch :**

- (i) Degree of separation from buildings and roads branch, *Shoubridge*, 16; *Gebbie*, 406; *Thomson*, 828; *Cowley*, 1,368; *Amar Nath Das*, 1,508; *Lacey*, 2,078(1), 2,085; *Wollaston*, 2,660; *Stanley*, 3,111; *Tillard*, 3,666; *Asbury*, 4,329; *Madras Government*, 3, p. 351, Vol. II.
- (ii) Should take over buildings and roads work in irrigated areas, *Kelkar*, 1,231; *Kitchin*, 4,603, 4,607.

**52. Isolation of public works department :**

- (i) Complaints regarding, *Copleston*, 448(10), 473; *Moss King*, 1,039(10), 1,052; *Patuck*, 1,073; *Walker*, 1,129; *Biggwither*, 2,822(17) (a)-(d), 2,841; *Chief Commissioner, Central Provinces*, 5(a), p. 333, Vol. II.

**L****53. Lower subordinates :**

- (i) Distinction between — and upper subordinates should be abolished, *Gebbie*, 403(1), 413; *Lacey*, 2,079(2); *Temple*, 3,214(2), 3,238; *Asbury*, 4,372.
- (ii) Minimum pay inadequate, *Dube*, 932(2); *Vacha*, 1,092; *Maug Ba*, 2,989; *Temple*, 3,246; *Blaber*, 3,618(3); *Ferreeres*, 3,860; *Hira Khan*, 4,033; *Asbury*, 4,372; *Kanhaya Lal*, 4,385(9), 4,404; *Keelng*, 4,791.
- (iii) Placed in subdivisional charge, *Thomson*, 881; *Vacha*, 1,092; *Dey*, 1,458.
- (iv) Should not be framed in major engineering colleges, *Heaton*, 1,895; *Venkatesa Aiyar*, 2,634(3); *Tripple*, 3,784; *Wood*, 4,114.

**54. Lump sum contracts :**

- (i) Advocated, *Crouch*, 1,535; *Lechmere-Oertel*, 1,714; *Gavin Jones*, 4,053.

**M****55. Material. Supply of —**

- (i) By contractors should be encouraged, *Thomson*, 821(6); *Bannerjee (J. C.)*, 1,984; *Chetty*, 2,476; *Keelng* 4,759-4,760.

**BY GOVERNMENT :**

- (ii) Disadvantageous to private enterprise, *Martin*, 1,952, 1,968; *Maug Ba*, 2,984; *Shaw*, 3,374; *Williams (W. H.)*, 3,533.

**ADVANTAGES OF —**

- (iii) Lower rates, *Cowley*, 1,352(i) (ii), 1,410; *Petters*, 2,748.
- (iv) Maintenance of reserve, *Cowley*, 1,430; *Zorab*, 1,766, 1,776, 1,799; *Bannerjee (J. C.)*, 1,984.
- (v) Prevents fluctuations in price, *Cowley*, 1,410; *Lacey*, 2,097; *Petters*, 2,748.
- (vi) Quality according to specification, *Shoubridge*, 41; *Mackison*, 531; *Cowley*, 1,371; *Zorab*, 1,776; *Bannerjee (K. C.)*, 1,920; *Petters*, 2,748.

**56. Matriculation examination :**

- (i) Low standard of education connoted by —, *Allen*, 235, 260; *Godbole*, 614.

**57. Mechanical engineers :**

- (i) Employment of — by government advocated, *Wilhams (G. B.)*, 1,636; *Bell*, 4,236; *West*, 4,269(6), 4,284; *Asbury*, 4,330; *Dorman*, 4,687(1).

**58. Military origin of public works department :**

- (i) Traces exist in present methods, *Lechmere-Oertel* . . . . . 1,679

**59. Minor irrigation establishment, Madras :**

- (i) Employed under collector, *Lacey*, 2,086; *Paddison*, 2,274; *Schmidt*, 2,320; *Macmichael*, 2,364, 2,366.

**60. Minor irrigation works, Madras :**

- (i) Transfer of — to district boards recommended, *Srinivasa Aiyengar*, 2,142; *Schmidt*, 2,318; *Gopala Aiyar*, 2,333(8) note; *Keelng*, 4,770.

**61. Minor Works :**

- (i) Limit of — should be raised; *Thomson*, 869; *Moss King*, 1,039(2), 1,047.

**62. Mistris :**

- (i) Further education of — desirable, *Wittet*, 151; *Dawson*, 270(8); *Mackison*, 524(2), 557; *Desmond*, 1,008; *Dey*, 1,463; *Harper*, 2,007; *Srinivasa Aiyengar*, 2,174; *Gopala Aiyar*, 2,337; *Spring*, 2,411; *Kanhaya Lal*, 4,389(6), 4,399.
- (ii) Passed students sometimes have to rely on practical experience of their clients —, *Mackison*, 524(i), 540, 555.

**PROPOSAL TO RECRUIT SUBORDINATES FROM BANK OF —**

- (iii) Advocated, *Wittet*, 117(9), 138; *Mackison*, 530, 557; *Thomson*, 877; *Vacha*, 1,100; *Mitra*, 1,301(4), 1,312, 1,332; *Dey*, 1,461; *Srinivasa Aiyengar*, 2,174; *Bishun Swarup*, 3,199, 3,211; *Tillard*, 3,702; *Lushman*, 3,982; *Kanhaya Lal*, 4,385(10), 4,399; *Keelng*, 4,792.
- (iv) Opposed, *Hansoti*, 380; *Godbole*, 612; *Dube*, 966; *Desmond*, 999; *Zorab*, 1,784, 1,790; *Blaber*, 3,638; *Hira Khan*, 4,032.

**63. Municipalities :**

- (i) Combination of small — for purpose of employment of trained staff advocated, *Chambers*, 637, 651; *Pratt*, 722.
- (ii) Establishment employed by —, *Shoubridge*, 23; *Wittet*, 132; *Hansoti*, 362; *Turner*, 487; *Mackison*, 562; *Pratt*, 716; *Kamat*, 754; *Thomson*, 845; *Kelkar*, 1,252; *Paddison*, 2,248(2), 2,273; *Wollaston*, 2,663; *Thompson*, 2,796; *DuBern*, 2,882; *Oldham*, 3,457; *Parry*, 4,138; *Maynard (H. J.)*, 4,504; *Bombay Government*, (ii) (4), p. 324; Vol. II.

**P****64. Patna school of engineering :**

See Technical schools.

**65. Payments on account :****PROPOSAL TO PERMIT —**

- (i) For materials, *Srinivasa Aiyengar*, 2,145(2); *Mullings*, 2,566, 2,580; *Dukoff Gordon*, 3,021; *Shaw*, 3,385; *Gamble*, 4,858(3).
- (ii) For work, *Tomkins*, 2,071; *Blaber*, 3,653; *Gamble*, 4,882.

**66. Peripatetic audit :**

- (i) System of — advocated, *Stuart Meneth*, 189(2), 200; *Thomson*, 879; *Milne and Stevenson*, 1,285, 1,290.
- (ii) Would not lead to saving of work, *Swetenham*, 334, 335, 337, 339; *Tomkins*, 2,057; *Gamble*, 4,856, 4,876, 4,888.

**67. Piecework system :****ARGUMENTS IN FAVOUR OF —**

- (i) Absence of large contractors, *Stuart Meneth*, 194; *Thomson*, 821(4), 830; *Mitra*, 1,300(3); *Dey*, 1,477; *Amar Nath Das*, 1,484(4), 1,497; *Lacey*, 2,078(2), 2,125; *Spring*, 2,409(1); *Pears*, 2,508; *Martindell*, 2,724; *Petters*, 2,738; *Stanley*, 3,129; *Tillard*, 3,659; *Bombay Government*, (i) (3), p. 323, Vol. II; *Madras Government*, 6, p. 352, Vol. II; *Bihar and Orissa Government*, 3, p. 305, Vol. III; *Punjab Government*, II, p. 312, Vol. III.
- (ii) Contractors usually middlemen employing pieceworkers, *Shoubridge*, 2(11); *Ormsby*, 737; *Thomson*, 821(5); *Zorab*, 1,775; *Bannerjee (K. C.)*, 1,937; *Srinivasa Aiyengar*, 2,141(5); *Blaber*, 3,613(3); *Ferreeres*, 3,820(4); *Parry*, 4,145; *West*, 4,266; *Narain Singh*, 4,573, 4,574.
- (iii) Easier to make contractor demolish bad work or remove faulty materials, *Shoubridge*, 2; *Pears*, 2,489 (1).
- (iv) Power to terminate agreement at any time, *Spring* . . . . . 2,409 (2)
- (v) Risk of litigation avoided, *Shoubridge* 2 (2); *Spring*, 2,416; *Pears*, 2,489 (1); *Blaber*, 3,613 (7).

## 68. Powers of public works department officers :

See Contracts, Disciplinary powers, Technical sanction, Tools and plant.

## 69. Practical training of students :

- (i) Appointment of special officer to superintend—advocated, *Keeling*, 4,752, 4,796; *Bombay Government*, (viii) (2), p. 328, Vol. II; *United Provinces Government*, (viii) (8), p. 310, Vol. III.
- (ii) Importance of —, *Shoubridge*, 33; *Sprott*, 155 (1) 179; *Allen*, 230; *Dawson*, 270 (3); *Mackison*, 524 (1); *Messent*, 579 (1); *Chambers*, 650, *Kamat*, 749, 757; *Lacey*, 2,083, *Maynard (F.)*, 3,423; *Lishman*, Annexure; *Wood*, 4,099; Annexure II; *Lane Brown*, 4,191; *Hewlett*, 4,586; *Yeoman*, 4,625 (2); *Bombay Government*, (viii) (6), p. 328, Vol. II.
- (iii) Government officers should receive fees for undertaking — *Dube*, 961; *Martindell*, 2,720, 2,730; *Wood*, 4,099; Addendum to Annexure II; *Yeoman*, 4,636; *Bombay Government*, (viii) (8), p. 328, Vol. II; *Punjab Government*, VIII, p. 314, Vol. III.
- (iv) Preliminary workshop training advocated, *Stuart Menteth*, 191 (1), 202-203.

## PROPOSAL TO GRANT STIPENDS TO STUDENTS UNDERGOING —

- (v) Advocated, *Sprott*, 171; *Allen*, 249; *Hansoti*, 372; *Mackison*, 536; *Godbole*, 613; *Mawson*, 679; *Lalubhai Samaldas*, 793; *Advani*, 813; *Desmond*, 998; *Abhyankar*, 1,181; *Lechmere-Oertel*, 1,695; *Morris*, 3,095; *Tipple*, 3,790; *Lane Brown*, 4,191; (2); *West*, 4,302, *Keeling*, 4,797; *Bombay Government*, (viii) (8), p. 328, Vol. II.
- (vi) Unnecessary, *Gebbie*, 417; *Kamat*, 757; *Vacha*, 1,097; *Budh Singh*, 4,739.
- (vii) Premium system advocated *Shoubridge*, 34, 51; *Chambers*, 650; *Preston*, 688, 695; *Dube*, 961; *Mitra*, 1,330; *Martindell*, 2,720, 2,730; *Yeoman*, 4,636.
- (viii) Paid apprenticeships advocated, *Stuart Menteth*, 191 (2); *Dawson*, 282.

## SANDWICH SYSTEM:

- (ix) Advocated, *Ormsby*, 739, 741; *Harper*, 2,006; *Chatterton*, 4,891 (2).
- (x) Difficulties in way of introduction of —, *Sprott*, 173; *Allen*, 245; *Godbole*, 615.
- (xi) Should be recognised as necessary qualification for degree, *Keeling*, 4,811
- (xii) Already so recognised in Madras, *James*, 2,620
- (xiii) Possibility that other universities may refuse, *Sprott*, 168; *Allen*, 248-249; *Messent*, 587; *Bombay Government*, (viii) (7), p. 328, Vol. I.

## O. Preaudit :

- (i) Introduction of system of — advocated, *Vacha*, 1,101; *Keeling*, 4,789.

## 1. Private practice :

- (i) Should be permitted without special sanction, *Stuart Menteth*, 211; *Meares*, 1,733 (2).
- (ii) Not recommended, *Framji*, 100; *Mitra*, 1,344; *Lishman*, 3,964; *Sullivan*, 4,443.

## 2. Profit and loss account :

- (i) Not kept of quasi-commercial undertakings, *Cowley*, 1,380, 1,414, *Martin*, 1,952; *Srinivasa Ayyar*, 2,390, 2,395; *Pullar*, 2,873; *Dukoff Gordon*, 3,022; *Gamble*, 4,860, 4,885.

## 3. Promotion of public works department officers :

- (i) Committee to regulate — recommended, *Dorman*, 4,718.
- (ii) Seniority more regarded than efficiency, *Thomson*, 823 (1), 859, 884, 888; *Dube*, 960; *Meares*, 1,718; *Wollaston*, 2,700; *DuBern*, 2,889; *Stanley*, 3,145; *Oldham*, 3,484; *Blaber*, 3,641; *Tillard*, 3,729; *Gavin*, *Jones*, 4,043, 4,051; *Dorman*, 4,687 (2), 4,700.

## 74. Quantity surveyors :

- (i) Importation of European — advocated, *Foster*, 2,916 (1) (d), 2,937; *Lishman*, 3,948, 3,980; *Sullivan*, 4,435.

## R

## 75. Reappropriations :

- (i) Powers of public works department officers to sanction — too extensive, *Walker*, 1,150, 1,159
- (ii) Public works department should be final authority regarding —, *Mitra*, 1,303 (1); *Keeling*, 4,750 (3), 4,786; *Chief Commissioner, Delhi*, 11, p. 316, Vol. III.

## 76. Repairs :

## ANNUAL ESTIMATES OF —

- (i) Based on standard measurement books, *Desmond*, 990; *Dey*, 1,456; *Srinivasa Aiyengar*, 2,169; *Verrieres*, 3,849; *Asbury*, 4,333; *Dorman*, 4,685 (7).
- (ii) Prepared before extent of repairs known, *Stanley*, 3,138; *Tillard*, 3,692; *Verrieres*, 3,849; *Hira Khan*, 4,036; *Bombay Government*, (v) (13), p. 326, Vol. II. *United Provinces Government*, 8 (vi) (4), p. 310, Vol. III.
- (iii) Unnecessary, *Framji*, 72; *Sweetnam*, 329; *Hansoti*, 369; *Tomkins*, 2,046; *Srinivasa Aiyengar*, 2,169; *Stanley*, 3,138; *Rishun Swarup*, 3,188; *Tillard*, 3,663 (4); *Verrieres*, 3,841; *Hira Khan*, 4,036; *Asbury*, 4,333.

## DEFINITION OF —

- (iv) Unnecessarily restrictive, *Moss King*, 1,023; *Lechmere-Oertel*, 1,681; *Hira Khan*, 4,014.
- (v) Case of Sylhet church, *Lechmere-Oertel*, 1,681.

## 77. Roads :

- (i) System of maintenance in various provinces, *Framji*, 82; *Hansoti*, 363; *Turner*, 489; *Pratt*, 719; *Abhyankar*, 1,163 (3); *Cowley*, 1393-1394; *Dey*, 1,452; *Lechmere-Oertel*, 1692; *Birley*, 1832; *Paddison*, 2,248 (2), 2,287; *Oldham*, 3,459; *Tillard*, 3,685; *Maynard (H. J.)*, 4,532.
- (ii) Burma. Road cess administered by deputy commissioner through public works department, *Thompson*, 2,797, 2,799
- (iii) Madras. Present system works satisfactorily, *Paddison*, 2,248 (2) (3), 2,268; *Macmichael*, 2,362.

## 78. Roorkee College :

## AFFILIATION WITH UNIVERSITY:

- (i) Advocated, *Tipple*, 3,758, 3,780-3,782, 3,802, 3,811; *de la Fosse*, 3,875 (2), 3,898.
- (ii) Opposed, *Wood*, 4,110
- (iii) Formation of faculty in 1893, *Tipple*, 3,756, 3,809, 3,816.
- (iv) Board of studies. Recognition of — advocated, *Tipple*, 3,777; *de la Fosse*, 3,895.
- (v) Curriculum. Proposal to reduce courses in estimating and surveying, *Tipple*, 3,772, 3,785, 3,786, 3,814.
- (vi) Should be under Education department, *Tipple*, 3,758, 3,779

See also Engineering colleges.

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## 79. Sanitary Engineers :

- (i) Appointed without previous specialist experience, *Shoubridge*, 17, 42, 46; *Maughan*, 573; *Thomson*, 857; *DuBern*, 2,888; *Gavin Jones*, 4,049; *Lane Brown*, 4,189; *Asbury*, 4,328.
- (ii) Importance of previous Indian experience, *Shoubridge*, 53; *Wood*, 4,107.
- (iii) Knowledge of sanitary engineering more important than previous Indian experience, *Williams (G. B.)*, 1,651; *Tillard*, 3,668; *Gavin Jones*, 4,050; *Parry*, 4,137; *Lane Brown*, 4,206; *United Provinces Government*, 8 (iii) (5), p. 309, Vol. III.
- (iv) Formation of separate branch for — advocated, *Shoubridge*, 18, 53; *Lacey*, 2,105; *Hutton*, 2,194 (1), 2,204; *Tillard*, 3,668; *Verrieres*, 3,822 (3), 3,837; *Bell*, 4,236; *West*, 4,269, 4,279.
- (v) Maintain staff for supervision of the execution of sanitary works, *Shoubridge*, 17, 19; *Williams (G. B.)*, 1,611, 1,613, 1,627; *Peters*, 2,750; *Stanley*, 3,114; *Temple*, 3,223; *Tillard*, 3,668; *Asbury*, 4,353; *Punjab Government*, IV (b), p. 313, Vol. III.

79. Sanitary Engineers—*contd.*

- (vi) Maintenance by — of staff for the execution of sanitary works advocated, *Shoubridge*, 19; *Williams (G. B.)*, 1,633; *Hutton*, 2,194, 2,204; *Temple*, 3,217, 3,224; *West*, 4,280; *Budh Singh*, 4,724 (3).
- (vii) Bengal and Bihar and Orissa. Not subordinate to Chief Engineer, *Cowley*, 1,370; *Williams (G. B.)*, 1,619, *Stanley*, 3,108 (2), 3,113.

## 80. Sanitary Works :

- (i) Absence of specialist firms, *Shoubridge*, 20, 55; *Lacey*, 2,014; *Hutton*, 2,202; *Nouroji*, 2,539; *Pelters*, 2,751.
- (ii) Contract system suitable for —, *Hutton*, 2,192 (2); *Nouroji*, 2,527 (6), 2,533, 2,535; *Lane Brown*, 4,204; *Hewlett*, 4,592.
- (iii) Executed by contract, *Patuck*, 1,064 (6); *Williams (G. B.)*, 1,614, 1,629-1,630; *Lechmere-Oertel*, 1,659, 1,673; *Temple*, 3,225; *Lane Brown*, Annexure B.

## 81. Scholarships :

- (i) Large expenditure on — at Sibpur college, *Heaton*, 1885 (iv)

## 82. School of architecture :

- (i) Proposed — in Bombay, *Wittet*, 122 (3); *Allen*, 224; *Begg*, 4,837.

## 83. Sibpur College :

- (i) High age limit at —, *Heaton* . . . . . 1,886  
See also Engineering colleges.

## 84. Specialist officers :

- (i) Diverse and unfavourable terms granted to —, *Wittet*, 129; *Stuart Menteth*, 192 (1), 204; *Taylor*, 1,572 (1) (2) (4), *Meares*, 1,730-1,731, 1,746-1,747; *Greenwood*, 2,225 (3)-(5); *Sullivan*, 4,445-4,446, 4,458; *Eastgate*, 4,468 (1); *Begg*, 4,826.
- (ii) Employment of — by government unnecessary, *Patuck*, 1,064 (5); *Mitra*, 1,302, 1,327; *Venkatesa Ayyar*, 2,631; *Beckett*, 3,506 (2), 3,520.
- (iii) Employment of — in bridge building advocated, *Wittet*, 120; *Thomson*, 858, 921.

## 85. Specialization in colleges :

## FURTHER—

- (i) Advocated, *Framji*, 63 (4), 92, 106; *Advani*, 802 (1); *Lechmere-Oertel*, 1,710; *Bannerjee (J. C.)*, 1,990; *Yeoman*, 4,625 (1).
- (ii) Unnecessary, *Allen*, 244, 261; *James*, 2,602 (6), 2,621; *Tipple*, 3,797.
- (iii) Should commence after graduation, *Allen*, 261; *Vacha*, 1,088 (7); *James*, 2,602 (7), 2,621.

## 86. Specialization in public works department :

- (i) Further — advocated, *Sprott*, 157 (1) (2); *Maughan*, 565; *Mawson*, 685; *Srinivasa Aiyengar*, 2,143; *Morris*, 3,089 (4); *Gavin Jones*, 4,040-4,041, 4,049; *Sullivan*, 4,447; *Maynard (H. J.)*, 4,499-4,500; *Punjab Government*, IV (b), p. 314, Vol. III.

## 87. Stores :

- (i) Rule prescribing percentage to value of stores sold too rigid, *Keeling* . . . . . 4,808

## 88. Stores rules :

- (i) Articles purchased under — not according to specification or not in working order, *Stuart Menteth*, Note 2-4; *Taylor*, 1,588; *Baker*, 3,063 (3).
- (ii) Delay caused by —, *Stuart Menteth*, Note 1-4, 197, *Harper*, 2,001; *Hutton*, 2,195 (1); *Nouroji*, 2,528 (1); *Wollaston*, 2,703; *Tillard*, 3,663, 3,679; *Hira Khan*, 4,015 (c).
- (iii) Discouragement of branches of British manufacturing firms, *Stuart Menteth*, 186; *Cowley*, 1,397; *Taylor*, 1,573; *Meares*, 1,751; *Gavin Jones*, 4,069.
- (iv) Discouragement of private enterprise, *Stuart Menteth*, 197; *Gill*, 435; *Lechmere-Oertel*, 1,680.
- (v) Economy not secured by —, *Stuart Menteth*, Note 1, 2, 5-6; *Harper*, 2,009; *Gibson*, 2,996; *Bell* 4,246; *Keeling*, 4,749 (4), 4,761.

88. Stores rules—*contd.*

- (vi) Firm supplying stores not responsible for safe arrival, *Stuart Menteth*, 197; *Nouroji*, 2,528 (2); *Bell*, 4,245.
- (vii) Militate against maintenance of stocks in India, *Gill*, 430; *Harper*, 2,016; *Fraser*, 2,456; *Clark*, 2,976; *Bombay Government*, (vi) (4), p. 326, Vol. II.
- (viii) Unduly restrictive, *Framji*, 61 (c); *Wittet*, 121, 136; *Stuart Menteth*, 186; *Srinivasa Aiyengar*, 2,141 (11); *Nouroji*, 2,538; *Stanley*, 3,135; *Lashman*, 3,958; *Asibury*, 4,339; *Kanhaya Lal*, 4,385 (22); *Yeoman*, 4,622 (2), 4,623 (f); *Budh Singh*, 4,722, 4,732; *Keeling*, 4,814; *Bombay Government*, (v) (7), p. 325, Vol. II.  
See also Testing of plant.

## 89. Study leave :

- (i) Advocated, *Vacha*, 1,100; *Kanhaya Lal* 4,390, (3); *Budh Singh*, 4,728 (5), 4,740; *Punjab Government*, VIII, p. 314, Vol. III.

## 90. Sub-divisional officers :

## DELEGATION OF POWERS TO —

- (i) Advocated, *Hansoti*, 353; *Advani*, 801 (3); *Mitra*, 1,323; *Hira Khan*, 4,026; *Kanhaya Lal*, 4,388 (5) (b), 4,398, 4,401; *Dorman*, 4,703.
- (ii) Opposed, *Thomson*, 886; *Dube*, 942; *Dey*, 1,458; *Zorab*, 1,782; *Wollaston*, 2,683.
- (iii) Powers of payment restricted to petty items costing less than Rs. 10, *Hansoti*, 384; *Dey*, 1,458, 1,469; *Lechmere-Oertel*, 1,683; *Stanley*, 3,126.

## 91. Sub-heads :

See Accounts.

## 92. Superintending Engineers :

- (i) Proposal to abolish, *Martindell*, 2,727; *Biggwither*, 2,842; *Hardiman*, 3,038; *Campbell*, 3,925.

T

## 93. Technical sanction :

- (i) Powers of officers to accord — should be increased, *Framji*, 61 (c), 83; *Stuart Menteth*, 189 (3); *Hansoti*, 353, 366; *Gebbie*, 419; *Advani*, 801(2); *Thomson*, 864-865; *Dube*, 933 (3); *Desmond*, 991; *Abhyankar*, 1,165; *Kelkar*, 1,228; *Mitra*, 1,303 (2); *Lechmere-Oertel*, 1,682; *Zorab*, 1,782; *Lacey*, 2,107; *Srinivasa Aiyengar* 2,166; *Srinivasa Ayyar*, 2,376 I (c); *Wollaston*, 2,684-2,685; *Stanley*, 3,142; *Bishun Swarup*, 3,192; *Blaber*, 3,636; *Tillard*, 3,662, 3,694-3,695; *Verrieres*, 3,838; *Dorman*, 4,689 (5), 4,702; *Keeling*, 4,749 (3), 4,783; *Bombay Government*, (v) (2)-(3), p. 325, Vol. II; *United Provinces Government*, 8 (v) (2), p. 310, Vol. III; *Chief Commissioner, Delhi*, 10, p. 316, Vol. III.
- (ii) Restrictions on powers of — necessitate unnecessary correspondence, *Zorab* . . . . . 1,782.
- (iii) Restrictions on powers of — permit local Governments to promote inefficient without risk, *Thomson*, 883

## 94. Technical schools :

## INSEIN :

- (i) Scope of —, *Morris*, 3,089 (2), 3,091, 3,097
- (ii) Inadequate accommodation at — : *Morris* 3,102.
- (iii) Relaxation in regard to age limit recommended, *Morris* . . . . . 3,092, 3,103-3,104

## PATNA :

- (iv) Scope of —, *Walford*, 3,298, Annexure B.
- (v) Inadequate workshop staff, *Walford* : 3,325

## 95. Tenders :

- (i) Not sufficiently advertised, *Williams (W. H.)*, 3,546; *Currie*, 4,671  
See also Contracts.

## 96. Testing of plant :

- (i) Can be undertaken in India, *Stuart Menteth*, 197; *Lechmere-Oertel*, 1,680; *Meares*, 1,751; *Bell*, 4,245.

**97. Tools and plant :**

- (i) Powers of purchase of — unnecessarily restricted, *Mitra*, 1,323; *Yeoman* 4,623, (a) (b); *Bombay Government*, (v) (4), p. 325, Vol. II.

**98. Treasury payments :**

- (i) System of — of personal claims inconvenient, *Srinivasa Aiyengar* . . . . . 2,154

## U

**99. University :**

- (i) Connection of engineering colleges with — of doubtful value, *Heaton*, 1,887; *Chatterton*, 4,903.

**100. University degree :**

- (i) Attractive to Indian students, *de la Fosse*, 3,898, 3,600. 3,963

**101. Upper subordi**

- (i) Prospects should be improved, *Desmond*, 992; *Vacha*, 1,092; *Mitra*, 1,301 (5), 1,314; *Lacey*, 2,079 (2); *Kankhaya Lal*, 4,385 (9), 4,397.
- (ii) Large number of — employed in Madras, *Mullings* . . . . . 2,582

## W

**102. Workshops :**

- (i) Maintenance of — by government in Madras, *Lacey*, 2,098; *Srinivasa Ayyar*, 2,375 I (h), 2,390, 2,395; *Keeling*, 4,762.
- (ii) Abolition of — at Roorkee, *Gavin Jones*, 4,047 (2)

# GOVERNMENT OF BIHAR AND ORISSA

PUBLIC WORKS DEPARTMENT.

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ANNUAL ADMINISTRATION REPORTS

FOR

ROADS AND BUILDINGS, IRRIGATION AND RAILWAYS

FOR THE YEAR

1917-18.

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PATNA :

SUPERINTENDENT, GOVERNMENT PRINTING, BIHAR AND ORISSA

1918.



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## SUMMARIES.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

Messrs. Stanley and Clayton, Chief Engineers and Secretaries to Government, held charge of their respective offices throughout the year. The retention of the 2nd Chief Engineer for a further period of three years from the 1st April 1917, was sanctioned, and the abolition of the 2nd Under-Secretaryship approved, by the Secretary of State. Two Assistant Engineers were appointed to the Provincial Engineer Service during the year. One Executive Engineer and one Assistant Engineer joined the Indian Army Reserve of Officers; and in addition, there were three Assistant Engineers and two Assistant Architects employed on Military duty connected with the War. Administrative changes.

A temporary Division, namely, the Electrical Works Division, was formed with its headquarters at Patna. The temporary Subdivision at Chandwa in the Chota Nagpur Division was abolished. The boundaries of the Kendupatna and Kendrapara Subdivisions of the Mahanadi Division were revised. A temporary Subdivision was opened in the Special Works Division, Bankipore.

Opinions were collected on the recommendations of the Royal Commission on the Public Services in India, in order to deal with the references from the Government of India when received. Royal Commission.

The report of the Public Works Department Reorganization Committee was examined by a Local Committee. Public Works Department Reorganization Committee.

A time-scale of pay was sanctioned for the Lower Subordinate Establishment, and a Circle scale of pay for the Ministerial establishment in Circle and Divisional Offices.

Orders were received from the Government of India in regard to the amalgamation of the cadres of the Subordinate Public Works and Civil Accounts establishments in Accounts Offices, as well as the procedure to be followed in distributing over the various heads of account the expenditure incurred by the Public Works Department on Establishment and Tools and Plant.

The system of provincializing the grants for travelling allowance in the Public Works Department was introduced during the year.

#### BUILDINGS.

So far as the carrying out of the building programme of the province is concerned, the year under review was one of special stress on the Department. Coal was generally unobtainable and this interfered very largely with the manufacture of bricks. The prices of iron and steel rose abnormally high and these materials were only procured with difficulty. Above all the restrictions in Railway transport handicapped the Department to a very great extent. General.

In the permanent Capital at Patna, work was concentrated on the construction of all residential buildings with a view to the permanent move of the seat of Government from Ranchi to Patna being effected in 1918-19, but progress was hampered to some extent owing to a meagre and spasmodic supply of cement through the Munitions Board. However, residences for most of the officials and some of the clerks' quarters were completed and other works in connection with the quarters for the menials and the Police staff were in progress. Capital works.

One point worth mentioning in connection with the Capital Works is the success which attended the experiments on reinforced brick-work which were carried out at Patna. Owing to its cheapness and reliability this method of

construction gained popularity throughout the province and has also attracted the notice of other provinces where the same form of construction is being introduced.

#### IMPERIAL MILITARY WORKS.

The construction of a new office building for the Proof Officer at Balasore was completed and work on the construction of quarters for the Sergeant Instructor and an armoury for the Bihar Light Horse at Bhagalpur was taken up.

#### IMPERIAL CIVIL WORKS.

##### Post and Telegraph office.

The work on the construction of the combined Post and Telegraph Office with Postmaster's and Head Signaller's quarters at Gaya was completed, while the quarters for the staff employed in the Puri Post Office were nearing completion. Materials were collected for the construction of quarters for the clerks and menials attached to the Post Office at Raxaul and the site was acquired.

##### Miscellaneous.

The work of extensions and improvements to the electric installation at the Agricultural College and Research Institute at Pusa was in progress and materials were collected for and arrangements made to start the work of constructing quarters at Pusa for the Electrical Engineer. Four blocks of temporary quarters and a well were constructed for the Settlement staff at Daltonganj.

#### PROVINCIAL CIVIL WORKS.

##### Court Buildings.

Some materials were collected for the new Court buildings at Gaya and the land acquired for the same was levelled and dressed. Materials were also collected for the construction of a Court building for the Sessions and Subordinate Judges at Hazaribagh. A separate record-room was constructed for the Deputy Commissioner's Court at Ranchi and the rebuilding of a portion of the record-room of the Puri Collectorate was completed. The construction of quarters for the ministerial staff of the Subdivisional Court at Simdega was also completed.

##### Circuit House.

The construction of the Circuit House at Netarhat known as 'The Chalet' was completed.

##### Jails.

The construction of quarters for the Press employes at Gaya was undertaken departmentally by the Jail Department with the help of convict labour as much as possible under the supervision of the Public Works Department. The system was initiated as a matter of experiment with the object of future expansion if found to be economical in the long run.

The construction of quarters for the two Assistant Jailors and one Deputy Jailor in the Central Jail at Buxar was in progress. Quarters for the staff of the Jail Department were also constructed in the Chaibassa and Darbhanga Jails.

Among the more important projects may be counted the construction of the eight outpost buildings in the Nepal frontier in the Kishanganj Subdivision, the Kotwali Police buildings at Bankipore and the outpost buildings at Mithapur which were in progress. The construction of the Thana buildings at Simdega was practically completed while the construction of the Police-tation buildings with residential quarters at Saspur and barracks for the accommodation of the Armed Police together with quarters for Sergeants at Jamalpur was in progress. A house with land was acquired for the Principal of the Police Training College at Hazaribagh. The construction of quarters for the Band Master at Bankipore was nearing completion while the quarters for the Inspector of the Armed Police at Chapra was completed.

##### Education.

The construction of new buildings for the Greer Bhumihar Brahman College at Muzaffarpur at an estimated cost of Rs. 5,07,352 was administratively sanctioned and a portion of the scheme only, viz., the construction of the Principal's residence and three hostel blocks were taken in hand during the year under review. Land was acquired for the proposed School of Engineering at

Cuttack and for the educational buildings in the Tarbana area at Bhagalpur. An office building was constructed for the Inspector of Schools, Tirhut Division. Some materials were collected for the construction of a Boarding House and the Lady Principal's quarters in connection with the Ravenshaw Girls' School at Cuttack. The remodelling of the Zila School building at Motihari was completed.

The construction of a Power House and a Steam Laundry and the extension of the Kitchen for Indian patients were in progress in the Temple Medical School at Bankipore. The construction of a Tuberculosis ward in the Hospital at Bhagalpur was completed while that at the Chapra Sadr Hospital was nearing completion. Progress was made with the construction of quarters for the two Assistant Surgeons in charge of the hostel for male students at the Cuttack Medical School and the dispensary buildings at Balandapara. The Hospital buildings at Chatra were also under construction.

A residence was constructed for the Superintendent of the European and Indian Lunatic Asylums at Kanke and the staff quarters in the Asylum for Indian insanes were in progress. Land was acquired for the Leper Asylum at Cuttack.

The construction of the Sub-Registry office buildings at Dhamnagar, Soru and Tirtol was completed. Quarters were constructed for the Sub-Registrar at Daltonganj and a Sub-Registry Office building was under construction at Giridih. The Registration office at Chapra was extended and additions and alterations were done to the liquor warehouses at Bahera, Benipatti and Ekma to adapt them for Sub-Registry Offices.

Works in connection with the Black Pagoda at Kanarak were completed. Materials were collected for repairing the several temples at Bhuvaneshvar which were declared as protected monuments under the Ancient Monuments Preservation Act. Special repairs were done to the Bakhtiyar Khan's tomb at Chainpur and the work of erecting a monument on the battlefield at Buxar was in progress.

Improvements were done to the electric plant in the Government House at Puri and additions and alterations were carried out to the staff and menials' quarters attached to the same. In the Government House at Ranchi quarters were constructed for the Stenographer to His Honour the Lieutenant-Governor and the Private Secretary's office was extended. A motor garage and a petrol godown were also constructed.

Residences for the following officers were either completed or in progress during the year :—

Three Sub-Judges and one Munsif and one Deputy Collector at Bankipore, the Subdivisional Officer at Buxar, the Executive Engineer of the Patna Division at Bankipore and the Sub-Deputy Collector at Barh.

The old Court building at Jahanabad was converted into a residence for the Subdivisional Officer.

#### COMMUNICATIONS.

Work on the road forming a link between Bihar and Orissa was continued, the portions passing through the districts of Gaya and Patna being started. Considerable damage was done to the Grand Trunk Road in several places in the Gaya District by floods, the Lilajan causeway was washed away and temporary arrangements had to be made for traffic across the river while the damages were being repaired. The redecking of the bridge over the Barakar river on this road was completed.

The improvements to the Chandwa-Kuru section of the Ranchi-Daltonganj road were nearly completed and considerable progress was made in remodelling and reconstructing the old culverts on the Ranchi-Chaibassa Road. The metalled portion of the Chaibassa-Jaintgarh Road was re-sectioned and bridges were constructed where necessary.

The metalling of the Bargarh-Bolangir road was completed and the construction of the bridges across the rivers on the road was started. Considerable improvements were made to the Raipur-Sambalpur road by remodelling the old culverts and constructing minor ones where necessary and also to the Cuttack-Sambalpur, Angul-Tickerpara and Cuttack-Sonepur Roads. The widening of the crests of certain portion of the Cuttack-Ganjam and Cuttack-Puri Roads was in progress and the construction of a causeway on the 16th mile of the Orissa Trunk Road was started and nearly completed. The extension of the Dak Bungalow Road at Bankipore was completed.

The new Inspection Bungalows at Dhanbad and Katra were completed, while that at Sakchi was in progress. The reconstruction of the Bungalows at Bagnadi and Telibandh and the extension of the Bungalow at Cuttack were completed. The two Inspection Bungalows at Netarhat constructed by the District Board of Palamau were taken over by the Public Works Department and work on a third Inspection Bungalow at this place was started.

#### MISCELLANEOUS PUBLIC IMPROVEMENTS.

A survey was made of the junction of the Gandak and Ganges rivers opposite the Munsif's Court at Bankipore.

Protective works to prevent the erosion of the right bank of the Ganges at Bankipore were carried out and repairs were made to existing revetments along the river bank.

The application of the Sijua (Jharia) Electric Supply Company, Limited, for the supply of electric energy to certain areas in the Jharia coal-fields was sanctioned.

#### RAILWAYS.

**Administration.** Three Light Railways are partially under the control of the Government of Bihar and Orissa. The Government of India in the Railway Department (Railway Board) control the larger and more important railway systems.

**Mileage.** During the year under review the total mileage was reduced by 31.55 miles.

**Surveys.** Surveys of about 93 miles were completed and authority was given by the Railway Board for the survey of four new lines.

**Accidents.** On the Bakhtiyarpur-Bihar Light Railway there were five derailments, on one occasion a trespasser was knocked down and received fatal injuries and on one occasion a passenger fell from a train and was severely injured. On the Bengal-Nagpur Railway there was one derailment in which one man was killed.

#### CANALS.

**Productive works.** The Son and Orissa Canals are productive irrigation works, constructed for both irrigation and navigation. The area irrigated by these two canals was 798,068 acres against 814,303 acres irrigated in 1916-17. The decrease was mainly on the Son Canals where owing to favourable rainfall continuing to a later date than usual, the area that came under *rabi* irrigation was much reduced; in some cases also lapsed long leases were not renewed owing to the failure of the cultivators to comply with the conditions under the rules.

The gross revenue from these canals amounted to Rs. 24,94,344 against Rs. 24,53,598 of the preceding year. Though the area irrigated during the year was somewhat less than that of the preceding year, the total receipts were in excess say Rs. 40,716; the reason is that on the Son Canals the long leases which were granted during the year were charged at the new enhanced rate; there was a slight increase in the navigation receipts also, as the result of the present restriction in Railway traffic.

After meeting the total working expenses (direct and indirect), viz., Rs. 13,88,481, the net revenue, viz., Rs. 11,66,863 only did not fully cover the interest charges of the year which were Rs. 18,20,437. The Orissa Canals are

being worked at a loss to Government; the Son Canals, however, are paying a return of about 4 per cent on capital and on this system after deducting the working expenses the accumulated arrears of interest are now being slowly but steadily worked off.

The Tribeni and Dhaka Canals which are the protective irrigation works <sup>Protective Irrigation Works.</sup> in this Province irrigated 65,791 acres during the year under review, against 31,470 acres of the preceding year. The reason for the increase is, that though the rainfall was good at the beginning of the irrigation season it was insufficient at the latter part and consequently the demand for canal water increased.

Season leases only are in force on these two canals and consequently the area irrigated depends very largely on the rainfall of each particular year. Measures to introduce the long lease system were started during the year, and when the regular long lease system has been established, the fluctuations in revenue should be much reduced.

#### EMBANKMENT AND DRAINAGE WORKS.

The expenditure on embankments was Rs. 89,784 against Rs. 85,845 in the preceding year. Of this the sum of Rs. 80,400 was expended on ordinary repairs and river protective works. The floods in the rivers except the Ganges were all of an ordinary nature but this was the highest on record. The Bankipore-Dinapore Road embankment however stood well against it.

## CHAPTERS.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

The appointments of Chief Engineers and Secretaries to Government in the Buildings and Roads, and Irrigation Branches, were held by Messrs. Stanley and Clayton, respectively, throughout the year. Mr. N. G. Dunbar, Under-Secretary, Buildings and Roads Branch, continued in charge of the office till the end of the year. The retention of the second Chief Engineer for a further period of three years from the 1st April 1917, was sanctioned by the Secretary of State and the proposal to abolish the appointment of Under-Secretary in the Irrigation Branch, approved. Administrative changes.

The Orissa, Western, Eastern and Gandak Circles remained in charge of Messrs. Bremner, Edge, Blaber and Huntingford, Superintending Engineers, respectively, throughout the year. Mr. C. B. Mellor, Superintending Engineer, continued in charge of the Son Circle till the end of the year except for a period of six weeks during which he was on privilege leave and Mr. Bishun Svaryp, Executive Engineer, held charge of the Circle.

Babu Bhuban Mohan Das, Supervisor, first grade, and Mr. Brij Narayan, a passed student of the Civil Engineer Class of the Thomason Civil Engineering College, Rurki, were appointed to the Provincial Engineer Service as Assistant Engineers.

The following officers joined the Indian Army Reserve of Officers during the year under review :—

Mr. F. A. Betterton, Executive Engineer.

Mr. T. F. Carter, Assistant Engineer.

Besides the above, Messrs. Collier, Hall and Hewitt, Assistant Engineers and Messrs. Millwood and Pollen, Assistant Architects, were employed on Military duty connected with the war. Messrs. Duncan and Stevenson, Assistant Engineers, returned to their civil duties during the year.

In order to facilitate the erection of the new power plant from Dacca and the fitting up of house connections in the several residences, a temporary Division, designated the Electrical Works Division, was formed with effect from the 1st August 1917, with its headquarters at Patna and with Mr. A. N. McIntyre, Electrical Engineer, in charge.

In the Chota Nagpur Division, the temporary Subdivision at Chandwa was abolished on the completion of the works for which it was opened and the work in it was distributed to other Subdivisions. For the construction of the new Inspection Bungalows and the Chalet at Netarhat, a temporary independent section, called the Netarhat Section, was opened in the Division. In the Sambalpur Division, a temporary independent section was formed at Barpali for the construction of certain causeways on the Bargarh-Balangir Road and for the investigation of certain Irrigation schemes in the district of Singhbhum.

The Kendupatna and Kendrapara Subdivisions of the Mahanadi Division being both long and straggling, certain alterations were made in their boundaries so as to make them more compact, and accessible from headquarters.

In the Special Works Division, Bankipore a sixth temporary Subdivision was constituted with effect from the 1st December 1917, while Subdivision No. 5 was temporarily abolished with effect from the 10th December 1917.

At the instance of the Government of India, information was collected in order to be in a position to deal with the references from the Government of India in connection with the recommendations of the Royal Commission on the Public Services in India so far as the Public Works Department was concerned. Royal Commission.

A Local Committee was also convened under instructions from the Government of India to examine the proposals of the Public Works Department Reorganization Committee in order to obviate delay in replying to the reference from the Imperial Government on the subject when received.

The time-scale of pay for the Lower Subordinate establishment and the Circle scale for the Ministerial establishment of the Circle and Divisional offices, which had already been approved but could not be financed previously, were introduced with effect from the 1st March 1918.

Orders were received from the Government of India in regard to the amalgamation of the cadres of the Subordinate Public Works and Civil Accounts establishments, with the exception of third and fourth grade Public Works Accountants (who would constitute a separate service) in all Civil Accounts offices where they work side by side. Orders of the Imperial Government were also received laying down the procedure that should be followed in distributing over the various heads of account, the expenditure incurred by the Public Works Department on Establishment and Tools and Plant.

The question of provincializing the grants for travelling allowance including conveyance, pony or horse allowance, in the Public Works Department was considered and the system introduced in the Department with effect from the 1st April 1917.

## BUILDINGS.

### IMPERIAL MILITARY WORKS.

The construction of quarters for the Sergeant Instructor and an armoury for the Bihar Light Horse at Bhagalpur was in progress.

The construction of a new office building for the Proof officer at Balasore was completed while the reconstruction of a Lascar's shed and the construction of a barrack for four constables and one Head-Constable at Chandipur was nearly completed.

### IMPERIAL CIVIL WORKS.

The main Post Office building at Patna was made over to the Postal authorities and work was started on the construction of the residences for the Postmaster-General, Deputy Postmaster-General, Superintendent of Post Offices, Traffic and for the European and Indian Personal Assistants to the Postmaster-General. Quarters for the Subordinate staff also were under construction. The Combined Post and Telegraph Office with Postmaster's and Head Signaller's quarters at Gaya was completed. Reinforced brick-work staircases were added to the east and west sides of the new Post Office building at Motihari and other minor improvements were done. The construction of quarters for the staff employed in the Puri Post Office was nearing completion. Materials were collected for the construction of quarters for the clerks and menials employed at the Post Office at Raxaul and the site for the same was acquired. Additions and alterations were carried out to the Post Office building at Mohania and the Sub-Postmaster's quarters at Kudra were provided with enclosure walls. A Sanitary receptacle was provided in the compound of the Jherria Post and Telegraph Office and a compound wall for the Post and Telegraph Office building at Barhi was under construction. Materials were collected for rebuilding the cracked wall and providing a Raniganj tiled roofing over the existing roof of the Post Office building at Jellasore. The extension of the compound wall of the Arrah Head Post Office and the provision of clerestories in the northern wall of the same were in progress.

Several small works were carried out in the buildings attached to the Residency in Nepal. In connection with the Agricultural Research Institute, Pusa, the extensions and improvements to the electric installation were in progress; materials were collected and arrangements made to start the work of constructing the quarters for the Electrical Engineer; a causeway over the Bur Gandak river was built to afford facilities for crossing the river and some petty works were carried out from the Minor Works Grant at the disposal of the Agricultural Adviser to the Government of India.



The Accountant-General's Office at Doranda was provided with sunshades and a well was being sunk in the compound.

Four blocks of temporary quarters and a well were constructed for the Settlement staff at Daltonganj.

The office of the Chief Inspector of Mines at Dhanbad was improved and a well was constructed for the residence of the Inspector of Mines.

#### PROVINCIAL WORKS.

A few additional works were done to the new Civil Court building at **Cuttack**, and to the record-room of the old Collectorate at Balasore. The southern portion of the record-room of the Puri Collectorate was rebuilt. A verandah was added to the Treasury building at Cuttack and counters were fixed and some petty works done to the building. Certain additions and alterations were done to the accountant's room and to the record-room of the District Court at Sambalpur and also to the Deputy Commissioner's Court at Purulia and Hazaribagh. A separate record-room was constructed for the Deputy Commissioner's Court at Ranchi. The liquor depôt at Purulia was converted into an office library for the Deputy Commissioner's Court and additions and alterations to the Treasury buildings at Sambalpur were in progress. Materials were collected for the construction of a Court building for the Sessions and Subordinate Judges at Hazaribagh and a Vendor's stall in the Kachahri compound at Purulia. Certain minor works were done to the hajat room in the Deputy Commissioner's Court at Daltonganj, the Treasure-guard's quarters at Sambalpur, the office rooms of the 2nd Sub-Judge and Additional Sub-Judge of Gaya and the Chaukidars' Shed attached to the Civil Court at Arrah. The Judicial Commissioner's Court at Ranchi was provided with skylights. The land acquired for the new Civil Court at Gaya was levelled and some materials were collected for the work. Improvements were made to the record room of the Collectorate at Arrah and Gaya and a combined urinal and latrine was provided for the amlas of the Shahabad Collectorate. Only a portion of the sanctioned additions and alterations to the Patna Collectorate was done and the rest abandoned. Materials were collected for the additions and alterations to the Darbhanga Collectorate. The construction of a stall with 20 shops in the compound of the Civil Court at Bankipore was completed. Improvements were carried out to the Civil Court building at Muzaffarpur and additions and alterations were made to the Civil Court building at Chapra. Iron racks were supplied to the record room of the Champaran Collectorate and certain minor works were done in the building. The addition of a Malkhana and a court room to the Subdivisional Court building at Kendrapara, the construction of an additional building for the Subdivisional Court at Phulbani and the quarters for the ministerial staff of the Subdivisional Court at Simdega, which were in progress from the previous year were completed. Certain additions and alterations were made to the Subdivisional Court building at Gumla and to the hajat room in the Subdivisional Court building at Dhanbad. Witness sheds for the new Subdivisional Courts at Barpali and Giridih were completed. The Subdivisional Court buildings at Barh and Kishanganj and guards' quarters at Bettiah were extended while a start was made with the extension of the Subdivisional Court building at Hajipur. Materials were collected for the extension of the Subdivisional Court building at Gopalganj. A building was constructed in the Court compound at Deoghar to accommodate the malkhana, hajat and offices of the Deputy Superintendent and Court Sub-Inspector. The work of constructing the Deputy Magistrate's Court at Chapra was in progress. Materials were collected for the construction of a tent godown for the Subdivisional Court building at Sitamarhi and additions were done to the Subdivisional Court Building at Samastipur. Minor Works were done to the Subdivisional Court buildings at Bhabhua, Buxar, Jahanabad, Aurangabad, Bettiah, and to the Sub-Treasury room at Bargarh and the Honorary Magistrate's Court at Bhabhua.

The construction of a two seated combined latrine and urinal in the compound of the Munsif's Court at Balasore was completed. Additions and alterations were done to the Munsif's Court at Dhanbad and petty works were

done to the Munsif's Court at Arrah. New pankhas were supplied to the Munsif's Court at Sasaram and a malkhana with witness-shed was added to the Munsif's Court at Gopalganj. Materials were also collected for the construction of the double Munsifi at Buxar.

**Circuit House.**

The construction of the Circuit House at Netarhat known as the "The Chalet" was completed. Improvements were done to the roof of the western verandah of the Circuit House at Chapra and to the roads and drains in the compound of the Circuit House at Dhanbad. A flag-staff was erected in the compound of the Circuit House at Chapra and a hedge was planted round the compound of the Circuit House at Purulia.

**Excise buildings.**

The tiled verandah in the distillery building at Bettiah was dismantled and damages to the compound wall repaired. Stone-paved pathways were provided in the spirit warehouses at Madhubani, Phulparas and Patori. Two rooms were constructed in the compound of the liquor depôt at Madhubani for storing *ganja*. A verandah was added to the liquor warehouse at Bihta and an office room was added to the liquor warehouse at Jahanabad. Petty works were done to the liquor warehouses at Aurangabad, Daudnagar and Behia. Additions and alterations were done to the distillery building at Giridih and sunshades were provided to the windows of the new extensions of the combined *Ganja gola* and liquor godown at Sambalpur. The *Ganja gola* at Hazaribagh was provided with a light terrace ceiling.

**Jails.**

Three blocks of the Hazaribagh Central Jail were converted into cells for special prisoners. An expanded metal enclosure was provided round the second block of cell No. 11-43 and a gravelled road was constructed round the Central Jail and the lightning conductors were improved. Certain improvements were carried out to the Central Jail and Hospital ward at Hazaribagh. The Settlement shed No. 2 at Hazaribagh was utilized for providing accommodation for the married warders and head warders of the Central Jail. The construction of two sets of Assistant and one set of Deputy Jailors' quarters in the Central Jail at Buxar was in progress. The following works were either completed or were in progress in the Central Jail at Gaya:—

1. Constructing five godown cells, a cookshed and a latrine.
2. Constructing a new Hospital and a Tuberculosis ward.
3. Constructing additional Sub-Assistant Surgeon's quarters.
4. Constructing latrine and urinals for the paid staff and prisoners employed in the Press Department.
5. Providing fire appliances for the Press and Forms Stores.

Besides the above, the construction of quarters for the Press employes which was taken up by the Jail Department was nearing completion while the construction of the partition wall between the Press and the proposed new hospital was eventually made over by the Jail Department to the Public Works Department. Fifteen electric lights were installed in the Press by the Jail Department and spare parts were obtained for the electric plant and made over to that Department. Bricks were collected for the construction of a Tuberculosis ward in the Central Jail at Bhagalpur while the work of constructing a new double-storied barrack and the provision of balconies to the existing barracks were in progress.

Quarters were built for the Second Assistant Jailor and Sub-Assistant Jailor attached to the Cuttack Jail. Improvements to the Cuttack and the Puri Jails were in progress. Certain improvements were done to the District Jail and the Jail Hospital at Purulia and a workshed was constructed. Quarters for the Sub-Assistant Surgeon, Assistant Jailor and Warders attached to the Chaibassa and Darbhanga Jails were completed. A separate cookshed was constructed for the Hospital Jail at Chaibassa. Additions and alterations were done to the District Jail at Purnea and also to the Motihari, Muzaffarpur and Darbhanga Jails.

The construction of family quarters for the Head Warder of the Phulbani Jail was completed. Additions and alterations were done to the Sub-Jails at Nawadah, Buxar and Samastipur. The construction of the Jailor's quarters in the Intermediate Jail at Dumka was in progress.

The roof of the cookshed attached to the Police Barrack at Phulbani was replaced by a roof of Ganjam tiles and a portion of the barrack of the Constables' Training School at Chauliaganj, Cuttack, was converted into a cell. Additions and alterations to the Police-station building at Angul and to the outpost at Patkura were in progress while materials were collected for the double-storied barrack with a cookshed for the Constables of the Reserve Police Lines at Cuttack. The thana buildings at Simdega were practically completed. The work of rebuilding the Police-station at Sohella was nearly completed and the construction of the Police-station building with residential quarters at Saspur was in progress. Improvements were done to the Police Office at Purulia, constables' cookshed attached to the Police-station at Nawadah and Raghunathpur, Court Inspector's office at Chatra and to the latrine attached to the Police Training College at Hazaribagh. Materials were collected for a barrack for the Armed Police Reserve at Daltonganj. Wells were sunk in the Gurkha Line at Doranda and in the compound of the Police-station at Sakchi. Venetian doors were provided to the Police Office building at Sambalpur and a Guard room to the Police Magazine at Chaibassa. A cookshed was constructed for the undertrial prisoners in the Padampur thana. Improvements were done to the Police Office at Arrah and a rack was also provided for the forms room. Materials were collected for a Police building at Sassaram. The construction of barracks for the accommodation of Armed Police together with quarters for a Sergeant at Jamalpur was in progress. The barrack and kitchen for the Military Police at Bhagalpur were constructed and the Town Police barracks at Purnea were taken in hand. The construction of eight outpost buildings in Nepal Frontier in the Kishanganj Subdivision and of the Kotwali Police buildings at Bankipore was in progress. The town outpost buildings at Mithapur, Bankipore, were in progress and certain additions and alterations to the old Opium Agent's Office at Bankipore for the location of the Pirbahore Police-station were taken in hand. A traverse wall was provided in the Reserve Police Lines at Bankipore and materials were collected for the accommodation of the Mounted Police Force at Bankipore. Arrangements were made to acquire the site for the new thana buildings at Bettiah and materials were collected. A new cookshed was constructed in the Police Lines at Samastipur and the existing one converted into a stable.

A house with land was acquired for the Principal of the Police Training College at Hazaribagh and the land was demarcated by boundary pillars. Additions and alterations were done to the Police Inspector's quarters at Nimapara and to the Sub-Assistant Surgeon's quarters attached to the Police Hospital at Sambalpur while improvements were done to the Police Sub-Inspector's quarters at Giridih. A well was sunk in the compound of the Reserve Police Inspector's quarters at Chaibassa and another in the compound of the quarters of the Inspector of Armed Police at Sambalpur was in progress. Additions and alterations were done to the Senior Sub-Inspector's quarters at Nawadah and to the Police Inspector's quarters at Sherghati and water connection was provided to the European Inspector's quarters at Gaya. The quarters of the Inspector of Armed Police at Chapra were completed and the Bandmaster's quarters at Bankipore were nearing completion.

The work on the provision of a system of drainage in the compound of the proposed Ravenshaw College buildings at Cuttack was nearly completed. The following works were completed during the year in connection with the Patna College—

1. Additional outhouses in connection with the extension of the Minto Hindu and Muhammadan hostels.
2. Additional work in connection with the extension of the Muhammadan hostel.
3. Compound wall to the south-west and north of the Chemical Laboratory.

4. Constructing Dispensary, Doctor's room and Assistant Superintendent's room on the roof of the Muhammadan Hostel.
5. Providing lightning conductors to the College buildings.

Administrative approval was accorded to the construction of new buildings for the Greer Bhumihar Brahman College at Muzaffarpur at an estimated cost of Rs. 5,07,352 and only a portion of the scheme, viz., the construction of the Principal's residence and three hostel blocks was taken in hand. The work on the Principal's residence was in progress and only materials for the hostels were collected when the year closed.

The construction of a new block and a drill shed for the Zila School at Balasore was completed. Land was acquired for a play-ground and materials collected for constructing a dwarf wall round it. The compound of the Ravenshaw Girls' School at Cuttack was levelled and enclosed and some materials collected for the construction of a boarding house and the Lady Principal's quarters for the School. A latrine, urinal and a skylight were provided to the Ravenshaw Collegiate School at Cuttack. Land was acquired for the proposed School of Engineering at Cuttack and the extension of the hostel attached to the Zila School at Puri was in progress. Materials were partly collected for the construction of a Hindu and a Muhammadan Hostel with Superintendent's quarters at Hazaribagh and quarters for the Superintendent of the Muhammadan Hostel attached to the Zila School at Purulia. Bricks were also collected for constructing an enclosure wall round the compound of the Girls' School at Rampella. Certain improvements were made to the hostel attached to the Zila School at Chaibassa and to some of the Reformatory School buildings at Hazaribagh. A shed was constructed for keeping drinking water for the boys of the Purulia Zila School. A combined latrine and urinal was constructed for the teachers of the Palamau Zila School. The construction of a separate kitchen for the Muhammadan boarders of the hostel attached to the Zila School at Ranchi was in progress at the end of the year. Lands were acquired for the educational buildings in the Tarbana area at Bhagalpur. The construction of an additional class room for the City School, Patna, the work of providing pankhas in the Patna Collegiate School and the extension of the water-supply system to the Segregation Hospital, St. Joseph's Convent, at Bankipore were in progress. The remodelling of the Zila School building at Motihari was completed and some venetian doors were supplied to the same. The construction of an office building for the Inspector of Schools, Tirhut Division, was taken up and completed during the year.

The construction of the Guru Training School building at Dalsahi, a pakka well in the compound of the Guru Training School at Dasrathpur and the family quarters for the Head Pandit of the Guru Training School at Phulbani was completed. The deepening of Goripukhar tank near the Guru Training School at Balasore and additions and alterations to the Guru Training School at Pattamundi were nearly completed. Materials were collected for the construction of an additional block for 16 workers with office and store rooms in the compound of the Weaving School at Sambalpur. Land was acquired for the approach road to the Guru Training School at Malkera and boundary pillars were erected to demarcate the land acquired for the Bihari School and the play-ground of the Middle Vernacular School at Hazaribagh. The following works were also done during the year :—

1. Covering the corrugated iron roof with nurria tiles and constructing an approach road to the Guru Training School at Malkera.
2. Adding two rooms to and constructing a well and latrine for the Middle Vernacular School at Rampella.
3. Sinking wells in the compound of the Guru Training Schools at Chainpur and Jorapokhar in the Singhbhum District.

Improvements were done to the drain and kitchen in the compound of the Guru Training School at Kanhauli and the construction of a well for the same school was in progress. The construction of buildings for

the Training School for Muhammadan Teachers at Ganjana in the Purnea District and of a sick room for the hostel of the 1st grade Training School at Muzaffarpur was in progress. The construction of a kitchen and a store room for the Muhammadan boarders of the above hostel was put in hand and bricks were collected for enclosing the compound of the school. The construction of the compound wall round the Women's Training School and residence for the Assistant Inspectress of Schools, Muzaffarpur, was completed and a kitchen and servant's quarters were added to the building.

The construction of a tiled roof over the terraced roof of the Civil Surgeon's residence at Laheriasarai was completed. Sunshades were provided to the windows of the Civil Surgeon's office at Chapra. The lands attached to the Sub-Assistant Surgeon's quarters at Kanti, Tarma and Raipura were formally acquired and the construction of a Tuberculosis ward in the Chapra Sadr Hospital was completed. The following works were in progress in the Temple Medical School at Bankipore :—

1. Construction of a Power House.
2. Construction of a Steam Laundry.
3. Addition of a pantry with cupboard to the kitchen for European patients.
4. Extension of the kitchen for Indian patients.

Servants' quarters and an additional store-room were built in the compound of the Temple Medical School, Bankipore, the feeding platform in the Lunatic Asylum at Bankipore was raised and sloped and the Tuberculosis ward in the Hospital compound at Bhagalpur was completed.

A residence was constructed for the Superintendent of the European and Indian Asylums at Kanke and Staff quarters in the Asylum for Indian insanés were in progress. Improvements were done to the Asylum for European insanés. Temporary arrangements were made for the supply of water to the Asylum from the bed of the Popoto river pending the erection of a water tower. Herring-bone pattern grooved floor was provided for the sheds of the Vaccine Depot at Nankum and materials were collected for the erection of a pakka straw shed.

The construction of the Hospital-building at Chatra was in progress and a rest-shed was constructed for the Mortuary at Purulia. Improvements to the General Hospital at Cuttack were in progress. The work of replacing the thatched roof of the dispensary buildings at Phulbani and the construction of a room for the examination of patients for the dispensary were completed. Progress was made with the construction of dispensary buildings at Balandapara and materials were collected for the construction of Dispensary buildings at Khejuripara and Phringia in the Khondmals Subdivision. Additions and alterations were done to the Assistant Surgeon's quarters at Angul and quarters were built for the Sub-Assistant Surgeon, Banki Hospital, but the quarters of the compounder were still in progress.

Certain minor works were done to the Pathological Laboratory, the Anatomical block and the Anatomical class room of the Orissa Medical School at Cuttack and the following other works were either completed or in progress in connection with the above Medical School :—

1. Construction of a block of quarters for six servants.
2. Improvements to the two Sub-Assistant Surgeons' quarters.
3. Construction of quarters for the two Assistant Surgeons in charge of the hostel for male students.
4. Water-supply to the Red brick hall, Medical School, Cuttack.

Land was acquired for a Leper Asylum at Cuttack and the diversion of a portion of the Mahanadi right embankment in connection with the Leper Asylum was in progress.

The laying out of the grounds attached to the Sabour Agricultural College as in progress.

**Forests.**

A verandah was constructed on the two sides of the Forest Building at Angul.

**Registration.**

The extension of the record racks in the Sadr Registration office at Balasore was completed. The construction of the Sub-Registry Office buildings at Dhamnagar, Soro and Tirtol was completed and the building at Kendrapara was nearing completion. Materials were collected for the Sub-Registry office buildings at Jellasore, Bikram (Patna), Islampur (Purnea), and Kishenpur and the work on the construction of the Sub-Registry buildings at Pupri and Phulparas was commenced. Quarters were constructed for the Sub-Registrar at Daltonganj and shelves of the Sub-Registry office at Dhanbad were provided with iron bands. A rural Sub-Registry office at Giridih was under construction. An additional record-room was constructed in the Registration office at Arrah. A door was opened between the Ijlas and the record-room of the Sub-Registry Office at Bhabhua. An additional record rack was fixed in the Registration office at Motihari and the additions and alterations to the existing record racks in the Registration office at Laheriasarai were completed. The Registration office at Chapra was extended and the liquor warehouses at Bahera, Benipatti and Ekma were adapted after certain additions and alterations for Sub-Registry offices. Land was acquired for a Sub-Registry office at Sheohar and improvements were done to the Sub-Registry office at Mirganj and Hajipur.

**Monuments and antiquities.**

Works in connection with the black Pagoda at Kanarak were completed except the carriage of iron beams to the Calcutta Museum. Materials were collected for repairing the several temples at Bhuvanesvar which were declared as protected monuments under the Ancient Monuments Preservation Act and were found to be in a deplorable condition. Special repairs were also done to the Bakhtiyar Khan's tomb at Chainpur and the work of erecting a monument on the battlefield at Buxar was in progress.

**Ecclesiastical.**

The work of raising the level of the Muharrampur cemetery and of constructing new roads within it was completed during the year. A shed for the mali attached to the cemetery at Dhanbad was constructed and the land attached to the shed was demarcated with boundary pillars. A pump and furniture were provided for the Lych gate of the above cemetery. Furniture were also supplied to the cemetery at Chakradharpur.

**Residence for the Lieutenant-Governor and Government Officials.**

Improvements to the electrical plan and the construction of bath-room for the staff quarters attached to the Government House at Puri were completed. Additions and alterations were also done to the staff and Chaffeur's quarters and quarters for 12 peons attached to the above Government House. The office of the Private Secretary in the compound of the Government House at Ranchi was extended and a motor garage, a petrol godown and quarters for the Stenographer to His Honour the Lieutenant-Governor were constructed. Pumping arrangements were made to water the garden attached to the Government House. Various works of minor importance were done to the Chief Justice's residence at Chajjubagh, the Judge's residence (Block B) at Chajjubagh, the Postmaster-General's and the Deputy Postmaster-General's residence at Gulzarbagh and to the Commissioner's residence at Muzaffarpur. The Council Chamber House at Gulzarbagh was converted into temporary quarters for the Superintendent of the Army Clothing Factory and for the Officer in charge of the Bihar and Orissa Drawing Office.

The construction of quarters for the motor driver in the compound of the Commissioner's residence at Ranchi was in progress and the east verandah of the Deputy Commissioner's residence at Purulia was converted into a dressing room and a motor shed and a wooden gate were erected in the compound of the Deputy Commissioner's residence at Daltonganj. The construction of a new cockshed for the Deputy Commissioner's residence at Ranchi and the reconstruction of the outhouses attached to the residence of the Inspector of Schools at Cuttack were in progress.

Certain improvements were done to the Deputy Commissioner's residence at Sambalpur, to the Subdivisional Officer's residence at Khuda, to the European Deputy Magistrate's residence at Hazaribagh and to the Subdivisional Officer's and 2nd Officer's residence at Dhanbad. The compound of the Subdivisional Officer's residence at Giridih was provided with wire fencing.

The old Court building at Jahanabad was converted into a residence for the Subdivisional Office. Water connections were provided in the two sets of residences of the Indian Deputy Magistrates at Gaya. Land was acquired for the compound of the Munsif's residence at Buxar and a residence for the Subdivisional Officer was also constructed at Buxar. The residences of the following officers were completed during the year :—

Sub-Deputy Collector, Barh, one Deputy Collector, Bankipore, two Munsifs, Bankipore, Executive Engineer, Patna Division, First Sub-Judge, Bankipore, and the residences of the following officers were in progress.

One Munsif at Bankipore, two Sub-Judges at Bankipore.

Various works of minor importance were done to the Lalkothi at Gulzarbagh, Indian Deputy Magistrate's residence No. 4 at Bankipore, Munsif's residences at Hajipur and Chapra and to the Sub-Deputy Collector's residence at Bettiah.

All works in connection with the Government House and the Council Chamber excepting a few minor alterations and iron entrance gates have been completed. Residences for the two Hon'ble Members, two Judges in the New Capital, the Chief Secretary, the Financial Secretary, the Revenue Secretary, two Public Works Department Secretaries and five Under-Secretaries were completed and works on the construction of residences for the following officers were in progress :—

Capital Works,  
Patna.

Assistant Secretary, Public Works Department, Assistant Commissioner of Excise, Personal Assistant to the Inspector-General of Police, Assistant Director of Public Instruction, Registrar of Co-operative Societies, Assistant Sanitary Engineer, Superintendent, Civil Veterinary Department, Inspector-General of Police, Commissioner of Excise and Salt, Electrical Engineer, Deputy Director of Agriculture, Director of Public Instruction, Personal Assistant to the Commissioner of Excise and Salt. The additional works in connection with the Patna High Court (except the witness shed) and the quarters for the Police attached to the High Court were completed.

In addition to the above the following works were in hand :—

1. Barracks for menials attached to the Secretariat.
2. Quarters for peons attached to the Officers' residences.
3. Quarters for the Compounder and menial barracks attached to the outdoor dispensary.
4. Road along the Serpentine.
5. Construction of a Central Power House.
6. Extension of chain fencing in front of the Government House.
7. Construction of a Nursery.
8. Carriage stand on the east of the Taylor road.
9. Construction of quarters for the Police in charge of the Secretariat Building.

The construction of quarters for the Sectional Officer stationed at Khatmandu was in progress. The construction of a new office at Bankipore for the Superintending Engineer, Eastern Circle, was completed, and land was acquired for the construction of a Public Works Department Subdivisional Office and godown at Bhagalpur. A portion of the verandah in front of the correspondence branch of the Executive Engineer's office at Buxar was enclosed and a carp hatchery was constructed at Dhelabagh in the Nasriganj Subdivision of the Arrah Division. The construction of the Public Works Department Subdivisional Office and godown with out-houses for the Singhbhum Subdivision and the Public Works Department Subdivisional officer's residence at Chaibassa was nearly completed. Materials were collected for the construction of the Public Works Department Subdivisional clerk's quarters at Bargarh and an

Public Works  
Department  
Buildings.

office building for the Sectional Officer and for a peon's room at Khurda. The construction of an office building for the Executive Engineer, Cuttack Division, was in full progress. The record-room and the Draftsman and Estimator's room in the Executive Engineer's office at Sambalpur were provided with cloth ceiling.

**Miscellaneous.**

The eastern verandah of the Oriental Library at Bankipore was converted into a room.

**Contribution.**

The construction of a cow-shed in the house of Raja Mukunda Deb of Puri, special repairs to his dwelling house and the re-excavation of a tank in the compound were undertaken. The cow-shed was completed and special repairs to his dwelling house were in progress. An operation room was constructed for the out-door patients of the Growse Central Hospital at Balasore. The work of putting a pump and a reservoir in the above hospital was in progress. The construction of two memorial covered wells at Doomda and Sanpara was in progress.

An infectious diseases ward was constructed in the main Hospital at Sambalpur and venetian shutters were provided to the doors and windows of dormitories etc., of the Hospital for Zamindars' sons and wards attached to the Zila School at Ranchi.

The reconstruction of the roof of the school building attached to the Lutheran Mission at Ranchi was undertaken. Bricks were collected for the construction of a Residential College at Bhagalpur and the extension of the Duchess of Teck Zanana Hospital at Patna was completed.

The work of enclosing, levelling, dressing and turfing the land acquired for extending the Bihar School of Engineering was commenced during the year. A well was dug in the compound of the Civil Court at Chapra from the contribution paid by one Amir Chand.

**Accidents, storm  
fire, flood, etc.**

A cyclonic storm passed through Purulia and Dhanbad on the 21st March 1918. A portion of the room of the Deputy Commissioner's residence at Purulia, was blown away and the roofs of other buildings at Purulia and Dhanbad were more or less damaged. Some damage was also done to the new reinforced roof of the stable attached to the residence of the Superintendent of the European Lunatic Asylum at Kanke during the heavy rains.

A statement of expenditure on Original Works—Civil Buildings—is given below:—

	Rs.
Administration	27,17,9-3
Monuments and antiquities	7,626
Educational	4,66,411
Ecclesiastical	4,112
Law and Justice	2,19,706
Jails	2,69,903
Police	2,34, 95
Medical	5,27,637
Miscellaneous	2,91,203
Forest	1,804
Total	37,50,910



## COMMUNICATIONS.

During the past year work on the roads forming a through route between Bihar and Orissa was continued; in the Patna and Gaya Districts the alignment of the road was settled and the preliminary earthwork, grading and culverts were started. The Grand Trunk Road in the Gaya District was badly damaged by floods in August 1917 and action was taken to repair the damages done. The causeway over the Lilajan river on this road was washed away and temporary arrangements had to be made to restore communication while the construction of a permanent bridge was under the consideration of Government. The redecking of the bridge over the Barakar river on this road at Chirkunda in the Manbhum District which was in progress at the end of the preceding year was completed.

In the Chota Nagpur Division work on the improvement to the Chandwa-Kuru section of the Ranchi-Daltonganj Road, including certain improvement to the Teeko bridge, the construction of which was completed in the preceding year, was nearing completion at the end of the year under report. The work of strengthening the existing culverts in the Messadi-Tebo and Tebo-Chakradharpur sections of the Ranchi-Chaibassa Road by substitution of trough plates for timber floors had to be held in abeyance in the previous year owing to the exorbitant price of iron work, but during the year under review it was proposed to reconstruct them with reinforced concrete top instead of trough decking; work was accordingly taken in hand and nearly three-fourths of the work was completed at the end of the year. The road was also realigned at the 63rd mile and near the Oriyagarh bridge. The metalled surface of the Chaibassa-Jaintgarh Road was resectioned in several miles, and the reconstruction of bridges, where necessary on this road with reinforced concrete floors was completed.

In Orissa, in connection with the work of bridging the Bargarh-Bolangir Road, it was decided that raised causeways should be substituted for the proposed bridges across the small rivers and a start was accordingly made with the construction of causeways over the Banjari and Pulsajore nalas and over the Ranj river, which were nearing completion at the close of the year. The only bridge that remained to be constructed on this road was that over the Bargarh nala. The metalling of the Raipur-Sambalpur Road was completed and the road was improved to a great extent by remodelling the old culverts and reconstructing new ones where considered necessary. The improvements to the Cuttack-Sambalpur Road, second section, second portion, were completed in the previous year but some more earthwork was executed during the year under report and the improvements to the third section of the road were nearly completed with the exception of some earthwork which was considered necessary and the construction of some culverts. The metalling of the clayey portion of the Cuttack-Sambalpur Road which was taken in hand during the previous year, was completed and that of the portion of the Cuttack-Sonepur Road lying within the town of Banki was commenced and progressed fairly well to the end of the year. In connection with the improvements to the Angul-Lickerpara Road, second section, earthwork, masonry work in bridges, construction of culverts, metalling and stone cutting, etc., were in progress. Estimates were sanctioned during the year for widening the crests of certain portions of the Cuttack-Ganjam and the Cuttack-Puri Roads from 8' to 12'. The works were started and considerable progress was made during the year. The construction of a causeway on the 16th mile of the Orissa Trunk Road (north) was taken in hand as a measure to drain off the surplus discharge of the Jalka river and was nearly completed.

At Patna, the extension of the Dak Bungalow Road up to the Exhibition Road and the construction of a new road from this extension running northward to meet the Fraser Road were completed as well as the work of linking the Patna-Gaya Road with the Chajjubagh compound.

The construction of a first class Inspection Bungalow with outhouses at Sakchi in the district of Singhbhum and another Inspection Bungalow at Dhanbad in the Manbhum District which were administratively approved in the preceding year was taken in hand; the former was in progress at the

close of the year while the latter was completed, the old Inspection Bungalow at the latter place having been converted into a Dāk Bungalow.

The construction of an Inspection Bungalow at Katra on the second section of the Cuttack-Sambalpur Road and the reconstruction of the bungalows at Bagnādi and Telibandh which were in progress from the previous year were completed as also was the work on the extension of the Staging Bungalow at Cuttack. Materials were collected for the construction of an Inspection Bungalow at Sitalpani on the Cuttack-Sonepur Road.

The two Inspection Bungalows, at Netarhat which had been constructed by the District Board of Palamau, were taken over by the Public Works Department, and the construction of an additional bungalow at this place was in progress to the end of the year. The planting and maintaining of trees alongside roads were carried out and nurseries maintained as far as funds permitted.

### MISCELLANEOUS PUBLIC IMPROVEMENTS.

**Protective Works.**

In connection with the damage to the revetments on the right bank of the river Ganges it was suggested that an investigation into the present condition of the outfall of the Gandak should be held—a thorough investigation of the junction of the Gandak into the Ganges was made and a cross-section was taken of the latter opposite the Munsif's Court at Bankipore.

The construction of new brick revetments at Bankipore along the right bank of the Ganges below the Patna College and near the Bihar School of Engineering which was commenced in the previous year for the protection of the quarters of the Principals of the Patna College and the Bihar School of Engineering was nearly completed and that of a skin revetment below the Civil Surgeon's compound and the club at this station was undertaken and progressed fairly well—two-thirds of the work having been completed during the year. Repairs to damages done to the existing revetment in several places at Bankipore by heavy floods of the year under review were commenced and the work was in progress at the end of the year.

**Miscellaneous**

Considerable progress was made with the construction of the metalled road on the crest of the Katjuri left embankment at Cuttack from the Collector's Court to the Puri ghat.

**Electricity.**

The application of the Sijua (Jharia) Electric Supply Company, Limited, for the sanction of the Local Government to the supply of electrical energy to certain areas in the Jharia coal-fields was granted.

### RAILWAYS.

**Administration.**

There are no railways under the direct control of the Government of Bihar and Orissa. With the exception of the three following Light Railways of local importance which are subject to a certain measure of control by the Local Government, all the important lines are under the direct administration of the Government of India in the Railway Department (Railway Board) :—

	Gauge.	Mileage.
(1) Arrah-Sasaram Light Railway ...	2' 6"	65.26
(2) Bakhtiyarpur-Bihar Light Railway ...	2' 6"	33.00
(3) Dehri-Rohtas Light Railways ...	2' 6"	23.83
total ...	...	122.09

**Mileage**

During the year under report no new railway line was opened to traffic. Owing to the want of railway material by the Military authorities the

Bhagalpur-Bausi Branch of the East Indian Railway was dismantled. The total mileage on the 31st March 1918, was therefore—

	Miles.
(1) Standard Gauge ... ..	1660-75
(2) Metre „ ... ..	1178 66
(3) 2' 6" „ ... ..	269-31
(4) 2' 0" „ ... ..	39-00
Total	3179-27

The following lines were under construction or sanctioned for construction during the year :—

	Gauge.	Miles.	Lines sanctioned or under construction.
Fatwa-Islampur ... ..	2' 6"	27-00	
Mayurbhanj Extension ... ..	2' 6"	38-71	
Bengal-Nagpur Railway from Kandra-Gomharia...	5' 6"	5-53	
Panposh-Raipura ... ..	5' 6"	14-30	
Portion of the Raipur-Parbatipuram Section of the Bengal-Nagpur Railway (from a point near Garjabota to a point near Bhowānipatna Road).	5' 6"	92-00	

The following surveys were completed during the year :—

	Gauge.	Miles.	Surveys completed.
Jagatpur-Kendrapara ... ..	2' 6"	33	
Lohardaga-Netarhat ... ..	2' 6"	34	
Onlajori-Sulaipat ... ..	5' 6"	15 34	
With a branch from Jaypur-Badampur ... ..	5' 6"	10-25	

Authority was given by the Railway Board to undertake the following surveys during the year :—

To the Darjeeling-Himalayan Railway Extensions Co. for—

- (a) A detailed survey for a line of railway on the metre gauge from Islampur to Siliguri, via Titalia, a distance of about 36 miles.
- (b) A detailed survey for a line of railway from Titalia or Ramganj to Jalpaiguri, a distance of about 22 miles.
- (c) A detailed survey for converting the Kishanganj-Islampur line from 2'-0" gauge to metre gauge, a distance of about 18 miles.
- (d) A reconnaissance survey for a line of railway on the 2'-0" gauge from Islampur to Dinajpur via Lahiri Hat with a branch from Lahiri Hat to Haldibari, a distance of about 89 miles.

While No. 6-Down Bakhtiyarpur-Bihar Light Railway Passenger Train was approaching Chero Station and passing round the curve at mile 4 $\frac{3}{4}$  at 11-45 on 2nd September 1917, brakevan No. 2 got derailed. Accidents.

While No. 17-Up Bakhtiyarpur-Bihar Light Railway Passenger Train was running between Chero and Harnaut, over a bit of line that had been repaired after the breaches at mile 4 $\frac{3}{4}$  covered wagon No. 2 got derailed at 17-35 on the 1st September 1917.

While No. 9-Up Bakhtiyarpur-Bihar Light Railway Passenger Train was entering Harnaut Station yard at 8-14 on the 6th September 1917 a blind and

deaf man of about 80 years of age attempted to cross the line and was knocked down and injured and expired in about half an hour.

While No. 13-Up Bakhtiyarpur-Bihar Light Railway Passenger Train was being admitted on the loop line at 14-50 on the 7th September 1917 and after the engine and 13 vehicles had passed point No. 1, covered goods wagon No. 2, 14th vehicle from the engine, got derailed and was dragged up to the clearance board, when the train stopped, fouling the line.

While No. 9-Up Bakhtiyarpur-Bihar Light Railway Passenger Train was approaching mile 22 T.P. 1 near Dipnagar Station at 10-43 on the 13th September 1917, a passenger aged about 40 years fell down from high sided truck No. 4 and was dragged some distance. The man had his right leg and three fingers of the left hand crushed, his leg being amputated when removed to hospital. He received also wounds on the body and hand.

While No. 13-Up Bakhtiyarpur-Bihar Light Railway Passenger Train was about to come to a stand at mile 22½ at Dipnagar Station at 15-20 on the 14th September 1917 the rear wheels of high sided truck No. 9, 7th vehicle from the engine, got derailed.

While No. 1-Up Bakhtiyarpur-Bihar Light Railway Passenger mixed Train was passing round the curve at mile 18 near Bihar Kachahri at 12-0 on the 8th February 1918 loaded bogie truck No. 2 containing bamboos got derailed, due to the side supports of the load breaking and some bamboos falling on the line.

At about 15-10 on the 6th August 1917 when 259-Down goods train from Chakradharpur to Kharagpur was running between Mahalimarup and Sini Stations, the driver felt a jerk and on bringing his engine to a stand found 14 wagons had been capsized or derailed. He went back to the wreckage and found a man pinned under one of the wagons. Every endeavour was made to get him out, but he died before this could be done.

The programme showing the proposed new lines in order of urgency is given as Appendix C.

#### CANALS—IRRIGATION AND NAVIGATION.

The transactions of the Irrigation Department for the year 1917-18, so far as they relate to works of Irrigation and Navigation, are shown in the statement below. Works which afford protection from flood or which facilitate drainage are reviewed separately and are not noticed in this report:—

#### CAPITAL ACCOUNT.

Heads.	Amount of Construction Estimate.	Expenditure during 1917-18.	Expenditure to end of 1917-18.	Balance for expenditure from 1st April 1918.
1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.
<b>PROTECTIVE IRRIGATION WORKS—</b>				
Direct charges ...	84,32,057	98,626	80,40,617	3,91,440
Indirect charges ...	2,25,222	2,435	2,22,795	2,427
Total ...	86,57,279	1,01,061	82,63,412	3,93,867
<b>MAJOR IRRIGATION WORKS—</b>				
Direct charges ...	5,26,58,076	7,917	5,24,20,815	2,37,261
Indirect charges ...	15,25,735	229	15,30,546	—4,811
Total ...	5,41,83,811	8,146	5,39,51,361	2,32,450
<b>MINOR WORKS AND NAVIGATION—</b>				
Direct charges ...	6,86,833	...	6,86,833	...
Indirect charges ...	27,923	...	27,923	...
Total ...	7,14,806	...	7,14,806	...

## REVENUE ACCOUNT.

Heads.	Receipts.	Working expenses,			Net Revenue.
		Direct.	Indirect.	Total working expenses.	
1	2	3	4	5	6
	Rs.	Rs.	Rs.	Rs.	Rs.
MAJOR IRRIGATION WORKS * ...	26,25,425	15,21,418	1,16,574	16,37,992	9,87,433
MINOR WORKS AND NAVIGATION—					
Works for which Capital and Revenue Accounts are kept.	1,000	481	24	505	495
Works for which only Revenue Accounts are kept.	7,351	28,600	1,595	30,195	—22,844
Works for which neither Capital nor Revenue Accounts are kept.	3,089	2,629	...	2,629	460

\* Inclusive of the Dhaka and the Tribeni Canals.

2. The following statements show the areas irrigated during the year compared with the average of the triennial period ending with March 1917 :—

Irrigation.

## MAJOR WORKS—(Productive).

	Orissa Canals.			Son Canals.			Total.		
	Kharif inclusive of hot weather.	Rabi.	Total.	Kharif inclusive of hot weather.	Rabi.	Total.	Kharif inclusive of hot weather.	Rabi.	Total.
1	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1914—17.	272,982	6,162	279,144	466,101	100,067	566,168	739,083	106,229	845,312
For 1917-18 ...	264,154	(a) 7,442	271,576	458,388	(b) 68,104	526,492	722,522	(c) 75,546	798,068

(a) Season lease.

(b) Includes long lease 21,714 acres and season lease 46,390 acres.

(c) Includes long lease 21,714 acres and season lease 53,832 acres.

NOTE.—All collections for season leases (Rabi) are made in the following year (1918-19) but those for long leases are made during the year (1917-18).

## MAJOR WORKS—(Protective).

	Tribeni Canal.			Dhaka Canal.			Total.		
	<i>Kharif</i> inclusive of hot weather.	<i>Rabi.</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi.</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi.</i>	Total.
1	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1914-17 ...	52,708	...	52,708	6,761	367	7,128	59,469	367	59,836
For 1917-18 ...	56,801	...	59,901	6,298	(a) 872	7,170	66,069	(a) 872	66,941

(a) Season lease.

## MINOR WORKS.

	Saran Canals.			Teur Canal.			Total.		
	<i>Kharif</i> inclusive of hot weather.	<i>Rabi.</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi.</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi.</i>	Total.
1	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1914-17 ...	Canal closed.	...	...	1,418	29	*1,447	1,418	29	1,447
For 1917-18 ...	...	...	...	1,698†	(a) 29	†1,727	1,698	(a) 29	1,727

(a) Season lease.

\* Includes the Madhuban Zamindar's *swat* land.† Includes 253 acres of the Madhuban Zamindar's *swat* land.NOTE.—All collections for season lease (*Rabi*) are made in the following year (1918-19) and those for long leases are made during the year (1917-18).

## 3. The length of canals and distributaries in operation during the year 1917-18 compared with the previous year are as follows:—

Length of Canals.

	Orissa Canals.		Sen Canals.		Tribeni Canal.		Dhaka Canal.		*Saran Canals.		Teur Canal.	
	1916-17.	1917-18.	1916-17.	1917-18.	1916-17.	1917-18.	1916-17.	1917-18.	1916-17.	1917-18.	1916-17.	1917-18.
1	2	3	4	5	6	7	8	9	10	11	12	13
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Main canals (Irrigation)	223½	223½	218½	218½	61½	62	8½	8½	} 11·57	} †11·57	6·18	6·18
Branch canal (Irrigation) ...	108	108	148½	148½	...	...	15½	15½			6·18	6·18
Distributaries	1,290½	1,291½	1,236½	1,234½	160·63	160·73	25½	25½	12·48	12·48	6·13	6·13
Of above—Navigable channels	204½	204½	218½	218½	...	...	...	...	...	...	...	...

\* Canals closed since the 1st April 1894.

† Includes minor channels.

‡ Part of the Patna distributary has been closed for sanitary improvement of the neighbourhood of the New Capital at Patna.

4. The following statement shows the traffic on the Navigable Canals during the year 1917-18 compared with the average of the triennium 1914-17 :—

	Orissa Canals		Son Canals.		Orissa Coast Canal.	
	Average for the triennium ending with March 1917.	For the year 1917-18.	Average for the triennium ending with March 1917.	For the year 1917-18.	Average for the triennium ending with March 1917.*	For the year 1917-18.†
1	3	3	4	5	6	7
Length of canal open ...	Miles. 204½	Miles. 204½	Miles. 218½	Miles. 218½	Miles. ...	Miles. 95½
Receipts ...	Rs. 70,476	Rs. 72,036	Rs. 18,366	Rs. 22,648	Rs. ...	Rs. 6,374
Tonnage of boats by canal measurement.	Tons. 399,784	Tons. 451,329	Tons. 45,651	Tons. 60,721	Tons. ...	Tons. 35,070
Estimated weight of cargo exclusive of rafts.	134,084	164,714	15,260	19,154	...	13,380
Estimated value of goods.	Rs. 1,04,44,738	Rs. 1,05,29,326	Rs. 9,37,104	Rs. 12,63,904	Rs. ...	Rs. 7,11,103
Estimated value of rafts.	3,72,788	2,71,562	3,84,567	3,54,230	...	17,418

\* Triennial average in column 6 not strictly as the figures in the accounts for 1914-16 relate to the whole length of the canal lying in the two Provinces—Bengal, Bihar and Orissa—while those for 1915-16 and 1916-17 relate only to that portion of the Canal which lies in this Province.

† For 95½ miles only lying in the Province of Bihar and Orissa.

5. The classification of works dealt with in this review is as follows :—

- (i) Major Works ; and  
(ii) Minor Works and Navigation.

(i) Major Works.

The works comprised in this class are the Orissa, Son, Tribeni and Dhaka Canals.

(a) *Productive Works*.—The Orissa and Son Canals are “ Productive Works ” of a remunerative character, undertaken for the improvement of the country. Their original cost of construction was met wholly from funds under the Imperial head “ 49 ”. Further Capital Outlay is now being charged to the divided head “ 43—Minor Works and Navigation ”. These two Canals were constructed both for irrigation and navigation.

(b) *Protective Irrigation Works*.—The Tribeni and Dhaka Canals are Protective Irrigation Works, constructed as a protection against famine, from funds under the Imperial head “ 35 ”. The Tribeni Canal is almost complete. The main works included in the Schedule of incomplete works, which remain yet to be constructed are the village channels and one distributary. Additional works not provided in the project Estimate and in the schedule of incomplete works are being charged to the Open Capital Account under the head “ 35 ”. Both the Tribeni and Dhaka Canals are open to irrigation. Their Revenue Account is under the divided head “ 42 ”.

(ii).—*Minor Works and Navigation.*

- (a) *Saran Canals*—Capital and Revenue Accounts are kept under the head "43". The Canals were intended for irrigation only but have remained practically closed since 1894. The question of abandoning the Canals altogether has not yet been settled.
- (b) *Orissa Coast Canal*.—The length of the Canal within this Province is  $95\frac{1}{2}$  miles. Revenue Account only is kept under the divided head "43". The Canal is meant for navigation only.
- (c) The Teur (Madhuban) Canal in the Champaran District is a small work, intended for irrigation only. Neither Capital nor Revenue Account is kept for this Canal.

The transactions of the year for each of the above works are briefly stated in the following summary compiled by Circles of Superintendence :—

## ORISSA CIRCLE.

## MAJOR IRRIGATION WORKS (PRODUCTIVE).

*Orissa Canals.*

- Capital Account.** 6. The expenditure (direct charges) debited to the Capital Accounts of the Orissa Canals during the year was only Rs. 289. The total Capital Outlay for direct charges to the end of the year stands at Rs. 2,64,61,804.
- Works in progress.** 7. The work taken in hand last year, of replacing the front shutters in one of the bays of the Bura Weir by Marchant's pattern improved, adjustable shutters of the French type, was completed during the year under report. No other work was in progress under this head. The question of remodelling the Baitarani Weir has been dropped for the present as a scheme for irrigation by a new canal taking off from a point higher up the river is being investigated, and the height of the weir crest will depend on the feasibility of the new proposed canal.
- Length of Distributaries.** 8. During the year under report only  $\frac{5}{8}$  mile of minor distributaries was added.
- Rainfall.** 9. The average rainfall at the 13 recording stations on the Orissa Canals was 74.01 against 66.79 inches in 1916-17 and 65.30 inches in 1915-16. The rainfall of the year was plentiful and well distributed throughout the year except in October. The paddy crop was good on the whole, but the abnormally heavy rains during October did considerable damage to the *rabi* crop.
- Irrigation.** 10. The area irrigated during the year was 271,576 acres against 278,065 acres of 1916-17. The amount assessed for water-rates during the year was Rs. 4,52,096 against Rs. 4,60,707 of the previous year. Less than 0.2 per cent of the demand remained uncollected at the end of the year. The decrease in demand and collection of the year in comparison with the preceding year's figures, is to a great extent due to the favourable rainfall of the year. Some few leases were not renewed.
- Navigation Receipts.** 11. The receipts from Navigation tolls on the Orissa Canals were Rs. 72,036 against Rs. 72,268 in the previous year and an average of Rs. 70,075 for the preceding five years.
- Financial Results.** 12. The revenue and working expenses (direct and indirect) during the year were Rs. 5,80,779 and Rs. 4,92,800 respectively against Rs. 5,79,442 and Rs. 5,11,584 of the previous year, the result being a net revenue of Rs. 87,979 against Rs. 67,858 of the preceding year.



13. The Canals were closed for annual repairs as detailed below :—

Closure of Canals.

Name of Canal,	From—	To—
Taldanda Canal	... 15th April 1917	... 11th May 1917.
Machgaon „	... 15th April 1917	... 17th May 1917.
Kendrapara „	...	
Ditto - extension	... } 16th May 1917	... 15th June 1917,
Gobri Canal	... }	
Do. extension	... }	
Pattamundi Canal	... }	
High Level Canal, Range I...	1st May 1917	... 3rd June 1917.
Ditto „ II...	15th April 1917	... 10th June 1917.
Ditto „ III...	15th April 1917	... 3rd June 1917.
Jajpur Canal ...	1st May 1917 ...	... 4th June 1917.

There were no severe storms or high floods during the year.

#### MINOR WORKS AND NAVIGATION.

14. The Canal was maintained in fair order and was open to traffic throughout the year. Some shoals were formed in Ranges IVA and IVB. These were removed by dredging. A portion of Range V was also dredged during the year. But the progress of silt clearance on Range V, for which an estimate amounting to Rs. 13,264 was sanctioned, was somewhat slow for want of coal. Orissa Canals. Coast

The gross receipts and working expenses (direct and indirect), were Rs. 7,351 and Rs. 30,195 against Rs. 5,681 and Rs. 33,726 respectively of the previous year.

#### SON CIRCLE.

#### MAJOR IRRIGATION WORKS (PRODUCTIVE).

##### Son Canals,

15. The following works chargeable to the Capital Account of the Son Canals under the head "43—Minor Works and Navigation," were in progress during the year :— Capital Account.

(a) A syphon on the Khargarh Distributary. The work is almost completed, expenditure to end of March 1918 being Rs. 5,014 against an estimated cost of Rs. 6,916. Works in progress.

(b) Thirteen permanent outlets in the Chausa Branch Canal. Expenditure to end of March 1918 being Rs. 661 against an estimate of Rs. 1,456.

The total capital outlay (direct charges) up to end of 1917-18 was Rs. 2,59,59,011 of which Rs. 7,628 represents the expenditure of the year.

16. The total length of distributaries during the year was 1,234 $\frac{1}{2}$  miles against 1,236 $\frac{1}{2}$  miles of the preceding year. The decrease is due to the fact that a part of the Patna Distributary was abandoned in order to improve the sanitary conditions in the neighbourhood of the new Capital at Patna. Length of distributaries.

17. The average rainfall of the 12 stations in the three divisions was 46.38 inches compared with the averages of 47.49 inches and 37.21 inches in 1916-17 and 1915-16 respectively and the average of 42.03 of the previous 20 years. The rainfall was above the average, evenly distributed and continued to a later date than usual, the area irrigated under *rabi* crops was consequently much reduced. Rainfall.

18. The area irrigated during the year was 526,492 acres against 535,698 acres in the preceding year. The decrease is due to the fact that in some cases the long lease which lapsed were not renewed owing partly to the failure of the cultivators to comply with the conditions and partly to favourable rainfall. Irrigation.

The demand for water-rates falling due during the year amounted to Rs. 18,02,869 against Rs. 17,72,639 of the preceding year. The increase is due to the fact that the long term leases renewed during the year were charged at the enhanced rates sanctioned with effect from the 26th March 1915. The amount assessed was collected practically in full before the end of the year.

**Navigation Receipts.** 19. The navigation receipts during the year were Rs. 22,648 against Rs. 17,068 of the previous year and an average of Rs. 20,660 for the previous five years. The figures of 1917-18 were a great improvement over those of the two previous years; owing to the restriction in Railway Service there was heavier boat traffic. The number of bamboo *balla* rafts also was unusually high.

**Financial Results.** 20. The gross receipts and working expenses (direct and indirect) were respectively Rs. 19,10,400 and Rs. 8,31,516 against Rs. 18,74,156 and Rs. 7,66,849 of the previous year, resulting in a net gain of Rs. 10,78,884 to Government.

**Floods.** 21. There were four floods in the river Son during the year and the Canals were closed on each occasion. The gauge reading at Barun on the 2nd August was the highest ever recorded, being 344.50 against a previous record of 343.70 in July 1910. The flood lasted an unusually long time. The Canals were kept closed as long as possible but the demand for water could no longer be denied and the Canals had to be opened at a high river level with the inevitable result of an increase in silt deposit. The record flood topped the bank of the Patna Canal in mile 50 but did no damage and the bank has since been raised.

**Flushing Operations.** 22. In the Eastern Main Canal five flushes were run during the year, but speaking of the season as a whole, the operations were not of much use, the September and October flushes which might have done some good were stopped on account of disturbances in the district as it was desirable to keep the country as dry as possible. The maximum discharge passed down was 2,178 cusecs. The total quantity of silt moved down was  $5\frac{1}{2}$  lakh cubic feet against 8 lakhs deposited.

The Main Western Canal was flushed three times during the season. The maximum discharge passed down was 4,376 cusecs on 24th October 1917. The third flush which lasted from 11th October to 30th November moved over six lakh cubic feet of silt.

"43"—MINOR WORKS AND NAVIGATION FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

**Investigation in connection with possible irrigation schemes.** 23. Investigations in connection with the proposed irrigation project from the Kiul river in the Monghyr District were carried out during the year. The project, on the lines proposed, has been dropped as being too expensive.

Some preliminary investigations carried out in connection with reservoirs for the Son Canals have so far shown that possibilities undoubtedly exist but the depletion of staff owing to the war has been so great as to prevent any sufficient reconnaissance at present. It can only be said that the Koel river and its tributaries provide one or more fair storage sites and that it will probably be feasible to supplement the supply sufficiently to allow of some extension of the Son Canal system.

Surveys were in hand for testing the possibilities of irrigation from storage reservoirs in the Government Estates in the Singhbhum District. Till staff is available after the war none of these schemes can be pushed on with any vigour however.

During the year under review surveys were also in progress of the Sakri river in Gaya District, in order to examine a proposal to divert the river back to its old bed, as the change in the course of the river has caused much deterioration in the Nawada Subdivision of that district.

GANDAK CIRCLE

PROTECTIVE IRRIGATION WORKS.—TRIBENI CANAL.

**Capital Account.** 24. The expenditure (direct charges) debited to the Capital Account of the Tribeni Canal during the year was Rs. 1,01,061 on works

included in the Schedule of incomplete works and on additional works chargeable to the Open Capital Account. The Capital Outlay for direct and indirect charges to the end of the year stands at Rs. 76,19,033.

The following works were in progress during the year :—

Works completed or in progress.

- (a) The new Khunti Nala Syphon.
- (b) Deolia Distributary.
- (c) A new Syphon at 172 chains of Hardinadwa Distributary.

Materials were also collected for the proposed Pandai and Bhora Syphons.

All the distributaries have been completed except the Rangi Distributary at the tail end of the Canal. Materials were collected and arrangements for starting the work were made.

Distributaries and village channels.

Surveys for village channels which were in progress last year have been completed. Projects were under preparation.

25. The rainfall was good at the beginning of the irrigation season but at the latter end it was insufficient to meet ordinary requirements, hence the demand for canal water increased and more than double the area of the previous year was leased out during the year under review. The total rainfall recorded was 75.26 inches at Ramnagar and 55.24 at Maniari against 79.62 and 80.01 respectively in 1916-17.

Rainfall.

26. The floods in the river Gandak were moderate. On the 24th July 1917 the river rose to 968.80 which was less by 1.20 than the flood level of the previous year and 9.15 lower than the highest recorded flood of 1902. The general condition of the supply in the river was good throughout the year. The Canal was opened for irrigation on the 26th June 1917.

Floods.

27. The total area irrigated was 58,801 acres against 28,107 acres in the previous year and an average of 52,778 acres of preceding three years. As stated above, the demand for canal water increased by the latter part of the season and hence, the rise in the area irrigated during the year, in comparison with the preceding year's abnormally low figure.

Irrigation.

28. The total working expenses (direct and indirect charges) amounted to Rs. 2,81,366 against the gross revenue of Rs. 1,15,415. The net loss to Government was Rs. 1,65,801 against the deficit of Rs. 2,08,381 of the preceding year. The Revenue Establishment maintained under the Collector at the cost of the Public Works Department collected the water-rates as usual; 64.1 per cent of the demand remained uncollected at the end of the year.

Financial results.

29. A rough project for the extension of the Tribeni Canal from the Telauhi to Teur was prepared in order to find out to what point the canal could profitably be extended and the preparation of the detailed project was put in hand.

Tribeni Extension scheme.

#### *Dhaka Canal.*

30. There was no capital outlay on the canal during the year under review. Rupees 1,022 was spent on constructing a drainage syphon at 8 miles 10 chains of the Siraha Branch and the expenditure was charged to the Revenue Account under '42'.

Capital Account

31. The total rainfall of the year was only 47.62 inches against 78.52 inches in the preceding year.

Rainfall.

32. The total area irrigated during the year was 7,170 acres against 3,363 acres of the preceding year. The demand for canal water was high by the latter part of the season owing to insufficient rainfall. The supply of the river was quite sufficient to meet the demand.

Irrigation.

33. The gross revenue derived from the Canal amounted to Rs. 15,516 against Rs. 8,584 of the preceding year while the total working expenses (direct and indirect) amounted to Rs. 29,145 against Rs. 16,726 of the preceding year. So the net deficit during the year under review was Rs. 13,629 against the deficit of Rs. 8,142 in the preceding year. The increase in the working expenses during the year was mainly due to the fact that extensive repairs had to be done to the head sluice.

Financial Results.

## WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

### THE TEUR (MADHUBAN) CANAL.

34. This small canal is only 6.18 miles long with a distributary 6.13 miles in length. The Canal was in good order and repairs cost Rs. 2,229 (excluding the cost of establishment). No original works were carried out during the year.

The rainfall of the year was 47.91 only against 71.41 inches in the preceding year. The demand for Canal water increased at the latter part of the season when rain failed. The total area irrigated was 1,727 acres inclusive of 253 acres of Madhuban Babu's *zirat* lands and the total receipts amounted to Rs. 3,089 against Rs. 2,865 of the preceding year.

### MINOR WORKS AND NAVIGATION.

#### WORKS FOR WHICH CAPITAL AND REVENUE ACCOUNTS ARE KEPT.

##### *The Saran Canals.*

35. The Canals, 19 miles \* in length remained practically closed since 1894. The question of abandoning them altogether has not yet been settled. The cost of maintaining the canals amounted to Rs. 310 (excluding the cost of establishment). The gross receipts amounted to Rs. 1,000 against Rs. 800 in the preceding year.

### EMBANKMENT AND DRAINAGE.

#### Classification of Embankments.

There are four classes of Embankments in this Province, namely :—

- (a) Embankments in Orissa, maintained at the expense of Government.
- (b) Schedule D and other embankments (excluding those in Orissa) maintained at the expense of Government.
- (c) Embankments not Government property but maintained by Government under the contract system.
- (d) Embankments not Government property but maintained by Government Officers as public embankments under the provisions of sections 47—58 of Act II (B. C.) of 1882.

#### Expenditure.

2. The total expenditure on works and repairs in connection with these embankments amounted to Rs. 89,784\* against Rs. 85,845 in the preceding year.

\* (Excluding Rs. 21,975 on works and repairs in connection with the Bankipore-Dinapore Road, Schedule D Embankments.)

#### Length of Embankments.

3. The total length of embankments of all classes maintained by Government in the Province was 821† miles 978 feet protecting an area of 7501.41 square miles. An actual survey of the Gandak embankments proved the length to be somewhat short of that shown last year.

† Exclusive of 4 miles 606 feet of Bankipore-Dinapore Road, Schedule D embankments.

#### Floods.

4. During the year under review high floods in the Orissa rivers occurred only in the Mahanadi, the Katjuri, some rivers in the Puri District and the Bāra Bolong. Some damage was caused to crops in certain tracts of the Puri District by breaches and by cuts made by villagers in some embankments.

The flood in the Ganges at Bankipore was the highest on record and the Bankipore-Dinapore road embankment stood well against it. There was some erosion on the right bank of the Panar river in the Purnea District which slightly damaged the spurs. There were no very high floods against the Madhipura and Bhagalpur Road Embankments.

In the Gandak Circle the floods were of an ordinary nature during the year under report. The flood level of the river Gandak near the railway bridge

\*24.05 miles including minor channels.

at Hajipur and of the Ganges at Chakaur in the 9th mile of the Gupta Bandh however exceeded the highest flood level previously recorded at these stations. The gauge at the former place rose to 166.30 and at the latter place to 140.13 against 166.20 and 139.83, the previous maxima.

5. Several breaches occurred in the Sunamahi, Nayanadi, Bhargovi, Kharsua No. 7(a) class B embankments in the Orissa Circle. The approximate area flooded was 73 square miles. The Patna Embankment No. 66B, the Daib Right Embankment No. 2B and Chitratola Embankment No. 55(g) and (h) each breached in one place. No damage was done to crops. Due steps were taken to close the breaches. Breaches.

There were no breaches on any of the embankments in the Gandak Circle.

The river Gandak eroded its left bank in 24th and 25th miles of the Tirhut Embankment to the extent of about  $\frac{3}{4}$ th mile in length and 10 to 25 feet in width but timely precautions stopped further cutting. Spurs which were put in to protect the scourings have so far proved successful.

The bed of the river between the 26th and 28th mile has silted up on the Embankment side.

The thick roots of big trees between the 24th and 27th miles stones of the Monghyr Embankment penetrating the bank caused some piping but have since been removed. An additional berm seven feet wide is being provided to stop further percolation.

The old breaches in the Gupta bandh were further widened with the result that a total length of 4,601 feet was washed away. No steps were however taken to prevent further cutting as the portion below 10th mile has been practically abandoned and the project of a retired line from this mile stone is under preparation.

The flood water rushed through the above breaches and inundated about 50 square miles of land in the Begusarai Subdivision causing damage to standing crops. There was however no loss of life or cattle. A proposal to construct a retired line to save Begusarai from flood has been approved by the Embankment Committee and the survey which began after the close of the year under report is now in progress.

The Champaran Embankment was seriously threatened near Dubaulia between 72nd and 73rd miles during the floods of 1916 but with the fall of the river the erosion ceased. In November 1917 the cutting recommenced very badly and orders were issued for the erection of two spurs which were in progress when the year closed.

The spurs and protective works constructed at Malahia in the previous year suffered nothing beyond petty damage to some of the bamboos and a small amount of brushwood washed away.

A *sota* of the river running along the old Surajpura bandh, now no longer maintained, opposite the 29th mile of the Champaran Embankment attacked the old bandh but a breach was prevented by floating tree spurs.

6. Detailed surveys were in progress during the year in connection with the proposed drainage channel from Paradia sluice in the Nayanadi to Satpara in the Puri District. The work was taken up very late in the year owing to difficulty in procuring a surveyor and could not be completed when the year ended. Surveys and Investigation.

In the Gandak Circle no survey for any new line was made during the year under review. The levels of crests, floors of sluices and Bench marks of the Saran Embankment were checked. Discharge observations of the Bur Gandak river at Khagaria during the flood season to ascertain what volume of water passes through the railway bridge were taken up at the cost of the District Board, Monghyr, but as there was no heavy flood no conclusions as to the adequacy or otherwise of the bridge opening could be arrived at.

**Original works.**

7. Expenditure on original works in Orissa Circle amounted to Rs. 9,384 against Rs. 2,237 of the preceding year.

The principal works carried out were (1) raising crest of Utikan Embankment, (2) closing Panu Panda and Kali Misra Ghais, (3) constructing an embankment connecting the embankment Nos. 6 and 7 (a) class B on the left bank of the Kharsua river.

No original works were carried out on any of the embankments during the year in the Gandak Circle.

**Repairs.**

8. The total amount expended on repairs was Rs. 50,400 against Rs. 83,402 in the preceding year. Of this, the sum of Rs. 29,704 was spent in the Orissa Circle, Rs. 45,858 in the Gandak Circle and Rs. 4,838 in the Eastern Circle.

The amount spent on ordinary maintenance and special repairs of the Gandak Takavi Embankment under contract was Rs. 35,017 against Rs. 33,896 in the preceding year.

No new retired lines were constructed on any of the embankments during the year under review. Some spur works were newly constructed on all the Takavi Embankments under contract. The Ring Bandh and spurs to the Malahia retired and the spurs at Sangrampur on the Champaran Embankment which were in progress from the previous year were completed during the year.

**Drainage.**

9. In the Gandak Circle the 12 Vent Sluice at Deosar in the 3rd mile of the Tirhut Embankment to drain off the Sarothar Chaur which was in progress from 1915-16 was completed during the year under review at a total cost of Rs. 11,372.

A proposal to construct two small sluices on both the banks of the Lahladpur channel at 33rd mile of the Tirhut Embankment for draining off water from the low lands of the adjacent villages was sanctioned during the year at an estimated cost of Rs. 1,654. The work was completed at an outlay of Rs. 1,350.

A fall board was also provided in a bridge on the Lahladpur channel for the above purpose at a total cost of Rs. 495.

The scheme for constructing an embankment and a sluice to prevent flood water entering the Pembranda Chaur in the district of Darbhanga was approaching completion.

There are no drainage works in this Province constructed under the Bengal Drainage, Sanitary Drainage or Embankment Act, excepting a small scheme known as the Rajmahal drainage scheme completed in 1902 and maintained by the Civil Officers under the Bengal Drainage Act, VI of 1880.

## APPENDIX A

### BUILDINGS, ROADS AND IRRIGATION.

*Statement of expenditure on Public Works during 1917-18.*

	Original Works.		Repairs.		Total.	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
1	2	3	4	5	6	7
<b>IMPERIAL.</b>						
<b>35—Construction of Protective Irrigation Works—</b>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Works ... ..	...	...	...	...	90,962	88,048
Establishment ... ..	...	...	...	...	25,938	24,127
Tools and Plant ... ..	...	...	...	...	5,100	4,223
Suspense ... ..	...	...	...	...	...	...
Receipt on Capital Account ... ..	...	...	...	...	-3,000	-8,822
<b>Total, Protective Works</b> ... ..	...	...	...	...	1,19,000	1,07,576
<b>47—Military Works—</b>						
Works ... {	6,000	6,457	...	...	6,000	6,457
Special ... ..	12,485	10,172	11,673	11,038	24,158	21,210
Ordinary ... ..	...	...	...	...	5,116	4,323
Establishment ... ..	...	...	...	...	362	302
Tools and Plant ... ..	...	...	...	...	...	...
Barrack Department ... ..	...	...	...	...	...	...
Suspense ... ..	...	...	...	...	...	...
Expenditure in England ... ..	...	...	...	...	...	...
<b>Total, Military Works</b> ... ..	18,485	16,629	11,673	11,038	35,656	32,292
<b>45—Civil Works—</b>						
Works ... {	1,46,293	1,51,350	52,238	49,431	1,98,531	2,00,781
Civil Building ... ..	...	...	...	...	...	...
Communication ... ..	...	...	...	...	...	...
Miscellaneous Public Improvement ... ..	...	...	...	...	...	...
Establishment ... ..	...	...	...	...	42,661	42,201
Tools and Plant ... ..	...	...	...	...	2,974	2,946
Suspense ... ..	...	...	...	...	...	...
Deduct—Expenditure in England ... ..	...	...	...	...	...	...
<b>Total, Civil Works</b> ... ..	1,46,293	1,51,350	52,238	49,431	2,44,166	2,45,928
<b>Carried over</b> ... ..	...	...	...	...	...	3,85,796





## APPENDIX A—concluded.

1	Original Works.		Repairs.		Total.	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Brought forward ...	...	...	...	...	...	82,57,552
<b>LOCAL FUNDS.</b>						
Other Local Funds ...	...	2,26,860	...	1,28,669	...	(a) 4,01,086
District Funds ...	...	...	...	...	...	(b) 47,94,301
Total, Local Funds ...	...	...	...	...	...	51,95,387
<b>CONTRIBUTION.</b>						
Imperial ... { Military ...	...	...	...	...	...	...
... { Civil ...	...	...	...	...	...	...
Provincial ... { Civil Building ...	...	1,50,603	...	625	...	1,51,228
... { Irrigation ...	...	...	...	...	...	...
Minor Works and Navigation ...	...	...	...	...	...	12,868
Total, Contribution ...	...	1,50,603	...	625	...	1,64,096
<b>GRAND TOTAL</b> ...	...	...	...	...	...	1,36,17,035

(a) Includes Rs. 46,556-11-3 on account of supervising establishment and Tools and Plant.

(b) Includes Rs. 6,51,342 for Establishment and Rs. 87,270 for Tools and Plant.

APPENDIX B.

Statement showing the length of road communication, village roads, maintained by the public authorities in Bihar and Orissa during the year 1917-18.

[This statement does not include roads and streets within Municipal limits, and maintained from Municipal Funds.]

Name of Division.	Name of District.	Length in miles of metalled roads maintained by the Public Works Department.	Length in miles of unmetalled roads maintained by the Public Works Department.	Length in miles of metalled roads maintained by Local authorities.	Length in miles of unmetalled roads maintained by Local authorities.	Total of metalled roads.	Total of unmetalled roads.	Grand Total.
1	2	3	4	5	6	7	8	9
Patna	Patna	34	..	134	471	168	471	639
	Gaya	87	...	202	734	289	734	1,003
	Shahabad	58	..	193	419	256	419	675
Tirhut	Saran	...	...	182	908	182	908	1,090
	Champaran	1	...	35	1,181	36	1,181	1,217
	Muzaffarpur	...	1	110	1,171	148	1,172	1,318
	Darbhanga	4	2	78	2,125	76	2,127	2,203
Bhagalpur	Bhagalpur	..	..	80	1,700	80	1,700	1,780
	Monghyr	...	..	119	1,360	119	1,360	1,479
	Purnea	...	...	138	1,571	138	1,571	1,709
	Santal Parganas	...	...	47	826	47	826	873
Orissa	Cuttack	75	21	108	432	193	453	636
	Puri	118	...	122	198	240	193	433
	Balasore	104	2	54	270	158	272	430
	Angul	37	88	...	...	37	86	123
	Sambalpur	100	20	4	147	104	167	271
	Orissa Feudatory States	11	209	..	...	11	209	220
	Ranchi	120	28	23	701	143	729	873
Chota Nagpur...	Palamau	13	...	9	476	18	475	494
	Hazaribagh	121	13	92	595	303	608	911
	Manbhum	145	..	104	620	249	620	899
	Singbhum	79	5	1	369	50	374	454
	Total	1,170	387	1,573	16,589	3,043	16,556	19,99

List showing in order of urgency, the new lines of Railways in Bihar and Orissa, which should take an early place in the programme of construction for the year 1919-20.

Order of priority.	Name of project.	Existing Railway with which the project is connected at initial point.	Initial and terminal points.	Whether Surveyed or not.	Gauge.	Length in miles.	Estimated cost.	Remarks.
1	2	3	4	5	6	7	8	9
					ft. in.		Lakhs of Rupees.	
1	Lohardaga Extension ...	Bengal-Nagpur Railway ...	Lohardaga and Netarlat Plateau ...	Surveyed in 1916-17 ...	2 6	34	...	
2	Bhojudih-Daltonganj Railway ..	Ditto ...	Bhojudih and Daltonganj ...	Surveyed in 1889-90 and 1897-98 ...	5 6	171	1,68,00	
3	Daltonganj-Hutar Coal field Railway.	East Indian Railway ...	Daltonganj and Hutar Coal field ...	.....	...	...	...	
4	Hazaribagh Road--Hazaribagh Railway.	East Indian Railway--Grand Chord Line.	Hazaribagh Road Station and Hazaribagh Town.	Surveyed in 1914 ...	2 6	41	14,58	
5	Gaya-Sherghati Railway	East Indian Railway ...	Gaya Station and Sherghati ..	Surveyed in 1912 ...	5 6	22	12,80	
6	Chakradharpur-Jaintgarh Railway...	Bengal-Nagpur Railway ...	Chakradharpur and Jaintgarh via Chaibassa.	Surveyed in 1916 ...	2 6	56	26	
7	Bhadrak-Chandbali Railway ...	Ditto ...	Bhadrak Station and Chandbali ...	Surveyed in 1915 ...	5 6	29	25,55	
8	Kapilas Road--Sambalpur Railway	Di to ...	Kapilas Road and Sambalpur ...	.....	...	...	...	
9	Thakurgaon-Purnea Railway ...	Eastern Bengal Railway ...	Thakurgaon Station in the projected Siliguri-Kishenganj line to Purnea.	Not Surveyed ...	3 3½	...	...	
10	Bausi-Baidyanath Railway ...	East Indian Railway ...	Bausi to Baidyanath or Deoghar ...	Surveyed in 1899 ...	5 6	44	32,35	
11	Bhagalpur-Nalhati (or Ahmadpur) Railway.	Ditto ...	Bhagalpur to Nalhati or Ahmadpur.	Surveyed in 1895-96 ...	5 6	...	...	
12	Laheria Sarai Singhia-Shakar p u r a Extension.	Bengal and North-Western Railway, Tirhut Section	Laheria Sarai and Shakarpura ...	.....	3 3½	...	...	
13	Muzaffarpur-Darbhangra Railway ...	Bengal and North-Western Railway	Muzaffarpur and Darbhanga ...	Surveyed in 1906-07 ...	3 3½	38	32,70	
14	Tewara-Sitamarhi Railway ...	Ditto ...	Tewara and Sitamarhi ...	Ditto ...	3 3½	30	16,53	

The 11th June 1918.

F. CLAYTON,

Secretary to the Government of Bihar and Orissa,  
Public Works Department.

# GOVERNMENT OF BIHAR AND ORISSA

PUBLIC WORKS DEPARTMENT.

S/1283

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## ANNUAL ADMINISTRATION REPORTS

FOR

5

ROADS AND BUILDINGS, IRRIGATION AND RAILWAYS

FOR THE YEAR

1918-19.

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PATNA

PRINTED AT THE BIHAR AND ORISSA GOVERNMENT PRESS.

1919.

## SUMMARIES.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

Messrs. Stanley and Clayton, Chief Engineers and Secretaries to Government, held charge of their respective offices throughout the year. One Assistant Engineer was appointed to the Provincial Engineer Service. The services of one Executive Engineer were placed temporarily at the disposal of the Government of India in the Public Works Department. One Executive Engineer and two Assistant Engineers joined the Indian Army Reserve of Officers.

Administrative changes.

The temporary No. II Subdivision of the Special Works Division, Bankipore, was closed and a temporary Subdivision was opened under the Brahmini Division with headquarters at Harbhanga.

A revised scale of pay was sanctioned for the Revenue staff in the Orissa Circle, and a time-scale of pay for the Upper Subordinate establishment.

At the request of the Government of India, a preliminary examination of the issues involved in the recommendations made by the Public Works Department Reorganization Committee relating to the transfer of Public Works to local bodies and to the encouragement of private enterprise in this province, was considered by a small Committee in April. The Local Government then received the provisional recommendations made by the Government of India on the conclusions arrived at by the Public Works Department Reorganization Committee and replies were submitted on all the questions on which their opinion was asked.

Public Works Department Reorganization Committee.

The tentative conclusions of the Government of India on the recommendations of the Public Services Commission were received for an expression of opinion of the Local Government and a reply containing their views was sent.

Public Services Commission.

#### BUILDINGS.

In the beginning of the year under review, the Government of India urged upon the Local Government the necessity of effecting all possible economy, and asked that all building operations except those of the most urgent nature should be postponed. In pursuance of the above request the building programme for the year was heavily curtailed with the result that the expenditure on original works—Civil Buildings (Provincial) during the year amounted to Rs. 22,42,663 as compared with the original Budget provision of Rs. 50,40,500.

General.

In spite of the shortage of transport which continued throughout the year and the great difficulty in obtaining building materials, good progress was made with all building work in the Capital. This was chiefly due to the very extensive use which was made of reinforced brick work in the construction of walls, floors and roofs of all buildings. This form of construction dispensed with the necessity for all rolled steel joists and steel work generally of large sections and had the further advantage of reducing the cost of the work and effecting a considerable saving at a time when prices were steadily rising. It enabled the construction of the remaining officers' residences and clerks' and menials' quarters to be proceeded with and their completion during the year, brought the building programme of the new Capital practically to a close.

Work in the Capital at Patna.

The sewerage scheme in the new Capital was commenced, but was subsequently postponed under orders of the Supreme Government.

The greater part of earthwork on the Patna-Dinapur road (from the Government House) was completed and soling and metalling was in progress on certain portions of the road.

#### IMPERIAL MILITARY WORKS.

The construction of an armoury and quarters for the Sergeant Instructor of the Bihar Light Horse at Bhagalpur and of a barrack for four constables and one head constable at Chandipur were completed. Progress was made with the collection of materials for several other military buildings at Chandipur.

#### IMPERIAL CIVIL WORKS.

Post and Telegraph Office Buildings.

The combined Post and Telegraph office building at Madhupur was in progress. The postal staff quarters at Raxaul and the quarters for the Deputy Postmaster, six clerks and a signaller attached to the Puri post office were completed.

Miscellaneous.

Mr. Graham's house at Bankipore was purchased at a cost of Rs. 28,706 for use as a combined office and residence of the Superintendent, Archæological Survey, Eastern Circle. Land was acquired and materials were collected for an office and godown and an Inspection bungalow for the Archæological Department at Nalanda. New quarters were constructed for the third clerk, one Draftsman-Surveyor and other staff of the Chief Inspector of Mines at Dhanbad. The Residency Overseer's quarters at Raxaul were in progress.

#### PROVINCIAL CIVIL BUILDINGS.

Court Building.

No work of any importance was undertaken during the year in connection with the Court buildings. The following were some of the less important works :—

Two 'vendors' stalls were constructed in the Kachahri compounds at Bankipore and Purulia. The construction of a new record room with record racks in the Subdivisional court at Dinapore was in progress. The thatched roof of the Treasury guard's barrack and cook-shed at Phulbani was replaced by a roof of Ganjam pattern tiles. Progress was made with the construction of an additional building for the Sub-Treasury and Record room at Banki. The double munsifi at Buxar was also in progress.

Jails.

The construction of a new double-storied barrack and balconies to the existing barracks in the Central Jail at Bhagalpur was in progress. Five godown cells, cook-shed and latrine and a new hospital in the Central Jail at Gaya and two Assistant and Deputy Jailor's quarters in the Central Jail at Buxar were completed. Several works of improvements were undertaken in the Hazaribagh Central Jail. Certain works in connection with the Puri Jail, e.g., the construction of quarters for the Jailor, Assistant Jailor, Head Warder and Matron and also of a cow-shed, etc., which had to be stopped during the previous year for want of cement were resumed and completed.

Police.

The old Opium Agent's office building at Bankipore was converted into Pirbahore Police Station. The construction of quarters and stables for the mounted Police Force in the compound of the new Kotwali Police building at Bankipore was in progress as also the Town Police Barrack and subsidiary buildings at Khazanchihat, Purnea, and barracks for the accommodation of Armed Police at Jamalpur. On the Nepal Frontier four outpost buildings were completed and the remaining four were in progress. The construction of two barracks for 50 constables each in connection with the Reserve Police buildings at Chapra was taken in hand and fair progress was made. Progress was also made with the construction of a double-storied barrack with cook-sheds for the constables of the Reserve Police Lines at Cuttack.

The residence for the Principal, Greer Bhumihar Brahman College at Muzaffarpur, which was in progress from the previous year, was completed. The hostel blocks and out-houses of the College were in progress. The old Zila School buildings at Puri were permanently transferred to the Puri Sanskrit College which was provincialized. Progress was made with the construction of a hostel and a residence for the Lady Principal of the Ravenshaw Girls' School at Cuttack. The construction of an additional block for 16 workers with office and store room in the compound of the weaving shed at Sambalpur was completed. A hostel for 50 Hindu and Muhammadan boarders of the Hazaribagh Zila School with Hostel Superintendent's quarters was in progress.

The Asylum for European insanes at Kanke, Ranchi, was opened by the Medical Department on the 17th May 1918. Certain minor buildings were constructed in the Asylum for the Indian insanes. Owing partly to the contemplated change of design of several important buildings, and partly to the scarcity of materials, the full programme of work of the year in connection with the above asylum could not be executed.

The construction of a dissecting block in the Temple Medical School at Bankipore and of a female out-patient ward in the General Hospital at Cuttack was in progress. The Leper Asylum at Cuttack was undertaken during the year and the work was in full progress when the year closed. The tuberculosis ward in the Sadr Hospital at Chapra, was completed and made over to the Municipality.

As a result of the decision to economise where possible, no new Sub-registry offices were undertaken during the year under review with the exception of one at Koilwar which was constructed only to avoid the deterioration of materials already collected. The few Sub-registry offices in progress from the previous year, were completed.

The office building of the Executive Engineer, Cuttack Division, at Cuttack and the Public Works Department Subdivisional offices and godowns at Bhagalpur and Chaibassa with Subdivisional Officer's residence at the latter station, were completed. A cement godown was constructed at Dhanbad and also a godown for storing famine tools at Chaibassa.

A solid iron beam was transferred from the Black Pagoda at Kanarak to the Calcutta Museum. Some special repairs were done to the temple at Kanarak with a view to preventing the collapse of stone works of the temple. The erection of a monument in the battle-field of Buxar was almost completed.

A three-roomed cottage with bath-rooms was constructed for the Government House at Ranchi. The new gate buildings in the above Government House were also nearly completed. A barrack with cook-shed was constructed for the Police Guard attached to the Government House at Puri.

The construction of a new residence for the Executive Engineer at Sambalpur was in progress. The residences for a Sub-judge and three Munsifs at Bankipore were completed and the remaining two Sub-judges' residences at that station and the residence of the Agency Inspector of Schools of the Orissa Feudatory States at Sambalpur were approaching completion.

### COMMUNICATIONS.

Only ordinary works in progress from previous years, and works of an urgent nature were taken up during the year.

The Patna-Gaya Road *via* Khagaul, Masaurhi and Jahanabad which forms part of the through trunk road from Bihar to Orissa, was considerably improved. The work of widening the Bankipur-Dinapur road was almost completed. Additional waterways were provided in miles 303 and 308 of the Grand Trunk road. Trial borings were taken in the Lilajan river at Dobhi to enable designs to be prepared for a high level bridge.

Considerable improvements were effected on the Ranchi-Chaibassa road by increasing the waterways of some of the culverts and by substituting masonry arch-flooring for worn-out wooden floors of some of the bridges. The widening of the right flank of the Barakar-Purulia road was completed and a start was made with the construction of bridges over the Gowain and Izri rivers on the Chas-Gulbera road.

Certain improvements to the Cuttack-Sambalpur road, 2nd section, 3rd portion, were nearly completed, while considerable progress was made with similar work on the Angul-Tickerpara road; all the bridges and culverts on the latter road were built. The construction of bridges over the Nigra, the Matulia and another stream on the 1st section of the Angul-Tickerpara road was taken in hand. Metalling of the Cuttack-Sonpur road in Banki Estate, and of the Cuttack-Sambalpur road, 2nd section, approached completion. The abutment and three piers of the bridge under construction over the Nigra river at Matanga on the Cuttack-Angul road were completed and the work of diverting the Cuttack-Sonpur road between Harbhanga and Sitalpani was undertaken during the year. Bridges on the Raipur-Sambalpur road were remodelled, and the construction of a raised causeway over the Bargarh nala on the Bargarh-Bolangir road was almost finished.

The old Dāk Bungalow at Dehri was converted into an office and quarters for a Sectional Officer.

The Inspection Bungalow under construction at Jamshedpur was completed, while a third Inspection Bungalow at Netarhat was almost finished at the end of the year. Certain improvements were made to the combined Dāk and Inspection Bungalow at Giridih.

The reconstruction of the Inspection Bungalow at Sitalpani on the Cuttack-Sonpur road was in hand, and work on the extension of the Dāk Bungalow at Cuttack was completed.

The planting and maintaining of trees alongside roads were carried out as usual.

#### MISCELLANEOUS PUBLIC IMPROVEMENTS.

A few works, mainly required for the safety of Government buildings from river encroachments, were taken up during the year.

The skin revetment under construction along the right bank of the river Ganges from the Civil Surgeon's compound to the Bankipur-Club was completed. Existing revetments below the Patna College, and the quarters for the Principal, Bihar School of Engineering, were repaired. Arrangements were made to repair the revetment below the old Recreation Bungalow at Gulzarbagh.

A masonry drain was constructed across the Race Course at Muzaffarpur.

Improvements were made to the tank in the Kachahri compound at Banki, Cuttack.

The metalled road under construction on the crest of the Katjuri Left Embankment at Cuttack was finished.

#### RAILWAYS.

Administration.

Three Light Railways are partially under the control of the Government of Bihar and Orissa. The Government of India in the Railway Department (Railway Board) control the larger and more important Railway systems.

Mileage.

The total mileage during the year under review remained unchanged.



Surveys of about 94 miles were completed and authority was given by the Railway Board for the survey of three new lines. Surveys.

On the Bakhtiyarpur-Bihar Light Railway there were seven derailments. Accidents.  
On one occasion a boy fell from a train and received serious injuries and on another occasion a boy attempted to pass between two trucks and was killed. A man also was run over and killed, on another occasion. On the East Indian Railway there were two derailments without loss of life. On the South Bihar Branch of the East Indian Railway a bridge collapsed while a passenger train was going over it and resulted in two passengers being killed and three wounded.

### CANALS.

The area irrigated by the two Productive Works, viz., the Orissa and Son Canals systems was 924,603 acres against 798,068 acres of the preceding year. The increase is due to the fact that there was an abnormally large *rabi* area on the Son Canals owing to the drought in October and November. These two canals are open for navigation and there was a slight increase in traffic on the Son Canals owing to the railway restrictions. Productive Works.

The gross receipts from all sources amounted to Rs. 25,83,632 against Rs. 24,94,344 collected in 1917-18. The water-rate receipts from the Son Canals were over three-quarters of a lakh of rupees above the average of the previous five years—the increase being mainly due to the development of long leases at the enhanced rate; the receipts from the large *rabi* area mentioned above, will appear in the accounts of the year 1920-21. There was also a slight increase in the navigation receipts.

The total working expenses (direct and indirect) amounted to Rs. 12,33,561. The nett gain to Government after meeting the year's working expenses was Rs. 13,50,071 which did not fully cover the interest charges of the year, amounting to Rs. 18,25,271. Including interest charges, the Orissa Canals were worked at a loss of Rs. 7,43,339 while the Son Canals brought in a net revenue of Rs. 2,68,139.

No new works of any importance were undertaken and the canals were maintained in a fair condition. There was a keen demand for canal water during the abnormally dry *rabi* season and water was supplied as well as possible to the leased areas.

The area irrigated by the Protective Works, viz., the Tribeni and Dhaka Canals was 66,300 acres against 65,791 acres of the preceding year. The long lease system was introduced on these canals for the first time during the year and about 19,000 acres were so leased out. These two canals are used for irrigation only. Protective Irrigation Works.

The gross receipts amounted to Rs. 1,50,322 while the working expenses (direct and indirect) were Rs. 3,11,313 resulting in a nett loss of Rs. 1,60,991 (excluding interest charges).

The three canals falling under this class, viz., the Teur (Madhuban) Canal, Orissa Coast Canal and Saran Canals were maintained at a total cost of Rs. 18,214 (excluding Establishment and Tools and Plant charges). The Teur Canal irrigated an area of 2,001 acres. The Orissa Coast Canal is open for navigation only while the Saran Canals are closed to irrigation since 1834. The gross receipts from these canals amounted to Rs. 12,025 only. Minor Works and Navigation.

Preliminary surveys and investigations in connection with certain possible irrigation schemes were carried out but these are not sufficient to admit of the preparation of any detailed estimates being taken in hand. Surveys and Investigations.

### EMBANKMENT AND DRAINAGE WORKS.

The expenditure on embankments was Rs. 1,74,362 against Rs. 89,784 in the preceding year. Of this the sum of Rs. 1,02,191 was expended on ordinary repairs and river protective works. The floods in the rivers were all of an ordinary nature.

## CHAPTERS.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

The appointments of Chief Engineers and Secretaries to Government in the Buildings and Roads, and Irrigation Branches, were held by Messrs. Stanley and Clayton, respectively, throughout the year. The services of Mr. Dunbar, Executive Engineer and Under-Secretary, Buildings and Roads Branch, were placed temporarily at the disposal of the Government of India in the Public Works Department early in April and Mr. W. Albert-Samuel, Assistant Secretary, held charge of the current duties of the office till the 1st week of August when Mr. Dunbar came back and resumed charge of his office. Mr. Dunbar's services were placed again at the disposal of the Government of India in September and Mr. Albert-Samuel held charge till the 2nd January when Mr. Brebner, Executive Engineer, joined the office. Administrative changes.

The Orissa, Western and Eastern Circles remained in charge of Messrs. Bremner, Edge and Blaber, Superintending Engineers, respectively, throughout the year. Mr. Mellor, Superintending Engineer, continued in charge of the Son Circle till the end of the year except for a period of six weeks during which he was on privilege leave and Mr. Bishun Svarup, Executive Engineer, held charge of the Circle. Mr. Huntingford, Superintending Engineer, continued in charge of the Gandak Circle, till the end of the year with an interval of five weeks' privilege leave during which Mr. Gubbay, Executive Engineer, held charge of the current duties of his office.

Mr. Munnings held the appointment of Government Architect with an interval of one month's privilege leave till about the middle of November, after which he proceeded on combined leave and Mr. Millwood, Assistant Architect, whose release from Military duty was obtained as a special case, was appointed to officiate as the Government Architect.

The appointment of Sanitary Engineer was held by Mr. Temple till the end of the year except for a period of five weeks when he was on privilege leave and Mr. Alexander, Assistant Sanitary Engineer, was appointed to officiate.

Maulavi Abdul Karim, a passed student of the Thomason Civil Engineering College, Rurki, was appointed to the Provincial Engineer Service as an Assistant Engineer.

Mr. Marshall, Executive Engineer, and Messrs. Duncan and Hudson, Assistant Engineers, joined the Indian Army Reserve of Officers. Mr. Millwood, Assistant Architect, returned to his civil duties during the year.

In the Special Works Division, Bankipore, No. II Subdivision was closed and the works in it were distributed to other Subdivisions. A temporary Subdivision was opened under the Brahmini Division (with headquarters at Harbhanga in connection with a diversion of the road from Tikarpara to Phulbani).

A revised scale of pay was sanctioned for the Revenue staff in the Orissa Circle, with effect from the 1st May 1918. The time-scale of pay for the Upper Subordinate establishment which had already been approved but could not be financed previously, was introduced with effect from the 1st January 1919.

At the request of the Government of India, a preliminary examination of the issues involved in the recommendations made by the Public Works Public Works Department Reorganization Committee.

Department Reorganization Committee relating to the transfer of Public Works to local bodies and to the encouragement of private enterprise in this Province, was considered in April by a small Committee comprising the two Chief Engineers, a Chairman and a Vice-Chairman of a District Board and an experienced District Engineer presided over by the Hon'ble Member in charge of the Public Works Department. Later on, the Local Government received the provisional recommendations made by the Government of India on the conclusions arrived at by the Public Works Department Reorganization Committee in regard to the transfer of Public Works to local bodies and the encouragement of private enterprise, questions of accounts procedure and decentralization, organization and conditions of service of the specialist branches, and general reorganization of the department, and replies were submitted on all the questions on which the opinion of the Local Government was asked.

**Public Services Commission.**

The tentative conclusions of the Government of India, as far as the Public Works Department is concerned, on the recommendations contained in the report of the Public Services Commission were received for an expression of opinion of the Local Government and their views were communicated to the Government of India.

## BUILDINGS.

### IMPERIAL MILITARY WORKS.

The construction of an armoury and quarters for the Sergeant Instructor of the Bihar Light Horse at Bhagalpur was completed. The Lascars' shed at Chandipur was rebuilt and a barrack was built for four constables and one Head constable at that station. Progress was made with the collection of materials for the construction of other military buildings at Chandipur and for the improvement of the Chandipur road.

### IMPERIAL CIVIL WORKS.

**Post and Telegraph Offices.**

The construction of a combined Post and Telegraph office building at Madhupur was in progress. An existing building in the compound of the Hazaribagh Post office, was converted into Signaller's quarters. The Postal staff quarters at Raxaul which were under construction from the previous year, were completed. Quarters were built for the Deputy Postmaster, six clerks and a signaller attached to the Puri Post office. The work of rebuilding a cracked wall and providing Raniganj tiled roof to the Post office building at Jellasore was nearing completion.

**Miscellaneous.**

Mr. Graham's house at Bankipore was purchased at a cost of Rs. 28,706 for use as a combined office and residence for the Superintendent, Archæological Survey, Eastern Circle. Land was acquired and materials were collected for constructing an office and godown and an Inspection bungalow, for the Archæological Department at Nalanda.

New quarters were constructed for the 3rd clerk, one Draftsman-Surveyor and some other staff of the office of the Chief Inspector of Mines at Dhanbad. The construction of a residence for the Electrical Engineer, Pusa, was completed with the exception of a few petty items.

Two spurs were constructed in the river Siriswa at Raxaul for the protection of the Nepal Resident's bungalow against its encroachment. The Residency Overseer's quarters at Raxaul were taken in hand but could not be completed on account of the failure in brick-burning.

The work of constructing a shed for the boat-men and khalasis at Hukitola was taken up.

PROVINCIAL CIVIL WORKS.

Some materials were collected for the new Civil Court buildings at Gaya. A stall was constructed for Muhammadan bakers in the Collectorate compound at Bankipore and certain improvements were also carried out in the said Collectorate and the office of the Board of Revenue. A Guard room with a cook-house for the Treasury Guard was constructed in the Deputy Commissioner's court at Hazaribagh and a vendors' stall was erected in the Kachahri compound at Purulia. The work of extending the existing certificate office and Nazarat building to provide accommodation for courts of Deputy Magistrates at Chapra was completed. Certain improvements were made in the Collector's Record room at Cuttack and additions and alterations were carried out in the Shahabad Collectorate and to the Court Inspector's and Sadr Kanungo's rooms in the Puri Collectorate. Court Buildings.

The work on the construction of a building to accommodate malkhana, hajat and office of the Deputy Superintendent and Court Sub-Inspector in the Subdivisional court at Deoghar and of a new record room and record racks in the Subdivisional court at Dinapore was in progress. Certain additions and alterations were carried out in the Subdivisional officer's court at Chatra and materials were collected for extending the Subdivisional court buildings at Siwan. The thatched roof of the Treasury Guard's barrack and cook-shed at Phulbani was replaced by a roof of Ganjam pattern tiles and the construction of a suitors' shed, latrine and urinal in the court compound at Phulbani was commenced and very nearly completed. Progress was made with the construction of an additional building for the Sub-Treasury and record room at Banki. A malkhana was constructed for the Nazir of the Subdivisional court at Aurangabad and wicket gates were provided to the doors of the English office and the four centre rooms of the above court buildings were remodelled. Certain additions were made to the Subdivisional court building at Sasaram.

Fire-appliances with iron tank were provided for the court of the Subordinate Judge at Sambalpur. The erection of a Chaukidar's shed in the Munsif's court compound at Bihar was completed. Materials were collected for the extension of the Munsif's court at Dhanbad and the double Munsif at Buxar was in progress.

Some additions and alterations were made to the out-houses attached to the Circuit House at Puri. The Circuit House at Dhanbad was provided with venetian shutters and the Chalet at Netarhat with an eternit sheet ceiling on the ground floor. Circuit House.

The following works were in progress in the Central Jail at Hazaribagh :— Jail.

- (1) Closing up ventilating spaces in the several wards and cells and providing ventilating holes covered with iron grating.
- (2) Replacing old-fashioned masonry night latrines by cottage pattern latrines.
- (3) Closing up windows in the sentry boxes looking into the jail and allowing slits into the wall as peep-holes for sentries, etc.
- (4) Fixing blanchard lamps for lighting the jail at night.
- (5) Improvement to water-supply to the Reformatory School and Central Jail.

The new double-storied barrack and balconies to the existing barracks in the Central Jail at Bhagalpur were in progress and the five godown cells, cook-hed and latrine and a new hospital in the Gaya Central Jail were finally completed. Quarters were constructed for the additional Sub-Assistant Surgeon in the same jail and the construction of a separate female ward was nearing completion. Several other minor improvements were also carried out in the Central Jail at Gaya. The construction of two Assistant and Deputy Jailor's quarters in the Central Jail at Buxar was completed and materials were collected for the extension of the office building.

The construction of the Jailor's quarters in the intermediate jail at Dumka was almost completed. A wall was constructed round the work-shed in the Purulia Jail and bricks were collected for a double storied under-trial prisoners' and Segregation ward in the same jail. The works of constructing a cook-shed and certain improvements appertaining to the Cuttack Jail which were in progress from the previous year, were completed and considerable progress was also made with the construction of a thirty-seated latrine in the aforesaid jail. Certain improvements to the Puri Jail consisting of construction of quarters for the Jailor, Assistant Jailor, Head Warder and Matron and cow-shed and kitchen for the jail and Civil ward which had to be stopped during the previous year for want of cement, were resumed and completed. The work of strengthening the weak grated door of the main sleeping ward of the Balasore Jail was almost completed.

A barrack for warders of the Kendrapara sub-jail was under construction.

Police.

At Bankipore, the old Opium Agent's office building was converted into a Pirbahore Police-station, a start was made with the construction of quarters and stables for the Mounted Police Force in the compound of the Kotwali Police building. The Police out-post building at Mithapur was completed except for wire-fencing, as also the Band Master's quarters and Kotwali Police buildings. The construction of a Town Police barrack and subsidiary buildings at Khajanchihat, Purnea, and the provision of extra rafters in the roof of the Constables' Training School barrack at Nathnagar, Bhagalpur, were taken up. The barrack for the accommodation of Armed Police and quarters for a Sergeant at Jamalpur and quarters for three Sub-Inspectors of Police and four Head constables at Araria were in progress. In the Nepal Frontier four out-post buildings were completed and the remaining four were in progress. The construction of the Constables' barrack at Dhanbad was taken in hand. Quarters were under construction for three Sub-Inspectors and five Head constables attached to the Police office at Dhanbad. The Police-station building with residential quarters at Saspur and the barrack for the Armed Reserve Police at Daltonganj which were in progress from the previous year were completed. New quarters were constructed for the Reserve Sub-Inspector of Police at Sambalpur.

The construction of two barracks (for 50 constables each) in connection with the Reserve Police buildings at Chapra was taken in hand and the roofs of both the barracks were in progress when the year closed. Considerable progress was also made with the Thana buildings at Bettiah.

A start was made with the construction of a double-storied barrack with two cook-sheds for the constables of the Reserve Police Lines at Cuttack. Two kitchens for patients of the Police Hospital in the above Police Lines and an infectious diseases ward in the compound of the Constables' Training School at Chauliaganj (Cuttack) were constructed. Quarters were built for the Inspector of Temple Police at Puri and progress was made with the construction of quarters for the Police Inspector at Nimapara. The Police out-post at Patkura underwent some additions and alterations. The thatched roof of the Police office building at Angul was replaced by a terraced roof. The work of providing a non-inflammable roof to the Police-station building at Balasore was in progress.

Education.

The construction of the residence for the Principal, Greer Bhumiharai Brahma College at Muzaffarpur, which was in progress from the previous year, was completed. The hostel blocks and out-houses of the College were in progress. The work of providing a system of drainage in the compound of the proposed Ravenshaw College buildings at Chauliaganj, Cuttack, was completed and some materials were collected for the construction of quarters for two Indian Educational Service officers in the aforesaid compound and trees were also planted in the compound. The conversion of the Gymnasium shed in the Law College, Patna, into class rooms was in progress. An additional plot of land was acquired for the extension of the play-ground of the Bihar School of Engineering at Bankipore. Certain improvements to the Purulia Zila School, such as the construction of a hall, two additional class rooms and

a new verandah, etc., were in progress. Quarters were constructed for the Superintendent of the Muhammadan hostel attached to the above school. The construction of a hostel for 50 Hindu and Muhammadan boys of the Hazaribagh Zila School with Hostel Superintendent's quarters was in progress. The following works in the Reformatory School at Hazaribagh were either completed or in progress :—

- (1) Providing lightning-conductor to the roof of the ophthalmic and operation room of the hospital attached to the school.
- (2) Improvements to water-supply to bathing platforms of the boys.
- (3) Making water connection to the old and new staff quarters and providing a branch sewer to it.
- (4) Improvement to general cook-shed and constructing a guard house for the school.

The construction of an additional block for 16 workers with office and store room in the compound of the Weaving School at Sambalpur was completed.

The residence and the office of the Inspectress of Schools, Muzaffarpur, were taken up and some materials were collected for the construction of the Principal's residence and the extension of the Sanskrit College, Muzaffarpur, and for the Teacher's quarters, High English School at Pusa. Progress was made with the construction of a hostel and a residence for the Lady Principal of the Ravenshaw Girls' School at Cuttack. The extension of the hostel attached to the Puri Zila School which was in progress from the previous year, was completed. The old Zila School buildings at Puri were permanently transferred to the Puri Sanskrit College which was provincialized. Certain additions and alterations were done to the old Civil Court building at Arrah to convert these into a hostel for the students.

The following works were completed in connection with the Temple <sup>Medical</sup> Medical School and General Hospital at Bankipore :—

- (1) Construction of a power-house in the Medical School.
- (2) Providing a cooking range in the European patients' kitchen in the General Hospital.
- (3) Converting the Hill Students' barrack into a Tuberculosis ward of the Medical School with Sub-Assistant Surgeon's quarters.
- (4) Providing collapsible gate in the General Hospital main building and out-patients' block.
- (5) The construction of a building for a Steam Laundry attached to the General Hospital.
- (6) Extension of the kitchen for the Indian patients of the General Hospital.
- (7) Adding pantry with cup-boards to the European patients' kitchen.

The construction of a dissecting block in the Temple Medical School was in progress. Thorough repairs were done to several buildings in the General Hospital compound preparatory to their being brought on to the books of the Public Works Department.

The asylum for the European insanes at Kanke, Ranchi, was opened by the Medical Department on the 17th May 1918. Many minor improvements were done to the buildings at the suggestion of the Medical Department. In the asylum for Indian insanes the following buildings were practically completed :—

- |     |   |      |                                   |
|-----|---|------|-----------------------------------|
| (1) | 2 | sets | of clerks' quarters.              |
| (2) | 3 | "    | compounders' quarters.            |
| (3) | 3 | "    | Hospital Assistants' quarters.    |
| (4) | 2 | "    | Chauffeur's quarters.             |
| (5) | 2 | "    | Deputy Superintendent's quarters. |
| (6) | 8 | "    | Menials' quarters.                |
| (7) | 3 | "    | Single attendants' quarters.      |
| (8) |   |      | Gate building, male enclosure.    |
| (9) |   |      | Enclosure wall for female asylum. |

The erection of a water tower to give a supply of filtered water to the asylum buildings was in progress and the filter works were completed, except the wash water tank. Owing to the difficulty of procuring materials and the contemplated change of design of several important buildings, the full programme of work of the year could not be executed.

The construction of a female out-patient ward and a covered passage connecting the above with the Lady Woodburn ward of the General Hospital, Cuttack, was in progress. The tiled roof over the anatomical class of the Cuttack Medical School was replaced by terraced roof. Quarters were built for two Assistant Surgeon teachers in charge of the hostel for female students of the aforesaid school. The construction of a Leper Asylum at Cuttack was undertaken and the work was in full progress when the year closed. The construction of a new office building for the Civil Surgeon at Balasore was in progress. The Tuberculosis ward in the Sadr Hospital, Chapra, which was in progress from the previous year, was finally completed and made over to the Municipality. Progress was made with the construction of dispensary buildings at Balandapara, Khejuripara, Phiringia and Chhendipada.

**Registration.**

The Sub-Registry office building at Islampur in the district of Purnea, was nearly completed. An office building was constructed for the Sub-Registrar at Giridih and the extension of the record room of the Registration office at Hazaribagh was in progress. The Sub-Registry office buildings at Pupri, Kendrapara and Koilwar were completed. Progress was made with the construction of a Sub-Registry office building at Jellasore and those at Kishanpur and Bikram were well-nigh completed.

**Public Works Department Buildings.**

An office building for the Executive Engineer, Cuttack Division, at Cuttack which was in progress from the previous year, was completed. Sub-divisional office buildings and godown were constructed at Bhagalpur and Chaibassa with Subdivisional Officer's residence at the latter station. A godown for storing famine tools and a cement godown were constructed at Chaibassa and Dhanbad respectively. The Sectional Officer's quarters at Khatmandu, which was in progress from the previous year, was completed and the Sectional Officer's office room and peon's shed at Khurda, which were burnt by fire in 1916-17, were reconstructed during the year. The work of additions and alterations to the Executive Engineer's office at Hazaribagh was in progress and Public Works Department Subdivisional clerk's quarters were constructed at Bargarh.

**Monuments and antiquities.**

A solid iron beam was transferred from the Black Pagoda at Kanarak to the Calcutta Museum and the Secretary to the Museum was furnished with a brief history of it. Some special repairs were done to the temple at Kanarak with a view to preventing the collapse of certain stone work of the temple. The erection of a monument in the battle-field at Buxar was almost completed, except fine polishing and erection of fencing. Barbed wiring was provided above the railing of the Bodh-Gaya Museum.

**Residences for the Lieutenant-Governor and other Government officials**

At Government House at Ranchi a three-roomed cottage with bathrooms fitted with water connections, and electric lights and fans, was constructed. Certain additions and alterations were also carried out on the Guard House and the construction of the new gate buildings was nearly completed. Certain improvements were made to the Government House at Puri and a barrack with cook-shed was constructed for the Police Guard attached to that Government House.

The quarters for the motor driver in the compound of the Commissioner's residence and a new cook-shed in the Deputy Commissioner's residence at Ranchi, which were in progress from the previous year, were completed. The construction of a stable and a coach-house for the Chaplain's residence at Cuttack was in progress.

Residences for a Sub-Judge and three Munsifs at Bankipore were completed and the remaining two Sub-Judges' residences were approaching

completion. The construction of a new residence for the Executive Engineer at Sambalpur was in progress and the residence of the Agency Inspector of Schools for the Orissa Feudatory States was nearly completed.

The quarters of the Post Office staff and of the Secretariat Police were **Capital Works** completed. A motor garage was built in the Secretariat compound.

Residences for the following officers were completed :—

Postmaster-General, Bihar and Orissa; Deputy Postmaster-General; Superintendent of Post Offices (Traffic); European and Indian Personal Assistants to the Postmaster-General; Assistant Secretary, Public Works Department; Assistant Commissioner of Excise and Salt, Bihar and Orissa; Personal Assistant to the Inspector-General of Police; Assistant Director of Public Instruction; Assistant Sanitary Engineer; Superintendent, Civil Veterinary Department; Inspector-General of Police; Commissioner of Excise and Salt; Electrical Engineer; Deputy Director of Agriculture; Director of Public Instruction; Registrar, Co-operative Societies; Personal Assistant to the Commissioner of Excise and Salt.

The following buildings were also completed during the year under review :—

- (1) Barracks for menials attached to the Secretariat.
- (2) Quarters for peons attached to the officers' residences.
- (3) Quarters for compounders and barracks for menials attached to the outdoor dispensary at Amlatola.
- (4) Carriage stand on the east of Taylor Road.

The Central Power House for electric plant was almost completed except the patent stone flooring which could not be taken up owing to the various boilers and engine not having been fixed in position.

The greater part of the earthwork of the Patna-Dinapore road (from the Government House) was completed and also the laying of soling and first coat of metalling was in progress in some portion of the road.

The Guards' shed at Gulzarbagh was converted into the Press Dispensary with quarters for the Sub-Assistant Surgeon and Compounder. Certain minor alterations and improvements were made in several other buildings.

The foundations of the new Tej Narayan Jubilee College at Bhagalpur were laid and arrangements were made for clearing and levelling the site.

The roof of St. Paul's School at Ranchi was reconstructed and the construction of a dispensary building at Chatra was nearing completion. The construction of a cow-shed in the house of Raja Makunda Deb of Puri, special repairs to his dwelling house and re-excavation of tank in the compound, which were undertaken in the previous year, were completed. The work of putting a pump and a reservoir in the Growse Central Hospital at Balasore was also completed.

A statement of expenditure on Original Works—Civil Buildings including contributions is given below :—

	Rs.
Administration ... ..	6,70,885
Monuments and Antiquities ... ..	12,376
Educational ... ..	3,48,437
Ecclesiastical ... ..	67
Law and Justice ... ..	1,73,912
Jails ... ..	1,90,274
Police ... ..	2,60,936
Medical ... ..	5,27,911
Miscellaneous ... ..	79,318
Total ... ..	22,64,116



## COMMUNICATIONS.

## General.

During the year under review only ordinary communication works in progress from previous years, and works of a very urgent character were taken up and carried out. A number of important schemes had to be deferred owing to the financial stringency, while for the same reason and for reasons of economy other projects which required materials from England were postponed. The main work done during the year, therefore, has been repair work.

## Roads.

*Bihar.*—A fair weather track was prepared towards the close of the year between Patna and Gaya via Khagaul, Masaurhi and Jahanabad which forms the alignment of the through trunk road between Bihar and Orissa. The widening of the road along the river bank from Bankipur Civil station to Dinapur was almost completed. The portion of the old Patna-Gaya road lying between the Collector's gate and the new Post Office, Patna, was considerably improved by being remetalled and tarred. Additional waterways were provided in miles 303 and 308 of the Grand Trunk road in order to prevent it from being over-topped and breached by floods. Trial borings were taken in the Lilajan river at Dobhi where it is proposed to build a high level bridge in place of the causeway which was washed away in the floods of August 1917. The remaining portion of this road was maintained in good condition.

*Chota Nagpur.*—Considerable improvements were made to the road from Ranchi to Chaibassa which constitutes a link in the through route. Waterways of the culverts at places where the road used to be flooded during the rains, were increased, and the wooden floors of some of the bridges which were old and in bad disrepair were replaced by masonry arched floors. The remodeling and reconstruction of the old culverts on the second section of this road from Hessadih to Tebo and from Tebo to Chakradharpur were completed. The work of widening and remetalling miles 5 to 7 of the road from Barakar to Purulia was in progress, while widening the right flank of the road throughout, was completed. Materials were collected for the construction of the bridges over the Gowain and Izri rivers on the Chas-Gulbera road, and a start was made with the work.

*Orissa.*—The work of improving the Cuttack-Sambalpur road, 2nd section, was nearly completed while that of the Angul-Tickerpara road, 2nd section, was in progress; all the bridges and culverts on the latter road were built. Materials were collected during the year for the construction of bridges over the Nigra, the Matulia, and another stream on the 1st section of the Angul-Tickerpara road. The work of metalling the Cuttack-Sonpur road lying in the Banki Estate and the 2nd section of the Cuttack-Sambalpur road, approached completion. A proposal to divert the Cuttack-Sonpur road between Harbhanga and Sitalpani was approved, and work taken in hand during the year. The construction of a bridge on the 7th mile of the Harbhanga-Phulbani road was undertaken during the year under report and nearly completed. Considerable progress was also made with the construction of a bridge over the Nigra river at Matanga on the Cuttack-Angul road. Approval was given to the construction of a vented causeway on the 12th mile of the Orissa Trunk road, north; materials were collected and the work taken in hand during the year. Bridges on the Raipur-Sambalpur road were remodelled, and the construction of a raised causeway over the Bargarh nala on the road from Bargarh to Bolangir was almost finished.

## Contribution Work.

The construction of four high level bridges on the road from Chaibassa to Jamshedpur which was in progress in the previous year, was completed and materials were collected for building a causeway over the Khorakai river on the same road.

## Roadside Accommodation.

The old Dak Bungalow at Dehri was converted into an office and quarters for the Sectional Officer in charge of the Grand Trunk road.

A first class Inspection Bungalow with outhouses at Jamshedpur, the construction of which had been undertaken during the previous year, was completed, and the bungalow provided with furniture, crockery and electric

lights and fans. The construction of a third Inspection Bungalow at Netarhat was almost completed at the end of the year, and certain improvements were made to the combined Dāk and Inspection Bungalow at Giridih.

Work on the reconstruction of the Inspection Bungalow at Sitalpani on the Cuttack-Sonpur road was in progress during the year under report. The extension of the Dāk Bungalow at Cuttack which was taken in hand last year reached completion. The extended portion has been reserved as an annexé to the Circuit House at the station.

The trees and nurseries along roadsides were maintained as in previous years, so far as funds permitted; young trees were also planted to make new avenues and to fill in gaps where necessary.

#### MISCELLANEOUS PUBLIC IMPROVEMENTS.

No very important works of public improvements could be undertaken during the year under report on account of scarcity of funds. Only a number of works affording protection to Government buildings from erosion by rivers were carried out. General.

The construction of the skin revetment along the right bank of the river Ganges from the compound of the Civil Surgeon's residence to the west of the nala near the Bankipur Club, was practically completed. Measures were taken to protect the river bank below the Patna College, and to strengthen the skin revetment below the quarters for the Principal of the Bihar School of Engineering at Bankipur. The old revetment below the Recreation Bungalow at Gulzarbagh was damaged by the unusually heavy rainfall of September, 1918 and collapsed. Materials were collected for reconstructing the same and foundation started. Protective Works.

A masonry drain was constructed across the Race Course at Muzaffarpur with the twofold object of draining the low-lying areas within the Race Course, and providing an outlet for the drainage of the compounds of the residences of several Government officials in the vicinity. Drainage.

Improvement to the tank in the Kachahri compound at Banki was in progress. Sanitation.

The metalled road on the crest of the Katjuri left embankment at Cuttack from the Collectorate to the Puri Ghat, which was under construction last year, was completed. Miscellaneous.

#### RAILWAYS.

There are no railways under the direct control of the Government of Bihar and Orissa. With the exception of the three following light railways of local importance which are subject to a certain measure of control by the Local Government, all the important lines are under the direct administration of the Government of India in the Railway Department (Railway Board):— Administration.

			Gauge.	Mileage.
1. Arrah-Sasaram	Light Railway	...	2'-6"	65.26
2. Bakhtiyarpur-Bihar	" "	...	2'-6"	33.00
3. Dehri-Rohtas	" "	...	2'-6"	23.83
				122.09

During the year under report no new line was opened to traffic. The total mileage on the 31st March 1919, was therefore;— Mileage.

				Miles.
1. Standard Gauge	...	...	...	1660.75
2. Metre Gauge	...	...	...	1178.66
3. 2'-6" Gauge	...	...	...	269.31
4. 2'-0" Gauge	...	...	...	39.09
				3147.72

Lines sanctioned  
or under con-  
struction.

The following lines were under construction or sanctioned for construction during the year :—

	Gauge.	Miles.
Fativa-Islampur ... ..	2'-6"	27-00
Mayurbhanj Extension ... ..	2'-6"	38-71

#### Bengal-Nagpur Railway—

	Gauge.	Miles.
Anara-Katgali ... ..	5'-6"	5-80
Kandra-Gomharia ... ..	5'-6"	5-53
Onajori-Sulapet with branch Badampahar ...	5'-6"	21-75
Portion of the Raipur-Parbatipuram Section (from a point near Gurjabota to a point near Bhowanipatna Road).	5'-6"	92-00
Panposh-Raipura ... ..	5'-6"	14-30

Surveys  
pleted.

com-

The following surveys were completed during the year :—

#### Kasta-Coalfield Railway—

	Gauge.	Miles.
1. From a point near the north end of the Adjai bridge on the Ondal-Sainthia chord to Kasta-Pariapur.	5'-6"	17-01
2. From a point near Gaurangdi on the Ondal Loop to Kasta-Pahatpur.	5'-6"	9-12

#### Amda-Jamda Railway—

(Kolhan-Keonjhar Railway)—

	Gauge.	Miles.
From Amda to a point in the neighbourhood of Jamda.	5'-6"	68

Surveys sanction-  
ed.

Authority was given by the Railway Board to undertake the following surveys during the year :—

#### 1. To the Bengal-Nagpur Railway—

(a) A detailed survey for a line of railway on the 5'-6" gauge from Amda, a station on the Bengal-Nagpur Railway, via Chai-bassa to a point to be selected in the neighbourhood of Jamda.

(b) A reconnaissance survey to determine the best alignment to serve the iron ore deposit to the south of Jamda, with the town of Keonjhar as a final objective.

The above surveys are known as the Kolhan-Keonjhar railway surveys. A length of 68 miles has already been surveyed during the year.

#### 2. To the East Indian Railway—

A detailed survey for a line of railway on the 5'-6" gauge from a point on the Ondal-Sainthia section of the East Indian Railway to serve the Kasta collieries—a distance of about 18 miles. This survey was also completed during the year.

#### 3. To the Bengal-Nagpur Railway—

A detailed survey for a line of Railway on the 5'-6" gauge from the neighbourhood of Leiyo in the Bokharo coalfield to serve the south Karanpura coalfield, a distance of about 40 miles.

#### BAKHTIYARPUR-BIHAR LIGHT RAILWAY.

Accidents.

In mile 9, between Harnaut and Wena at 15-15 on the 27th April 1918, the front axle of low-sided truck No. 10 of the down ballast train broke and this truck as also truck No. 4 attached next to it were derailed.

On a slight rising grade between Soh and Pachasa near mile 16 at 17-56 on 23rd May 1918, three trucks of the No. 4 Down Mixed train Nos. 15, 17 and 18 loaded, with stone ballast and attached behind the rear brake van of the train, got detached.

On passing mile 18 near Bihar station at 20-38 on the 23rd June 1918, the driver of the Down Goods Special noticed a crowd collected on the Railway line. He stopped the train and found the dead body of a boy, aged about 8 years, lying on the line with his head severed from the body, and several cuts on his body. The accident occurred with the stone train returning from the Hill Siding.

While No. 1 Up Mixed train was passing bridge No. 7 at mile 3 near Chero Station at 9-25 on the 23rd August 1918, the guard of the train noticed that empty wagon No. 16, the twentieth vehicle from the engine and attached behind the rear brake van, was derailed. He at once applied his brake and signalled the driver to stop; but before the driver could pull up, the coupling opened out and the wagon parted from the train, all four wheels of the wagon were derailed.

At mile 4-14, between Chero and Harnaut Station, at 0-15 on the 28th August 1918, the front wheels of loaded covered wagon No. 15 of No. 3 Up Mixed train left the rails on a curve.

While No. 3 Up Mixed train was passing over a curve near telegraph post 4-15, two wheels of loaded covered wagon No. 16 was derailed at 17-12 on the 3rd October 1918.

In mile 10 between Wena and Bhaganbigha, at 7-10 on the 20th October 1918, a boy aged about 8 years travelling from Bakhtiyarpur to Soh with his parents on open truck No. 7 of the No. 1 Up Mixed train fell between two vehicles and received serious injuries.

At mile 15 near Pachasa Station at 13-43 on the 11th November 1918, four wheels of loaded covered Goods wagon No. 18 of the No. 4 Down Mixed train, the seventh vehicle from the engine, got derailed.

A man, named Lachhman Ahir, was run over and killed by the engine of No. 3 Up Mixed train at mile 6 near Harnaut Station at 17-18 on the 15th November 1918.

At mile 2-12 near Chero Station, at 16-50 on 17th November 1918, covered Goods wagon No. 16 of the No. 3 Up Mixed train, the third vehicle from the engine, got derailed.

While No. 3 Up was passing over the curve at mile 3 on bridge No. 8 near Chero Station at 16-55 on the 26th November 1918, covered Goods wagon No. 17, the fourth vehicle from the engine, got derailed.

#### EAST INDIAN RAILWAY.

On the 15th April 1918, No. 171 Up Goods train on the Grand Chord at mile 258-2, near Gurpa Station, which left Gujhandi at 2-37 and passed Dilwa at 3-10 was derailed between Dilwa Station and Tunnel No. 2. The front portion continued on its journey but was caught by the rear portion, derailling, smashing or damaging 23 wagons.

On the 24th May 1918, No. 171 Up Goods train on the Grand Chord at mile 255-22 near Dilwa Station which left Gujhandi at 4-15 and passed Dilwa at 4-19 was derailed of 13 wagons, all of which were smashed.

At about 22-40 on the 7th September 1918, when No. 27 Up passenger of the South Bihar Line had just left Sirari Station and proceeding slowly between the Down Home and outer signals, the east abutment of bridge No. 32 collapsed, causing the engine and tender to fall into the gap. The two leading coaches were derailed, two passengers being killed and three wounded.

The programme showing the proposed new lines in order of urgency is given as Appendix C.

## CANALS—IRRIGATION AND NAVIGATION.

THE transactions of the Irrigation Branch of the Public Works Department for the year 1918-19, relating to works of Irrigation and Navigation, are shown in the Table below. The embankment and drainage works are reviewed in a separate report and are not noticed in this report.

## CAPITAL ACCOUNT.

Heads.	Amount of Construction Estimate.	Expenditure during 1918-19.	Expenditure to end of 1918-19.	Balance for expenditure from 1st April 1919.
1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.
<b>MAJOR IRRIGATION WORKS.</b>				
<b>PRODUCTIVE IRRIGATION WORKS—</b>				
Direct charges ...	5,26,69,736	4,640	5,24,25,647	2,44,281
Indirect charges ...	15,25,735	352	15,30,898	—5,163
<b>Total ...</b>	<b>5,41,95,471</b>	<b>4,992</b>	<b>5,39,56,545</b>	<b>2,39,118</b>
<b>PROTECTIVE IRRIGATION WORKS—</b>				
Direct charges ...	87,80,457	1,31,207	81,71,824	6,08,633
Indirect charges ...	2,25,222	5,761	2,28,556	—3,334
<b>Total ...</b>	<b>90,05,679</b>	<b>1,36,968</b>	<b>84,00,380</b>	<b>6,05,299</b>
<b>MINOR WORKS AND NAVIGATION—</b>				
Direct charges ...	6,86,883	...	6,86,883	...
Indirect charges ...	27,923	...	27,923	...
<b>Total ...</b>	<b>7,14,806</b>	<b>...</b>	<b>...</b>	<b>...</b>

## REVENUE ACCOUNT.

Heads.	Receipts.	WORKING EXPENSES.			Net Revenue.
		Direct.	Indirect.	Total working expenses.	
1	2	3	4	5	6
	Rs.	Rs.	Rs.	Rs.	Rs.
MAJOR IRRIGATION WORKS*...	27,33,954	14,34,963	1,09,911	15,44,874	11,89,080
MINOR WORKS AND NAVIGATION—					
Works for which Capital and Revenue Accounts are kept.	758	792	48	840	—82
Works for which only Revenue Accounts are kept.	6,477	33,252	2,317	35,569	—29,092
Works for which neither Capital nor Revenue Accounts are kept.	4,789	2,141	...	2,141	2,648

\* Inclusive of the Dhaka and the Tribeni Canals.

2. The following statements show the areas irrigated during the year compared with the average of the triennial period ending with March 1918:—

Irrigation.

## MAJOR WORKS—(Productive).

	Orissa Canals.			Son Canals.			Total.		
	Kharif inclusive of hot weather.	Rabi.	Total.	Kharif inclusive of hot weather.	Rabi.	Total.	Kharif inclusive of hot weather.	Rabi.	Total.
1	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1915—1918 ...	269,597	5,865	275,462	461,344	71,702	533,046	730,941	77,587	808,528
For 1919-20 ...	279,870	(a) 5,329	285,199	471,691	(b) 167,723	639,404	751,551	(c) 173,052	924,603

(a) Season lease.

(b) Includes long lease 21,837 acres and season lease 145,886 acres.

(c) Includes long lease 21,837 acres and season lease 151,165 acres.

NOTE.—All collections for season leases (Rabi) are made in the following year (1919-20) but those for long leases are made during the year (1918-19).

MAJOR WORKS—(Protective).

1	Tribeni Canal.			Dhaka Canal.			Total.		
	Khari <sup>f</sup> inclusive of hot weather.	Rabi.	Total.	Khari <sup>f</sup> inclusive of hot weather.	Rabi.	Total.	Khari <sup>f</sup> inclusive of hot weather.	Rabi.	Total.
	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1915—1918 ...	46,099	47,999	5,843	465	5,708	52,249	465	66,807	
For 1918-19 ...	57,454	57,454	8,677	(a) 160	8,816	66,131	(a) 160	66,807	

(a) Season lease.

MINOR WORKS.

1	Saran Canals.			Teur Canal.			Total.		
	Khari <sup>f</sup> inclusive of hot weather.	Rabi.	Total.	Khari <sup>f</sup> inclusive of hot weather.	Rabi.	Total.	Khari <sup>f</sup> inclusive of hot weather.	Rabi.	Total.
	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1915—1918 ...	Canal closed.	...	1,344	83	* 1,377	1,344	* 83	1,377	
For 1918-19 ...	...	...	1,981	(a) 20	† 2,001	1,981	(a) 20	2,001	

(a) Season lease.

\* Includes the Madhuban Zamindar's *surat* land.

† Includes 168 acres of the Madhuban Zamindar's *surat* land.

NOTE.—All collections for season lease (E 13) are made in the following year (1919-20) and those for long leases are made during the year (1918-19).

3. The lengths of canals and distributaries in operation during the year 1918-19 compared with the previous year are as follows :—

1	Orissa Canals.		Saran Canals.		Tribeni Canal.		Dhaka Canal.		Teur Canal.		Saran Canals.	
	1917-18	1918-19	1917-18	1918-19	1917-18	1918-19	1917-18	1918-19	1917-18	1918-19	1917-18	1918-19.
	2	3	4	5	6	7	8	9	10	11	12	13
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Main canals (Irrigation) ...	223½	223½	(a) 206½	206½	61½	61½	3½	3½	6½	6½	} Canals closed.	
Ranch canal (Irrigation) ...	109	109	149½	149½			16½	15½				
Distributaries ...	1,291½	1,293½	1,234½	1,234½	160½	178½	23½	23½	6½	8½		
Of above—Navigable channels	204½	204½	(a) 206½	206½								

\* Canals closed since the 1st April 1894.

(a) The figure shown in previous reports was in correct.

4. The following statement shows the traffic on the Navigable Canals during the year 1918-19 compared with the average of the triennium 1915-18 :—

	Orissa Canals.		Son Canals		* Orissa Coast Canal.	
	Average for the triennium ending with March 1918.	For the year 1918-19.	Average for the triennium ending with March 1918.	For the year 1918-19.	Average for the triennium ending with March 1918.	For the year 1918-19.
1	2	3	4	5	6	7
Length of canal open ...	Miles. 204½	Miles. 204½	Miles. 203½	Miles. 208½	Miles. 95½	Miles. 95½
Receipts ...	Rs. 71,186	Rs. 71,392	Rs. 18,872	Rs. 28,393	Rs. 6,112	Rs. 5,197
Tonnage of boats by canal measurement.	Tons. 421,182	Tons. 449,96	Tons. 46,597	Tons. 65,868	Tons. 29,378	Tons. 29,617
Estimated weight of cargo exclusive of rafts.	145,095	154,001	16,217	28,774	10,422	19,708
Estimated value of goods.	Rs. 1,07,28,793	Rs. 1,15,13,902	Rs. 9,61,746	Rs. 19,54,670	Rs. 6,43,598	Rs. 6,38,324
Estimated value of rafts.	Rs. 3,67,872	Rs. 1,63,760	Rs. 3,19,755	Rs. 3,58,077	Rs. 14,469	Rs. 21,870

\* For 95½ miles only lying in the Province of Bihar and Orissa.

Classification of Irrigation and Navigation Works.

5. The classification of Works dealt with in this review is as follows :—

(i) *Major Works.*—Of the four Major Irrigation Works in this Province, two, viz., the Orissa and Son Canals, are classed as Productive and the other two, viz., the Tribeni and Dhaka Canals, are Protective Irrigation Works.

(a) The Orissa and Son Canals were originally constructed from funds under the Imperial head "49—Irrigation" and were classed as "Productive" as it was expected that the net revenue derived from them would repay the annual interest on the Capital invested. The expectation has never been realized in the case of the Orissa Canals system. The Son system is however now paying a four per cent interest. Further Capital outlay on both these systems is now being incurred under the divided head "43—Minor Works and Navigation" and their Revenue Account is kept under the head—"42 Major Works—Working Expenses" which is also a divided head. The canals are utilized both for irrigation and navigation.

(b) *Construction of Protective Irrigation works.*—The Tribeni and Dhaka Canals, which have been constructed from funds under the Imperial head "35" though not directly remunerative, are calculated to guard against a probable future expenditure in relief of the population of the tract of country served. The Tribeni Canal is almost complete, the Rangī distributary not being yet fully constructed, and permanent outlets and some village channels yet remaining. The extra works outside the construction estimate, which were approved by the Government



of India in 1916 and which provide additional drainage facilities across the canal to enable it to withstand without damage the high floods which in one part of the tract or another occur almost annually, have been completed except the Bhota aqueduct, under construction, and the Pandai spill syphon. The cost of these additional works is being charged under the Open Capital Account rules to the head "35". These Canals are open to irrigation only.

(ii) *Minor Works and Navigation*.—There are three canal systems under this class.

(a) *Orissa Coast Canal*.—No Capital account is now maintained and the cost of maintaining the canal is charged to the sub-head "Works for which only Revenue accounts are kept". The canal 95½ miles long (in this Province) is used for navigation only.

(b) The Teur (Madhuban) Canal is a small work intended for irrigation only. Neither Capital nor Revenue accounts are kept.

(c) *Saran Canals*.—Capital and Revenue Accounts have hitherto been kept under the head "43—Minor Works and Navigation" as the canals have remained practically closed to irrigation since 1894; there was a proposal under consideration to abandon them altogether, but the managers of two indigo concerns having agreed to pay the annual cost of maintenance of the canals the proposal has been given up and the canals are being transferred to the sub-head "Minor Works for which neither Capital nor Revenue accounts are kept".

The progress of the year for the works under each of the above heads is briefly stated in the following summary compiled by circles of Superintendence.

## ORISSA CIRCLE.

### MAJOR IRRIGATION WORKS (PRODUCTIVE.)

#### *Orissa Canals.*

- Capital Account.** 6. The expenditure (direct charges) debited to the Capital Account of the Orissa Canals during the year was only Rs. 2,687. The total capital outlay for direct charges to the end of the year was Rs. 2,64,64,491. The only work, chargeable to the Capital Account, which was in progress during the year was the construction of a minor distributary at Solanpur from the 21st chain of the first mile of No. 2 A distributary of the High Level Canal, Range III. 75 per cent of the earthwork was done and materials for masonry works collected.
- Works in Progress.**
- Revenue Account Extensions and improvement.** 7. The total expenditure on new works chargeable to the Revenue Account amounted to Rs. 7,263 against Rs. 12,409 in the previous year. No work of any importance was undertaken and the expenditure was mainly incurred on certain small distributaries, office buildings and residences.
- Maintenance and Repairs.** The expenditure amounted to Rs. 1,58,276 against Rs. 1,57,345 in the previous year. The head-works, main canals with their distributaries, drainage and protective works were maintained in fair order. As there was no heavy flood during the year, no special repairs had to be carried out.
- Length of Distributaries.** 8. During the year nearly two miles of distributary channels were added.
- Rainfall.** 9. The average rainfall during the year at the 13 recording stations was only 47.85 inches against the average of 58.76 inches for the previous 49 years. The rainfall of the year was much below the normal and not well distributed. The scanty rain in July and the severe and prolonged drought in October caused widespread damage to the standing paddy crop on unleased areas. Canal water was supplied as well as possible to the leased areas on which a

fair crop was reaped. The drought in October did also a good deal of damage to the *Rabi* crop.

10. The area irrigated was 285,199 acres against 271,576 in 1917-18. As stated above, the increase is due to unfavourable rainfall. The total assessment for water-rates on the area irrigated was Rs. 4,83,948 against Rs. 4,52,096 in 1917-18. About 0.7 per cent of the nett total demand remained uncollected at the end of the year. This percentage is unusually high but is due to the drought and abnormally high prices. Irrigation.

11. The receipts from Navigation tolls on the Orissa Canals amounted to Rs. 71,392 against Rs. 72,036 in the preceding year. There was a little decrease in the tonnage of boats and some increase in the value of cargo. Navigation.

12. The revenue and working expenses (direct and indirect) were Rs. 5,86,802 and Rs. 4,08,748 respectively, against Rs. 5,80,779 and Rs. 4,92,800 of the previous year. Thus the nett revenue which amounted to Rs. 1,78,054 was only 65 per cent on the capital outlay and did not cover the interest charges of the year. The Government of India having asked for a careful investigation into the unsatisfactory financial position of the canals in this Province, a thorough analysis of the revenue and working expenses of the Orissa Canals, which was already in hand, was completed. Of the possible means of improving matters on the Orissa Canals, which are chiefly responsible for this lack of success, the only one which promises much return is an increase in the water-rates, which is under consideration. Financial Results.

13. The canals were closed for annual repairs for the number of days detailed below :— Canal Closure.

Name of canals.					Days closed.
Taldanda	Canal	...	...	...	31
Machgaon	"	...	...	...	36
Kendrapara	"	...	...	...	31
Kendrapara	Extension	...	...	...	31
Gobri	Canal	...	...	...	31
Gobri	Extension Canal	...	...	...	31
Pattamundi	Canal	...	...	...	31
<b>HIGH LEVEL CANAL—</b>					
Range I		...	...	...	37
Do. II		...	...	...	48
Do III		...	...	...	52
Jajpur	Canal	...	...	...	50

14 There were no severe storms or high floods during the year. Flood.

#### MINOR WORKS AND NAVIGATION.

##### *Orissa Coast Canal.*

15. The Canal (95½ miles in this Province) was maintained in fair order and was open to traffic throughout the year. A portion of Range V of the Canal was partially cleared of silt at a cost of Rs. 5,673 against the sanctioned amount of Rs. 13,264. Better progress could not be made for want of coal. Some shoals were removed in miles 101 and 104 of the Canal.

No new works were carried out. The total cost of maintenance (direct and indirect) including dredging, amounted to Rs. 35,569 against Rs. 30,195 of the previous year. The gross receipts were Rs. 6,478. Export through this canal was less during the year owing to failure of crops and consequent restrictions on the export of food-crops from the district. The rainfall was below normal.

## SON CIRCLE.

## MAJOR IRRIGATION WORKS (PRODUCTIVE).

*Son Canal.*

## Capital Account.

16. The total Capital outlay (direct charges) on the system up to end of 1918-19 was Rs. 2,59,61,156 of which Rs. 2,145 represents the expenditure during 1918-19.

The total expenditure on works only in 1918-19 was Rs. 4,592 as detailed below:—

Works out.	carried	(1) Constructing 13 permanent outlets for Chausa Branch Canal ...Rs. 757 (Completed.)
		(2) Constructing a syphon in the 2nd mile of the Khargarb distributary. Rs. 1,472 (Completed.)
		(3) Constructing permanent outlets in the Sikraul Subdivision ... Rs. 735 (In progress.)
		(4) Constructing permanent outlets in the Daudnagar Subdivision ... Rs. 1,628 (In progress)

Revenue Account  
Extensions and  
Improvements.

17. The total expenditure during the year on Extensions and Improvements amounted to Rs. 57,498. The most important of these works was the construction of the river gates for the Digha Lock Weir at a cost of Rs. 40,666. The balance was spent on small quarters for some of the revenue staff and on rest sheds, etc.

Maintenance and  
Repairs.

17. The annual repairs to the canals and head works were carried out during the year at a total expenditure of Rs. 2,64,070 against Rs. 2,68,685 of the previous year.

## Rainfall.

18. The average rainfall of the 12 stations in the three Divisions was 29.92 inches compared with average of 39.66 inches for the last 36 years and 46.38 for the year 1917-18. The rainfall over the Buxar Division was considerably below normal and this Division felt the drought in September and October severely. The rainfall in the other Divisions was just about the normal but was not well distributed over the year. The whole of October and November was absolutely rainless and the *hathia* abnormally dry.

## Irrigation.

19. The area irrigated during the year was 639,404 acres against 526,492 acres of the preceding year. The large increase is due to the failure of rains during the *Rabi* season making the irrigated area (167,723) nearly three times the normal. The *Kharif* and hot weather areas were also 6,000 acres above the average of the previous five years. In spite of the rainless *hathia* the *Kharif* outturn was very nearly normal. The total assessment for water-rates amounted to Rs. 18,80,590 of which Rs. 18,73,036 was realized during the year, Rs. 390 was remitted and the unusually large balance of Rs. 7,093 remained unrealized at the close of the year, or 0.17 per cent of the nett demand. The balance, which however was collected early in April, was due mostly to influenza as there was great difficulty in recovering the dues from the next-of-kin of the many victims of the epidemic.

## Navigation receipts

20. The receipts from navigation amounted to Rs. 28,393 against Rs. 22,648 of the year before and an average of Rs. 20,600 for the last five years. The increase is due to the restrictions in the railway service.

## Financial Results.

21. The gross receipts and working expenses (direct and indirect) were respectively Rs. 19,96,830 and Rs. 8,24,813 against Rs. 19,13,565 and Rs. 8,34,781 of the previous year. The nett receipts after deducting working expenses amounted to Rs. 11,72,017 which was 4.36 per cent on the capital outlay and after meeting the interest charges of the year, a balance of Rs. 2,68,139 was left against the accumulated arrears of interest amounting to Rs. 2,01,52,782. The earnings of the canals were over three-quarters of

lakh of rupees above the average of the previous five years—the increase being mainly due to the development of long leases at the enhanced rate. The receipts from the large area of *rabi* do not affect the receipts of the year 1919-20.

Canal Closure.

or annual repairs during 1918-19.

Floods.

ny consequence during the monsoon recorded at Barun on August 26th was recorded at Dehri. Both the

Flushing operations.

Main Eastern Canal, the first two on the silt. The third flush which was run when the demand for water was high due to the new accumulation of the flood on the canal for flushing as although the river in this manner, considering the entire lack of water, did not last long enough. The maximum discharge was 1,000 cft. per second. The total quantity of silt removed was 968,000 cft.

ed twice in July and once in October— during the periods and the flushes could have been run for irrigation throughout the year. There is no doubt be credited with the canal. The maximum discharge sent to the river in October. About 968,000 cft. of silt was

ON FOR WHICH NEITHER CAPITAL ACCOUNTS ARE KEPT.

Investigation in connection with possible irrigation schemes.

ed or continued on the Butana and other works now to test their capabilities for storage and the works are being taken.

er in the Gaya District back to its normal level in the year.

#### CIRCLE.

WORKS (PROTECTIVE).

Capital account.

*Dehri Canal.*

tion estimate's schedule of incomplete works sanctioned as chargeable to the open account expenditure (direct and indirect) was Rs. 1,36,968 during the year.

Works completed.

ala syphon, a new boulder mattress and other works which were started last year are in progress.

Works in progress.

5 feet 420.

the Bela Babu's *pain*.

The estimate for an escape syphon at Pandai in the 49th mile was nearly completed and materials were collected.

Revenue account. Extensions and Improvements.

27. A sum of Rs. 33,196 was spent on Extensions and Improvements. Of this amount about Rs. 18,000 was spent on the Khunti syphon and the balance on certain quarters and other small works.

Maintenance and Repairs.

The cost of ordinary maintenance of the canal including silt clearance and repairs to syphons and distributaries amounted to Rs. 1,60,612.

## SON CIRCLE.

## MAJOR IRRIGATION WORKS (PRODUCTIVE).

*Son Canal.*

## Capital Account.

16. The total Capital outlay (direct charges) on the system up to end of 1918-19 was Rs. 2,59,61,156 of which Rs. 2,145 represents the expenditure during 1918-19.

The total expenditure on works only in 1918-19 was Rs. 4,592 as detailed below:—

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Extensions and  
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## Navigation receipts

20. The receipts from navigation amounted to Rs. 28,393 against Rs. 22,648 of the year before and an average of Rs. 20,600 for the last five years. The increase is due to the restrictions in the railway service.

## Financial Results.

21. The gross receipts and working expenses (direct and indirect) were respectively Rs. 19,96,830 and Rs. 8,24,813 against Rs. 19,13,565 and Rs. 8,34,781 of the previous year. The nett receipts after deducting working expenses amounted to Rs. 11,72,017 which was 4.36 per cent on the capital outlay and after meeting the interest charges of the year, a balance of Rs. 2,68,139 was left against the accumulated arrears of interest amounting to Rs. 2,01,52,782. The earnings of the canals were over three-quarters of

lakh of rupees above the average of the previous five years—the increase being mainly due to the development of long leases at the enhanced rate. The receipts from the large area of *rabi* do not affect the receipts of the year but will appear in the accounts of the year 1919-20.

Canal Closure

22. There were no canal closures for annual repairs during 1918-19.

Floods.

23. There were no river floods of any consequence during the monsoon of 1918-19. A gauge of 338.41 was recorded at Barun on August 26th and a gauge of 337.48 on September 3rd was recorded at Dehri. Both the canals were closed on each occasion.

Flushing operations.

24. There were three flushes in the Main Eastern Canal, the first two of which in July made no impression on the silt. The third flush which was run during the first fortnight of October when the demand for water was very great, moved nearly the whole of the new accumulation of the flood season. It was not a favourable season for flushing as although the river supply was maintained in an excellent manner, considering the entire lack of rain after the middle of September, it did not last long enough. The maximum discharge passed down was 2,218 cusecs. The total quantity of silt removed was 475,000 cft. against 600,000 cft. deposited.

The Main Western Canal was flushed twice in July and once in October—quite moderate supplies were run during the periods and the flushes could have been of little use. The high supplies which were run for irrigation throughout the whole of October and part of November must no doubt be credited with the scouring out of the silt in the main canal. The maximum discharge sent down was 4,220 cusecs on the 2nd October. About 968,000 cft. of silt was removed.

43.—MINOR WORKS AND NAVIGATION FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

Investigation in connection with possible irrigation schemes.

25. Preliminary surveys were started or continued on the Butana and other rivers in the Palamau District with a view to test their capabilities for storage of water. Further discharge observations are being taken.

A proposition to divert the Sakri river in the Gaya District back to its old bed, was further examined during the year.

### GANDAK CIRCLE.

#### MAJOR IRRIGATION WORKS (PROTECTIVE).

##### *Tribeni Canal.*

Capital account.

26. Works included in the construction estimate's schedule of incomplete works and other works subsequently sanctioned as chargeable to the open Capital account are in progress. The total expenditure (direct and indirect) debited to the Capital account amounted to Rs. 1,36,868 during the year.

Works completed.

The reconstruction of the Khunti nala syphon, a new boulder mattress apron to the head regulator, and some other works which were started last year were completed during the year under report.

Works in progress.

The following works were in progress:—

- (1) The Bhora aqueduct at mile 45 feet 420.
- (2) A syphon in the 36th mile for the Bela Babu's *pain*.
- (3) Rangi distributary.

The estimate for an escape syphon at Pandai in the 49th mile was nearly completed and materials were collected.

Revenue account. Extensions and Improvements.

27. A sum of Rs. 33,196 was spent on Extensions and Improvements. Of this amount about Rs. 18,000 was spent on the Khunti syphon and the balance on certain quarters and other small works.

Maintenance and Repairs.

The cost of ordinary maintenance of the canal including silt clearance and repairs to syphons and distributaries amounted to Rs. 1,00,612.

**Distributaries and village channels.**

28. The construction of the Rangī distributary at the tail end of the Canal, the only one remaining incomplete, was in progress. Some 23 masonry works were built and the earthwork carried out for 11 miles during the year.

Projects for village channels which are to be constructed as part of the Tribeni Canal project, were being prepared in connection with one of the distributaries, two estimates were sanctioned and arrangements made for acquiring the necessary land.

**Rainfall.**

29. The rainfall was satisfactory at the beginning of the irrigation season, but the serious drought which occurred in September and October resulted in a keen demand for water which the canal failed to cope with adequately in the lower reaches. The total average rainfall of six stations during the year was 83.05 inches against the average of 74.76 inches for the last eight years, but it was badly distributed.

**Floods.**

30. Floods in the river Gandak were normal, the highest flood level during the year being 970.25 or 7.70 below the highest recorded level (1902). The canal was opened for irrigation on the 16th June.

**Irrigation.**

31. The total area irrigated was 57,454 acres compared with 58,801 acres of the previous year and an average of 46,999 acres of the past three years.

**Financial results.**

32. The total working expenses (direct and indirect charges) amounted to Rs. 2,87,137 while the gross receipts were Rs. 1,28,185 against Rs. 1,15,565 of the previous year. The nett loss to Government was therefore Rs. 1,58,952 against Rs. 1,50,747 of the previous year. 5.42 per cent of the demand remained uncollected at the end of the year. The long lease system was introduced and the rate for season leases was raised by four annas per acre which accounts for the reason for the increase over the last year's collection, in spite of a slight decrease in the area irrigated. The canal will never be a profitable investment directly but should do something more than pay for its working expenses when made capable of passing down its full supply, which it cannot yet do owing to heavy accumulation of silt deposited by the low supplies of its earlier years of commencing irrigation. It will, however, always be rather an expensive canal to maintain owing to silt difficulties, the heavy growth of jungle grass and its liability to attack by very heavy local floods. Its bed gradient is too low to allow of a silt carrying velocity and it crosses drainage off the hills for a length of some sixty miles.

**Tribeni Canal Extension Scheme.**

33. The project for the proposed extension of the Tribeni Canal was under preparation.

*Dhaka Canal.***Capital Account.**

34. There was no capital expenditure on the canal during the year under review.

**Revenue Account. Extensions and Improvements. Maintenance and repairs.**

35. A total sum of Rs. 2,426 was spent on some small works.

A sum of Rs. 9,102 was spent on the construction of spur at head sluice and on ordinary maintenance of the canal.

**Rainfall.**

36. The total rainfall was 56.43 inches against the average of 55.94 inches for the last 13 years. The demand for canal water was high in September and October when there was severe drought.

**Irrigation.**

37. Owing to this there was some increase in the area that came under irrigation. The total area irrigated was 8,846 acres against the average of 5,708 acres for the last three years.

**Financial results.**

38. The gross receipts and working expenses of the year amounted to Rs. 22,117 and Rs. 24,176 respectively against Rs. 15,516 and Rs. 29,145 respectively of the previous year. The nett loss to Government after paying off the working expenses was Rs. 2,039. The long lease system has been introduced on this canal also.

## MINOR WORKS AND NAVIGATION.

### WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

#### THE TEUR (MADHUBAN) CANAL.

39. This small canal was maintained in good order and only the necessary repairs to the regulator, bridges and bungalows were carried out at a total cost of Rs. 1,551 (excluding establishment charges).

The rainfall of the year was 73·70 inches against the average of 54·74 inches for the last 19 years. The demand for canal water increased in September and October when there was no rain. The total area irrigated during the year was 2,001 acres against 1,727 acres of the previous year. The total receipts of the year amounted to Rs. 4,789 against Rs. 3,089 of the previous year.

### WORKS FOR WHICH CAPITAL AND REVENUE ACCOUNTS ARE KEPT.

#### SARAN CANALS.

40. The canals are closed to irrigation. The proposal to abandon the canals altogether has been given up but they are being transferred to the head "Minor Works for which neither Capital nor Revenue Accounts are kept". The maintenance charges amounted to Rs. 446 exclusive of the cost of establishment.

#### WESTERN CIRCLE.

41. A survey was started in connection with a tank project at Khunta in the Singhbhum District and observation of discharges of the Roro river was taken up for this purpose. Preliminary investigations.

## EMBANKMENT AND DRAINAGE.

The embankments are divided into four classes :—

Classification of embankments.

(a) Embankments maintained at the expense of Government—

(i) in Orissa,

(ii) under Schedule D.

(b) Embankments not Government property but maintained by Government under the contract system.

(c) Embankments not Government property but maintained by Government officers and public embankments under the provisions of sections 47—58 of Act II (B.C.) of 1882.

2. The expenditure on works and repairs during the year (exclusive of the book charges on establishment, tools and plant) amounted to Rs. 1,74,362 against Rs. 89,784 in the preceding year. Expenditure.

3. The total length of embankments of all classes maintained by Government in the province during the year was 814 miles 2,550 feet protecting an area of 7398·949 square miles. There was a net increase of 1,972 feet in the length of embankments in the Cuttack district owing to the closing of the Panu Panda and Kali Misra Ghais on the right bank of the Chitratola and a net decrease of 4 miles 4,151 feet in the Gandak Circle owing to the abandonment of the last 4 miles 2,862 feet of the Gupta bandh and the exclusion of 628 feet of cross bandhs and the abandoned portion, namely 667 feet of the old Daudpur embankment. Length of embankments.



## Floods.

4. During the year under review high floods in the Orissa rivers occurred only in the Mahanadi and its branch, the Katjuri, some rivers of the Puri district and the Burchabalong. No damage to crops was reported. There was a high flood in the Chandan river on the 14th August 1918, the flood water rising to 10 inches below the crest of the lower portion of the embankment. Though the embankment stood well against it, a portion of the river bank was eroded and a pit was also formed on the banks by flood water passing over the bank. The high flood (Kosi river) in the Madhipura Public Works Department embankment and the Bhagalpur Road embankment was only 0.4 feet lower than the maximum high flood level yet recorded. The Public Works Department embankment stood well, but a portion of the Road embankment measuring 395 feet only was eroded. Another portion of the Road embankment measuring 1,100 feet long, was also scoured away. A flood in the Panar river in the Purnea district damaged the spurs, the outer half of one of them being carried away by the current. The Ganges flood was comparatively low which enabled the sluices to carry the drainage of the capital area at Patna. The portion on the south of the East Indian Railway was, however, completely flooded by heavy rain, the drain carrying the discharge from the north to the south being insufficient; the clerks' quarters in this area were under water for a couple of days.

In the Gandak Circle, the floods were of an ordinary nature, the highest flood levels of the rivers being considerably under previous record, except in the river Gandak which rose higher than it did in the previous year, at Bhawanipur, Siswa Head Sluice and Baya, but at Sarangpur and Chuttiah, the gauge readings stood at exactly the same figures as in 1917-18.

## Breaches.

5. Several breaches occurred in the Bhargavi, Naya Nadi (left), Sonamuli and Dhauria class B embankments in the Orissa Circle. Besides these there were three other breaches in the Mahanadi Division. The lower portion of the embankment No. 8-B at Khannagar (Cuttack) was slightly damaged owing to some slips. The new revetment at Bogla Groynes was also washed away.

In the Gandak Circle, there were no serious breaches in or damage to any of the embankments with the exception of the following:—

The Tirhut embankment in the 33½ mile was cut by the villagers to drain the flooded area, but the damage was very slight.

The Saran embankment was eroded and encroached upon by the river in Mangerpal Charki. This has been protected by tree spurs.

The Champaran embankment was seriously threatened at village Bariya where the embankment crosses the Lalbegia Nala. At the end of September 1918, the cutting of the river recommenced very badly at this place. Two spurs were constructed above and below this *nala* during the year to stem the current.

The *Sota* in the 64th mile of the Sangrampur embankment opposite the spurs silted up somewhat. The spurs were slightly damaged but successfully checked the further progress of the river.

At Duboulia, the river continued to encroach upon the banks between the 72nd and 73rd miles and one of the two spurs completed during the year, was broken. The big gap known as the Husaini gap continued to pass flood water, but this was not attended with any serious consequence. The flood water entering the country through the breaches in the abandoned portion of the Gupta bandh below 10th mile caused damage to some crops.

## Surveys and investigations.

6. In the Orissa Circle, surveys and investigations in connection with an irrigation channel from Paradia sluice in the Nayanadi to Satpara in the Puri district, were completed during the year, but the project has been abandoned as, after comparing the levels of the country, it was found that the proposed irrigation channel would not serve the purpose.

In the Gandak Circle, surveys in connection with the extension of the Gupta bandh from 0 mile to Gurhara and from 9½ mile to a point near the Railway station, Lakho, was nearly completed when the year ended.

The levels of crest, floors of sluices and bench marks of the Bazidpur, Gupta and Monghyr embankments were checked.

7. The total outlay on original works amounted to Rs. 72,171 against **Original works.** Rs. 43,196 of the previous year. Of the total sum, Rs. 40,867 were spent in Orissa Circle. The expenditure in the Eastern Circle was Rs. 6,217 and the remaining Rs. 25,087 were expended in the Gandak Circle.

In the Orissa Circle the sum mentioned was spent on the (1) raising of the crest of the Utikan embankment, (2) closing Panu Panda and Kali Misra Ghais, (3) constructing an embankment connecting the embankment Nos. 6 and 7 (a) class B on the left bank of the Kharsua river, (4) constructing a rest-shed at Singpur on the left bank of the Kharsua river and (5) constructing Executive Engineer's office building at Cuttack.

There was a proposal to take over the Gogri bandh in the Monghyr district as a public embankment under the Bengal Act II of 1882. Proceedings were in progress and a sum of Rs. 13,800 was allotted for expenditure on raising and improving the *bandh* in 1918-19.

8. The total amount expended on repairs was Rs. 1,02,191 against **Repairs.** Rs. 80,400 in the preceding year. Of this Rs. 86,257 was spent in the Orissa Circle, Rs. 63,268 in the Gandak Circle, and Rs. 2,666 in the Eastern Circle.

The amount spent on ordinary maintenance and special repairs to the Gandak Takavi embankments under contract was Rs. 32,861 exclusive of the percentage charges for establishment, tools and plant against Rs. 35,017 in the preceding year.

No new retired lines were constructed on any of the embankments during the year under review. Some new spurs were constructed on the Tirhut embankment to arrest further attacks of the river. The two spurs in the 47th mile of the Champaran Embankment which were in progress when the year ended and the treespurs at Duboulia were finally completed during the year under report.

9. In the Gandak Circle the 12 vent sluice at Deosar in the 3rd mile of the Tirhut embankment which was reported in the previous year as completed, collapsed during the year under report owing to its foundation being undermined by swirls on the up-stream side. **Drainage.**

The scheme for constructing an embankment and a sluice to prevent flood water from entering the Pembranda Char in the district of Darbhanga has been finally completed during the year under report.

There are no drainage works in this province constructed under the Bengal Drainage, Sanitary Drainage or Embankment Act excepting a small scheme known as the Rajmahal Drainage Scheme completed in 1902 and maintained by the Civil Officers under the Bengal Drainage Act, VI of 1880.

## APPENDIX A.

## REPORT ON WORK IN HAND IN THE OFFICE OF THE CONSULTING ARCHITECT, BIHAR AND ORISSA, DURING THE YEAR 1918-19.

The value of the work designed during the year 1918-19 was about Rs. 50,55,893 only.

The attached list shows the projects which the Consulting Architect has been engaged on during the year 1918-19. Projects for Government House Ranchi (Gate House), residence for Postmaster General with outhouses, residence for Inspector-General of Police, residences for Director of Land Records and Surveys and Commissioner of Excise, residences for the Director of Public Instruction and Registrar of Co-operative Credit Societies, residences Type E (two-storied) and residences Type E (two-storied), alternative design, only have been completed during the year 1918-19. The line plans and the photographs show the general designs of these buildings.

It comes to some Architects to specialize on one type or another of Public buildings such as schools or churches and to others to range freely over the whole field but nearly all take their turn at domestic work.

In such buildings as schools, etc., there is comparatively small scope for invention as the code of rules laid down by the Government Department concerned ties one down, but in domestic work the problem is never twice the same and the variety of plan and treatment is endless. This can easily be seen, by studying the four types of plans and photographs annexed hereto. In designing these houses Mr. Munnings has avoided being merely clever for the sake of effect and the maximum amount of accommodation both as regards rooms and verandahs has been given for the money allowed to be spent.

Perhaps the most interesting plan of the four is the Type E. As an alternative plan from Type E, Personal Assistant to Inspector-General of Police, the same accommodation is given for practically the same cost, i.e., Rs. 19,377 against Rs. 19,430 including outhouses.

Type E (alternative) shows how the dining room, drawing room, office, etc., are grouped round the Entrance Hall while two good bed rooms, two dressing rooms, bath-rooms, etc., are on the first floor. This type of plan gives a roomy verandah on both sides well protected from the sun. In the Type E, Personal Assistant to the Inspector-General of Police, the same accommodation is provided but the rooms are grouped right and left of the Entrance Hall with a verandah running the length of the building.

In all designs of buildings the comfort of the occupant depends largely on the building being built in a favourable position on the site allotted. The prevailing breeze, protection from the sun, etc., must be considered, an all-important point often neglected when type plans have been sent into the district.

Illustrations 3 and 4 give another example of two residences giving nearly the same accommodation and built for the same money, i.e., Rs. 34,403, Rs. 34,405 including outhouses being planned on entirely different lines.

As the elevations and external lines of the building must follow the plan, these residences lend themselves to many interesting Architectural Designs.

Mr. Munnings is convinced of the practical advantage of flat roofs for the following reasons :—

It is sometimes supposed rather thoughtlessly that a house can be planned simply with reference to the required disposition of the rooms but that is not the case. If a pitched roof is contemplated it has to be considered from the start so that its gables and hips may be rightly contrived.

An irregular ground plan involves all sorts of difficulties with eaves, gutters, etc., and the employment of flat roofs simplifies things immensely. The plan can have any sort of projection or recess without creation of difficulties up above.

Another practical advantage is the reduction of down pipes necessary to carry off rain water and the immunity from the vagaries of wind and rain which are apt to try slate or tile beyond endurance.

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## GOVERNMENT HOUSE, RANCHI.

### ENTRANCE GATE LODGES.

The homely simplicity of the temporary Government House, Ranchi, designed by Mr. Munnings, makes a charming picture amidst the pleasant surroundings in which it is built and lately a small addition has been added by two small entrance gate houses. These gate houses give accommodation for the Police and staff and are designed so as to harmonise with the existing building, the general effect being obtained by a nurriah tiled roof. It has been built of brick plastered and teak wood and the whole costing about Rs. 2,468.

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The drawings and estimates of projects for Ravenshaw College, with Hindu and Muhammadan Hostels, Science College, Botany Block, Principal and Vice-Principal's residences, etc., Tej Narain Jubilee College with Hindu and Muhammadan Hostels, Science College, Principal and Vice-Principal's residences, etc., Greer Bhumi-har Brahman College with Hindu and Muhammadan Hostels, Science College, Principal and Vice-Principal's residences, etc., water towers at Daltonganj, Bhagalpur and Chapra, water tower (for General Hospital) at Patna and construction of second floor for the additional accommodation for His Honour's suite at Puri are complete and building operations have in most cases started.

Projects for the Civil Court at Gaya and Museum and Library at Patna are at present under consideration and sketch plans and elevations only have been submitted.

The site of the Patna University has been advanced by further tree planting.

Designs and suggestions were prepared and put forward for the University Buildings at Patna but the question of funds is always a difficult factor in designing educational buildings and the work is at present suspended pending further orders.

A. M. MILLWOOD,  
*Offg. Government Architect,*  
*Bihar and Orissa.*

*Statement showing the Designs prepared by the Government Architect, Bihar and Orissa, in the year 1918-19.*

Serial No.	Name of project.	Where constructed.	Approximate estimated cost.	Remarks.
1	2	3	4	5
			Rs.	
1	Ravenshaw College, with Hindu and Muhammadan Hostels, Science College, Botany Block, Principal and Vice-Principal's residences, etc.	Cuttack ...	10,00,000	
2	Tej Narayan Jubilee College, with Hindu and Muhammadan Hostels, Science College, Principal and Vice-Principal's residence, etc.	Bhagalpur ...	7,22,191	
3	Greer Bhumihar Brahman College, with Hindu and Muhammadan Hostels, Science College, Principal and Vice-Principal's residence, etc.	Muzaffarpur ...	4,72,293	
4	Water Tower ... ..	Dalkonganj ...	15,000	
	Ditto ... ..	Bhagalpur ...	58,000	
5	Ditto ... ..	Chapra ...	40,000	
6	Ditto (for General Hospital, Patna) ...	Patna ...	15,000	
7	Civil Court ... ..	Gaya ...	2,00,000	
8	Government House, Ranchi (Gate House) ...	Ranchi ...	2,468	
PATNA UNIVERSITY PROJECT.				
9	Lay-out Plan of Patna University, Patna College with Hostels.	Patna ...	8,63,435	
10	Science College ... ..	Do. ...	10,64,382	
11	Construction of 2nd floor for the additional accommodation for His Honour's suite at Puri.	Puri ...	9,700	
12	Residence for Postmaster-General with out-houses.	Patna ...	33,379	
13	Residence for Inspector-General of Police ...	Do. ...	33,379	Same type of design as for Postmaster-General.
14	Residences for Director of Land Records and Commissioner of Excise.	Do. ...	72,806	2 Buildings constructed.
15	Residences for Director of Public Instruction and Registrar. of Co-operative Credit Societies.	Do. ...	72,810	2 ditto.
16	Residences, Type E (two-storied) ... ..	Do. ...	77,920	4 ditto.
17	Ditto Type E (two-storied). Alternative Design.	Do. ...	58,131	3 ditto.
18	Museum and Library ... ..	Do. ...	2,50,000	
	Total ... ..	.....	50,58,393	

A. M. MILLWOOD,

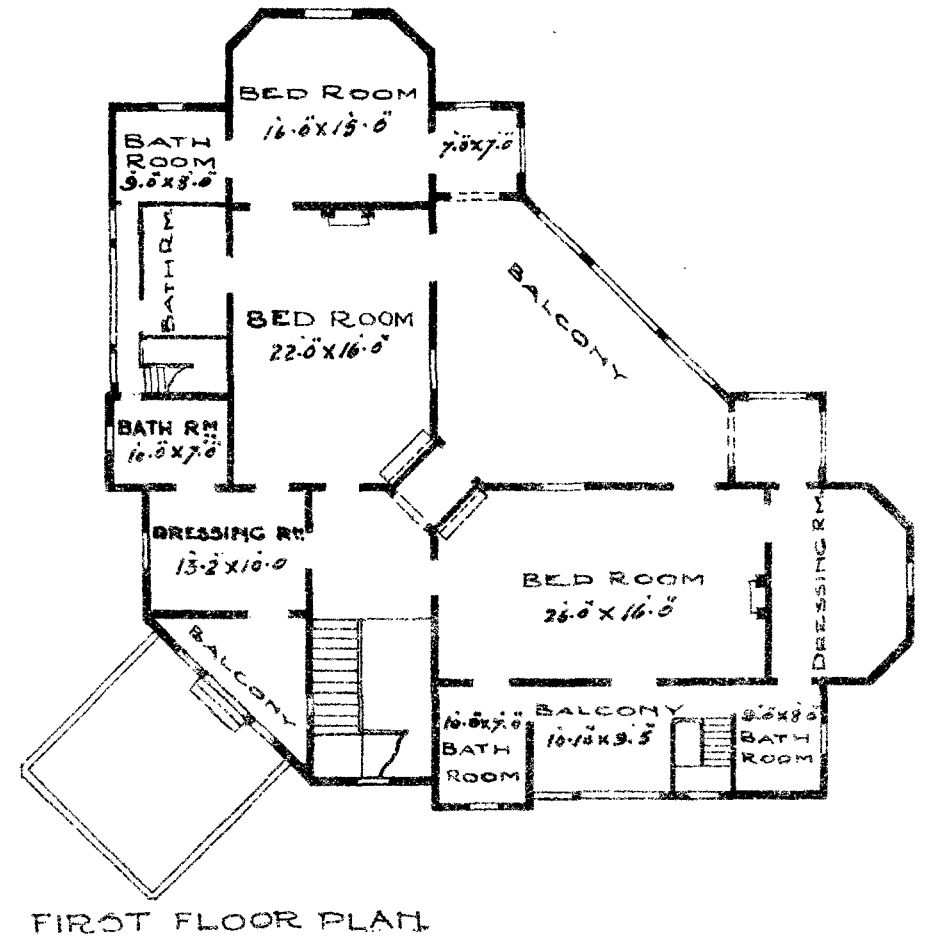
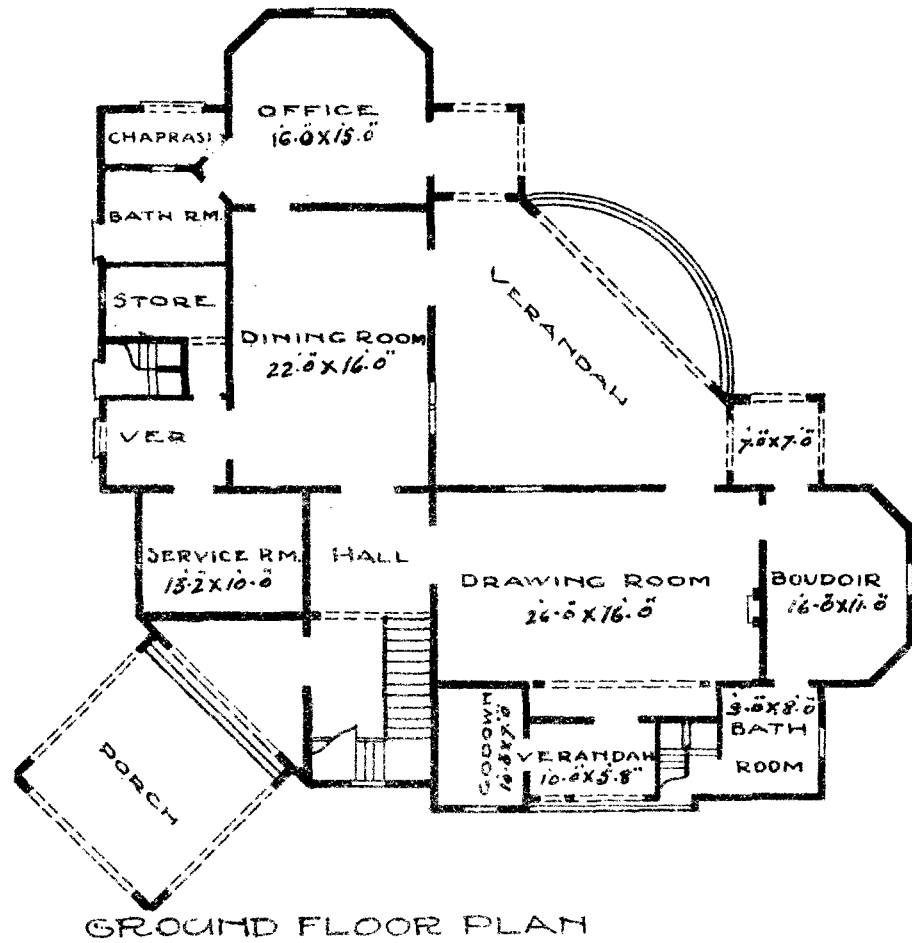
*Offg. Government Architect, Bihar and Orissa.*





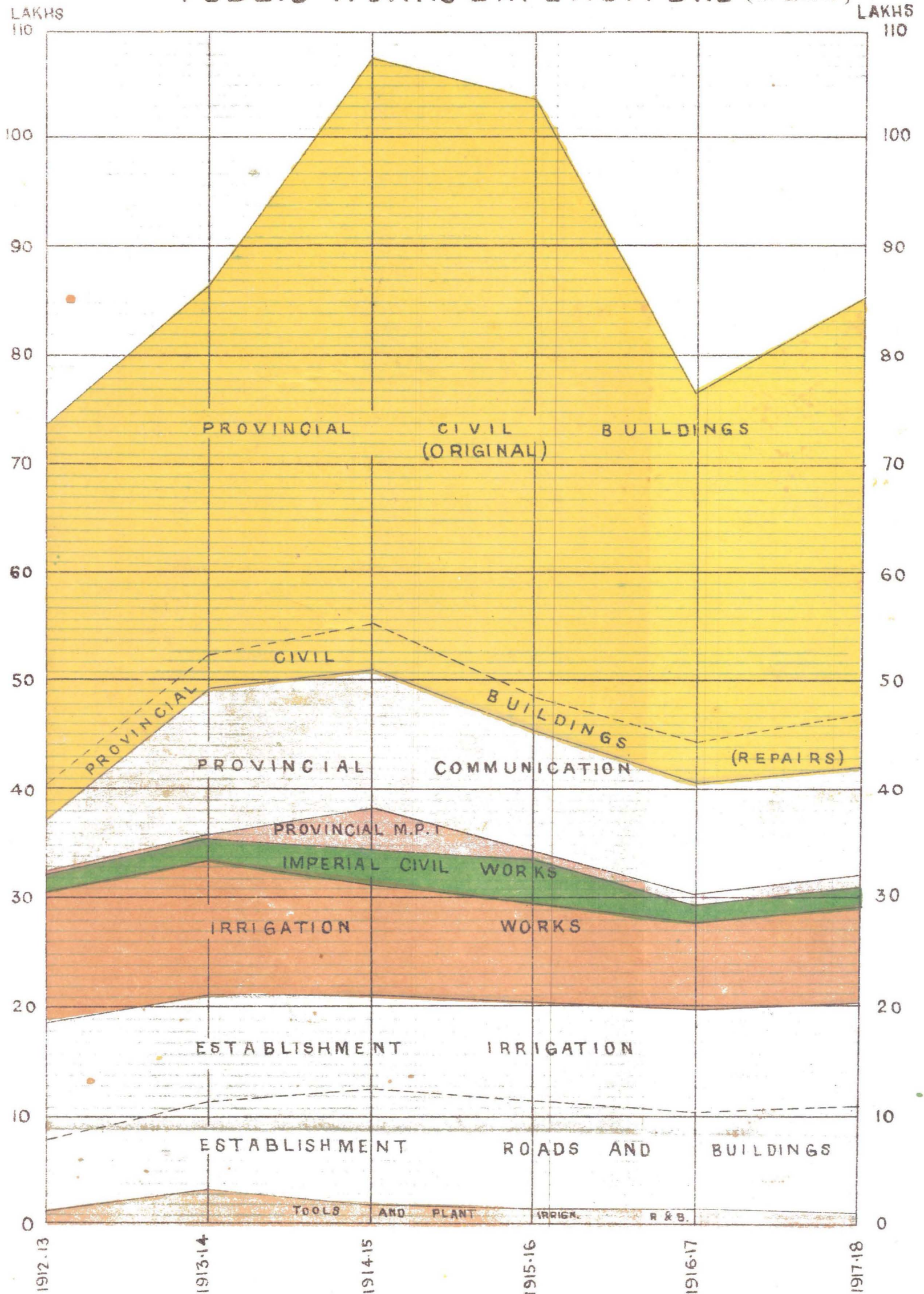


RESIDENCE FOR DIRECTOR OF PUBLIC INSTRUCTION  
 NEW PATNA  
 REVISED REVENUE SECRETARY'S TYPE  
 LINE PLAN



SD/ J.F. MANNINGS, A.R.I.B.A.  
 CONS. ARCHITECT  
 BIHAR & ORISSA  
 D/12-1-18.

# DIAGRAM SHOWING YEARLY PUBLIC WORKS EXPENDITURE (IN LAKHS)

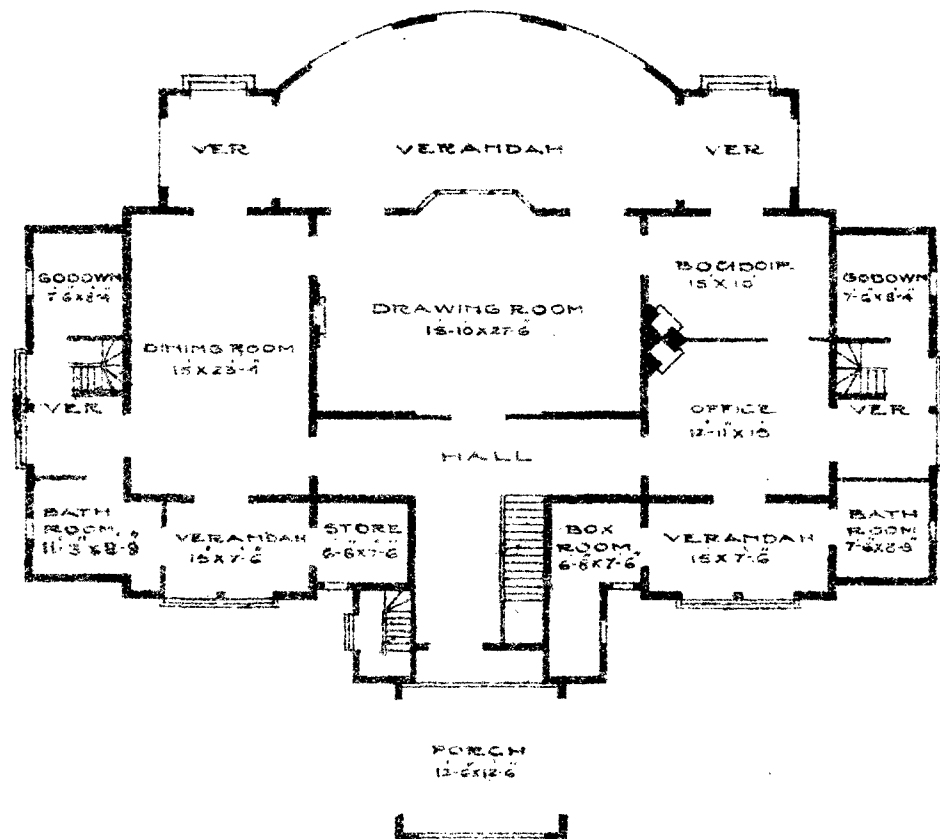
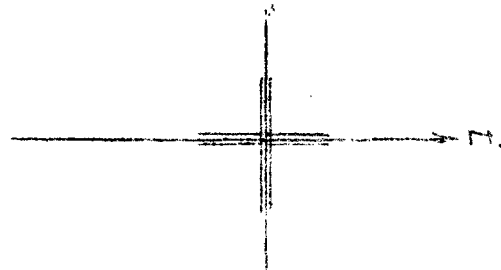




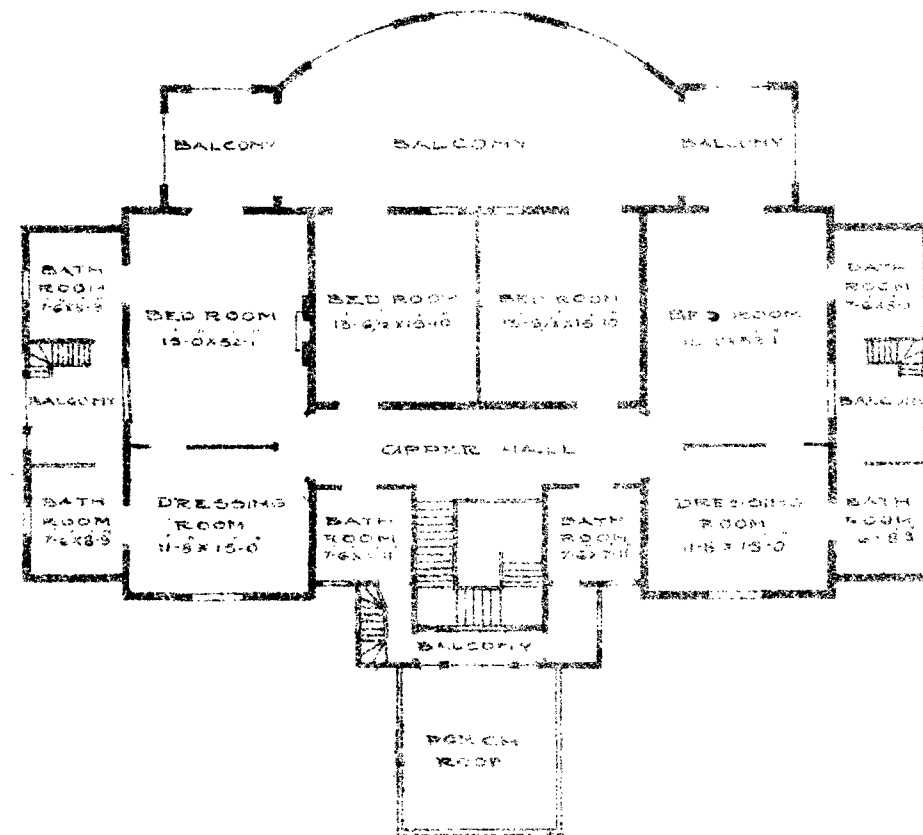
# RESIDENCE FOR D L R

## NEW PATNA

### LINE PLAN



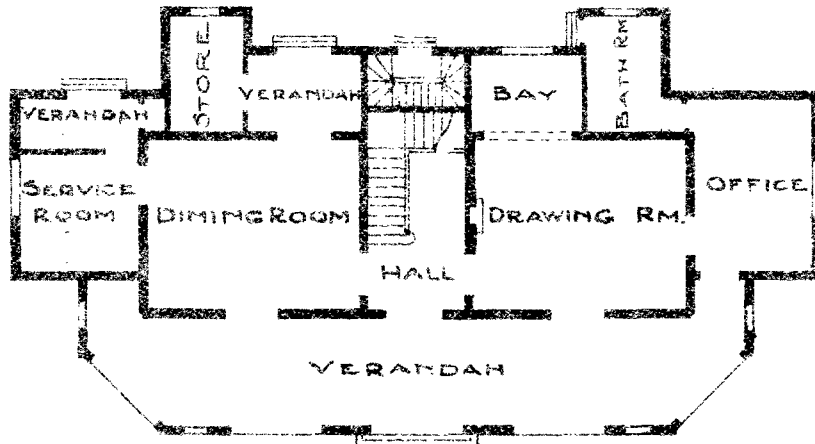
GROUND FLOOR  
PLAN



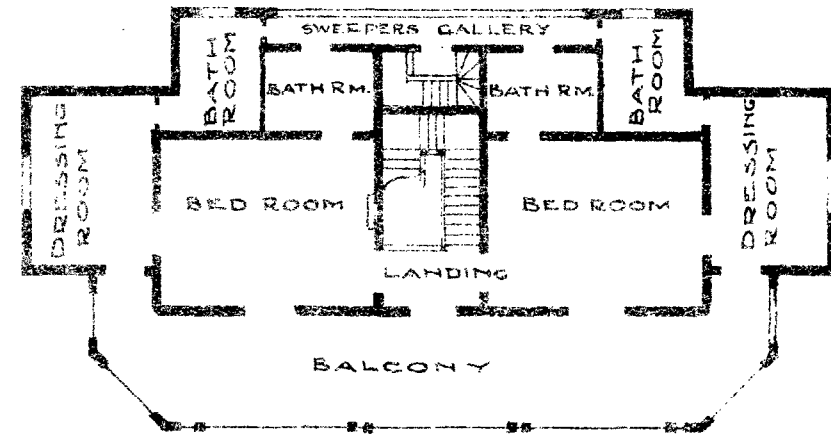
FIRST FLOOR  
PLAN

SD/ J. S. MONTAGNES, A.R.I.B.A.  
CONS ARCHITECT  
DESIGN & ORIGINAL  
D/ 11-12-17

RESIDENCE TYPE E  
 NEW PATNA  
 TWO STORED  
 FOR P. A TO I. G. OF POLICE  
 LINE PLAN



GROUND FLOOR PLAN

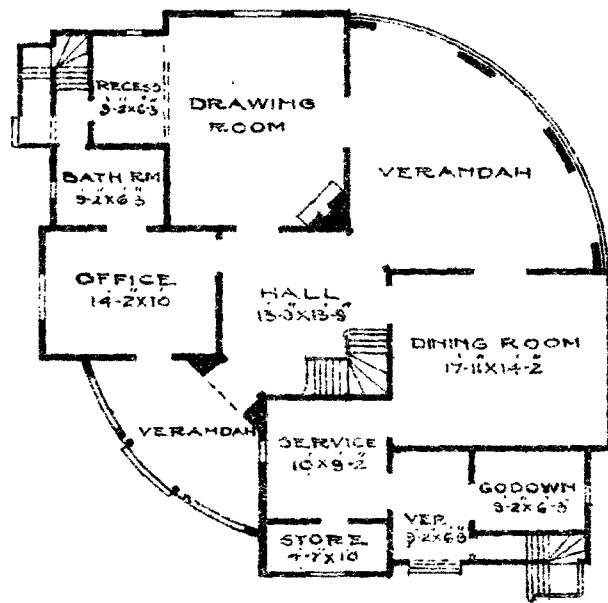
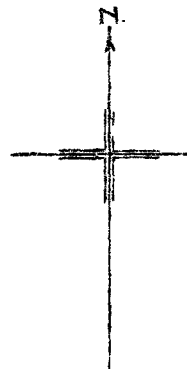


FIRST FLOOR PLAN

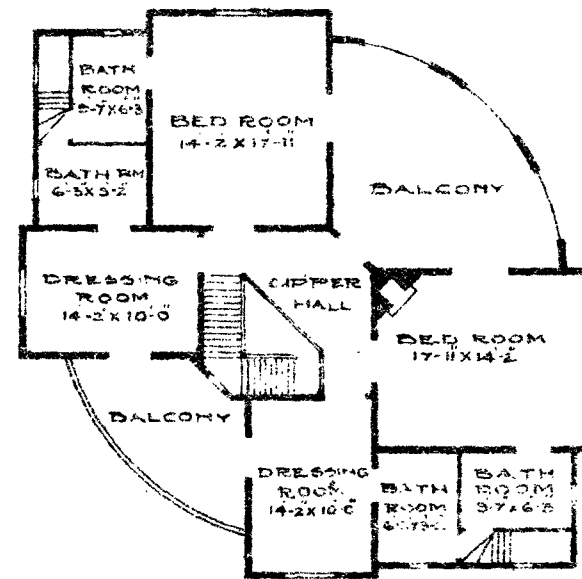
SD/- J. F. MANNINGS. A.R.I.B.A.  
 CONS. ARCHITECT  
 BIHAR & ORISSA  
 D/ 22-11-17

RESIDENCE TYPE E  
 NEW PATNA  
 TWO STORED (ALTERNATIVE DESIGN)  
 (FOR ELECTRIC INSPECTOR)

LINE PLAN



GROUND FLOOR  
 PLAN

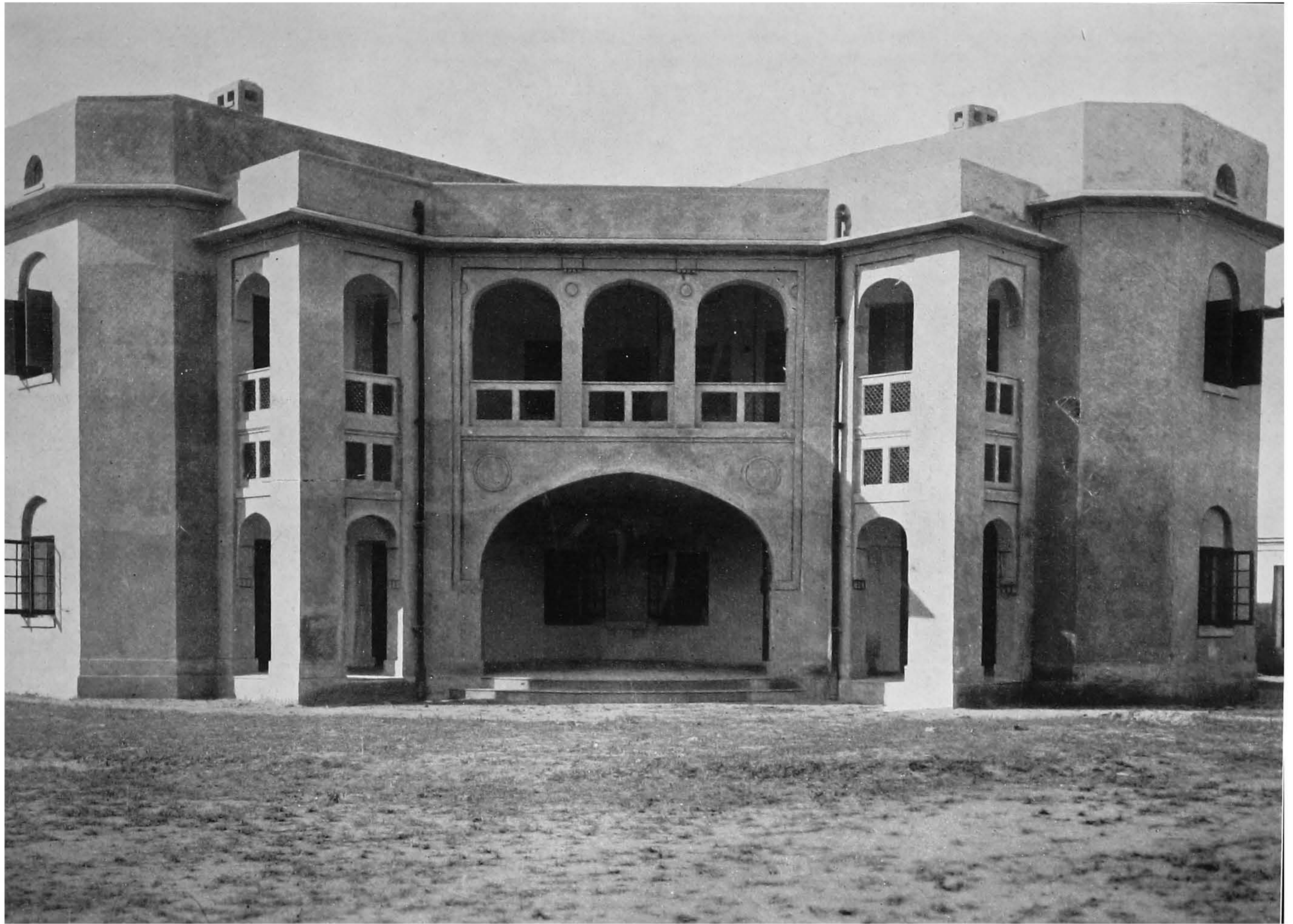


FIRST FLOOR  
 PLAN

*M.S.A.*

SD/ J. F. MANNINGS, A.R.I.B.A.  
 CONS. ARCHITECT  
 BHAR & ORISSA  
 D/ 11-12-17.





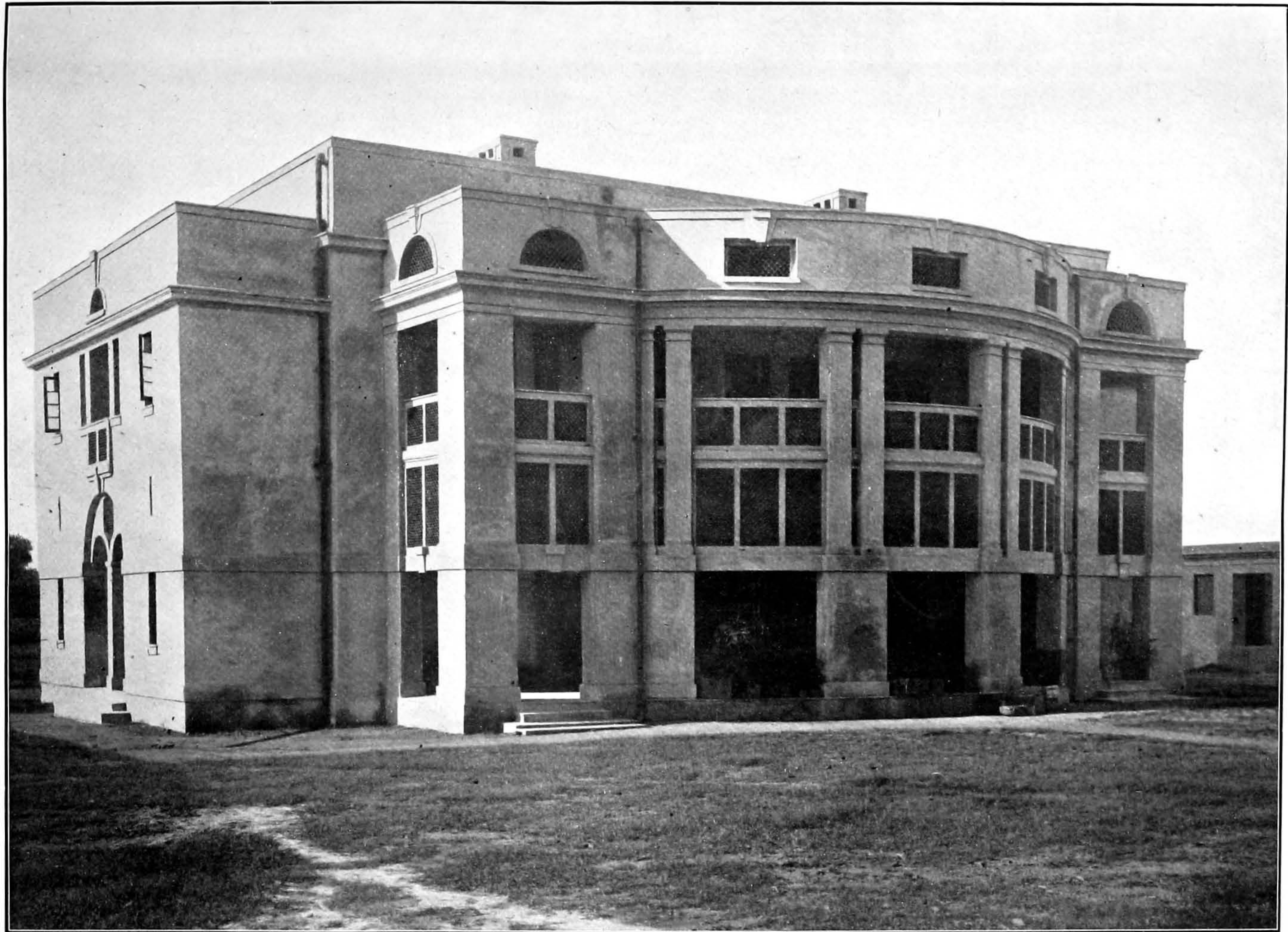
Director of Public Instruction's Residence.





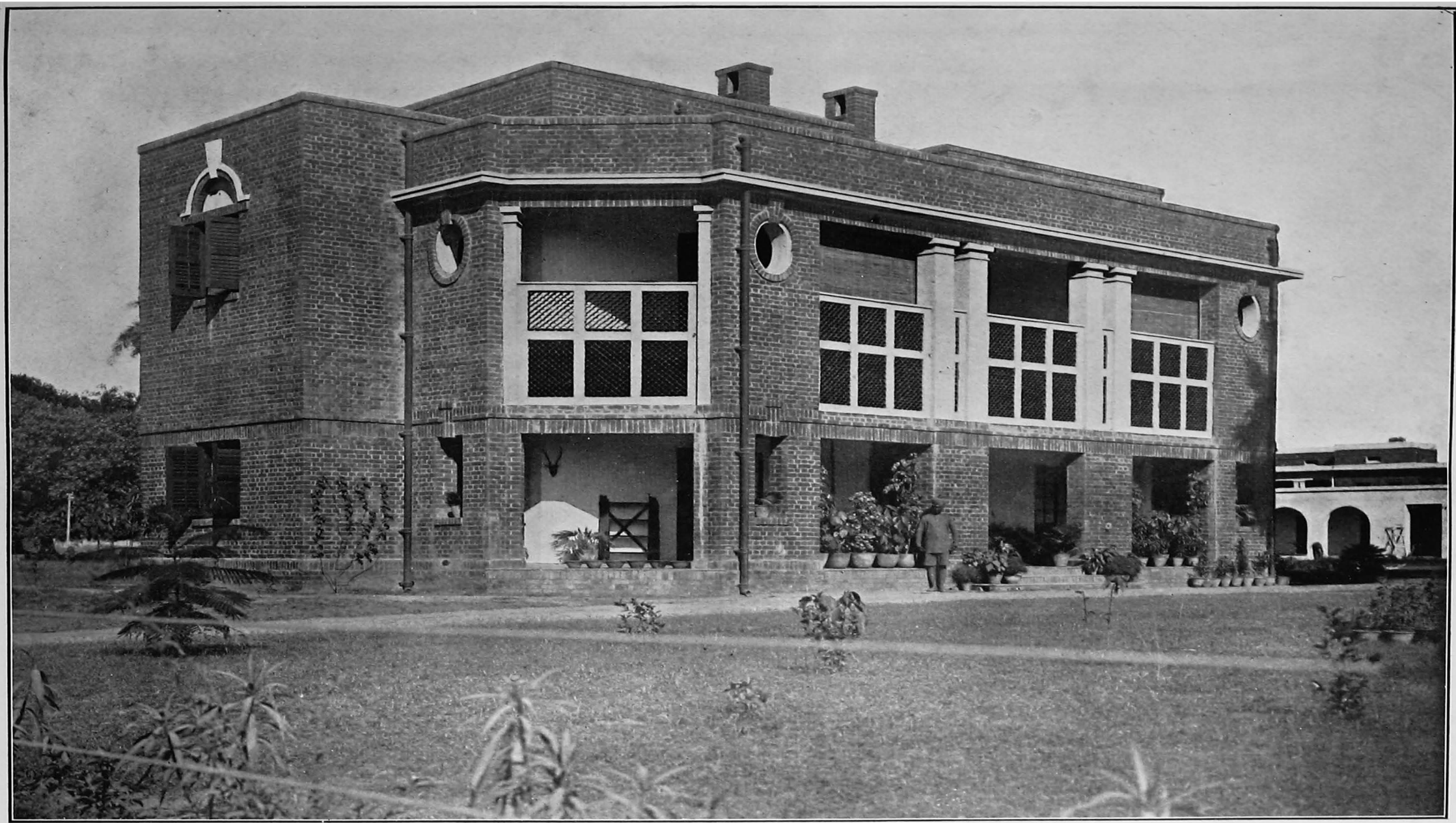
Director of Land Record's Residence, Front Entrance.





Director of Land Record's Residence, Garden Front.



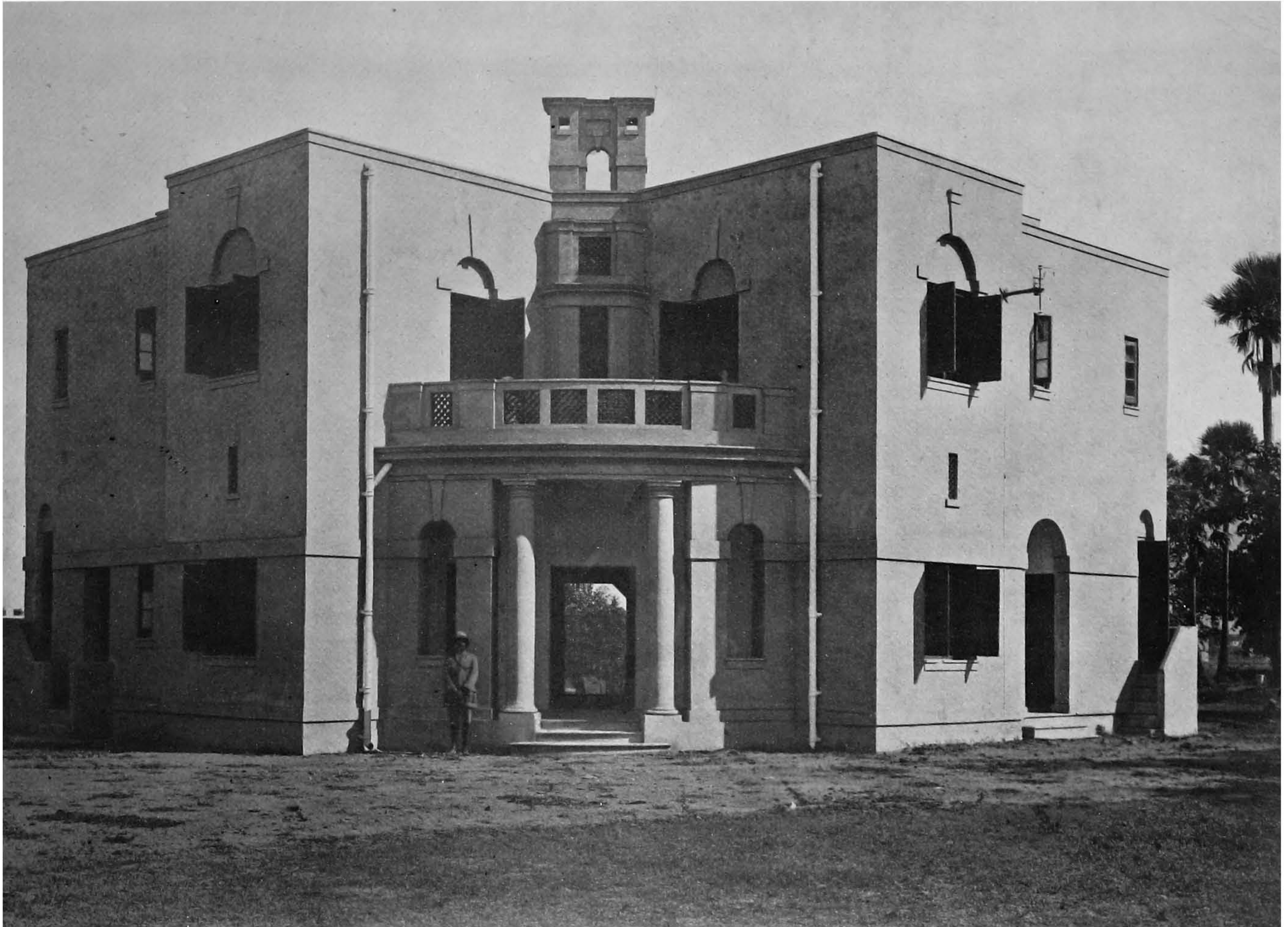


Type E, Residence.



Type E (Alternative) Residence, Entrance Front.





Type E (Alternative), Residence, Garden Front.





Gate House, Government House, Ranchi.

## APPENDIX B.

Statement showing the length of road communication, excluding village roads, maintained by the public authorities in Bihar and Orissa during the year 1918-19.

[This statement does not include roads and streets within Municipal limits, and maintained from Municipal Funds.]

Name of Division.	Name of District.	Length in miles of metalled roads maintained by the Public Works Department.	Length in miles of unmetalled roads maintained by the Public Works Department.	Length in miles of metalled roads maintained by Local authorities.	Length in miles of unmetalled roads maintained by Local authorities.	Total of metalled roads.	Total of unmetalled roads.	Grand Total.
1	2	3	4	5	6	7	8	9
Patna	Patna	42	...	134	470	176	370	646
	Gaya	67	...	202	734	269	734	1,003
	Shahabad	58	...	198	419	259	419	675
Tirhut	Saran	...	...	184	684	184	684	1,068
	Champanan	1	...	85	1,182	86	1,182	1,218
	Muzaffarpur	1	...	161	1,187	162	1,187	1,339
	Darbhanga	2	...	76	1,189	79	1,189	1,267
Bhagalpur	Bhagalpur	...	...	98	1,737	99	1,737	1,835
	Monghyr	...	...	139	1,445	139	1,445	1,584
	Purnea	...	...	146	1,567	146	1,567	1,713
	Santal Parganas	...	...	44	826	44	826	870
Orissa	Cuttack	77	25	112	418	169	443	632
	Puri	118	...	125	111	243	111	354
	Balasore	104	2	65	262	169	264	433
	Angul	39	60	...	...	38	60	98
	Sambalpur	100	20	4	158	104	178	282
	Orissa Feudatory States	11	203	...	...	11	203	214
Chota Nagpur...	Ranohi	117	28	23	765	140	792	893
	Palaman	10	...	13	468	23	468	491
	Hazaribagh	213	11	92	595	305	606	811
	Manbhum	145	...	108	622	253	622	875
	Singhbhum	83	...	1	491	84	491	575
	Total	1,187	349	1,950	15,530	3,137	15,879	19,016

List showing in order of urgency, the new lines of Railways in Bihar and Orissa, which should take an early place in the programme of construction for the year 1920-21.

Order of importance	Name of project.	Existing Railway with which the project is connected at initial point.	Initial and terminal points.	Whether surveyed or not.	Gauge.	Length in miles.	Estimated cost.	Remarks.
1	2	3	4	5	6	7	8	9
1	Mohuda-Daltonganj Railway with a siding to Hutar Coal-field.	Bengal Nagpur Railway	Mohuda Junction and Daltonganj.	Surveyed in 1889-90 and 1897-98.	Ft. 5 in. 6	171	Lakhs of Rupees. 1,68,00	
2	Lohardaga Extension	Ditto	Lohardaga and Netarhat Plateau	Surveyed in 1916-17	2 6	34	...	
3	Bhadrak-Chandbali Railway	Ditto	Bhadrak Station and Chandbali	Surveyed in 1915	5 6	29	25,55	
4	Amda-Jamda Railway	Ditto	Amda and Jamda	Surveyed in 1918-19.	5 6	70	...	
5	Hazaribagh Road—Hazaribagh Railway.	East Indian Railway, Grand Chord Line.	Hazaribagh Road Station and Hazaribagh Town.	Surveyed in 1914	2 6	41	14,58	
6	Gaya-Sherghati Railway	East Indian Railway	Gaya Station and Sherghati	Surveyed in 1912	5 8	22	12,80	
7	Kapilas Road—Sambalpur Railway.	Bengal Nagpur Railway	Kapilas Road and Sambalpur	.....	...	...	...	
8	Thakurgaon-Purnea Railway	Eastern Bengal Railway	Thakurgaon Station in the projected Siliguri-Kishenganj line to Purnea.	Not surveyed	3 3½	...	...	
9	Bausi-Baidyanath Railway	East Indian Railway	Bausi to Baidyanath or Deoghar	Surveyed in 1899	5 6	44	32,35	
10	Bhagalpur-Nalhati (or Ahmadpur) Railway.	Ditto	Bhagalpur to Nalhati or Ahmadpur.	Surveyed in 1895-96	5 6	...	...	
11	Laheria Sarai, Singhia-Shakarpura Extension.	Bengal and North-Western Railway, Tirhut Section.	Laheria Sarai and Shakarpura	.....	3 3½	...	...	
12	Muzaffarpur-Darbhanga Railway	Ditto	Muzaffarpur and Darbhanga	Surveyed in 1906-07	3 3½	38	32,70	
13	Tewara-Sitamarhi Railway	Ditto	Tewara station in the Muzaffarpur Darbhanga line and Sitamarhi.	Ditto	3 3½	30	16,53	

The 12th June 1919.

F. CLAYTON,

Secretary to the Government of Bihar and Orissa,  
Public Works Department.

APPENDIX D.

BUILDINGS, ROADS AND IRRIGATION.

Statement of expenditure on Public Works during 1918-19.

1	Original works.		Repairs.		Total.	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
2	3	4	5	6	7	
<b>IMPERIAL.</b>						
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<b>35—Construction of Protective Irrigation Works—</b>						
Works ...	1,00,100	...	...	...	1,00,100	96,293
Establishment ...	...	...	...	...	45,400	43,599
Tools and Plant ...	...	...	...	...	4,500	1,326
Suspense ...	...	...	...	...	...	...
Receipt on Capital Account ...	...	...	...	...	-3,000	-8,729
<b>Total, Protective Works ...</b>	<b>1,00,100</b>	<b>...</b>	<b>...</b>	<b>...</b>	<b>1,47,000</b>	<b>1,32,989</b>
<b>47—Military Works—</b>						
Works { Special ...	17,640	15,861	...	...	17,640	15,861
Works { Ordinary ...	2,021	2,195	11,000	10,389	13,021	12,584
Establishment ...	...	...	...	6,251*	6,452	6,251
Tools and Plant ...	...	...	...	436*	367	436
Barrack Department ...	...	...	...	...	...	...
Suspense ...	...	...	...	...	...	...
Expenditure in England ...	...	...	...	...	...	...
<b>Total, Military Works ...</b>	<b>19,661</b>	<b>18,056</b>	<b>11,000</b>	<b>17,076</b>	<b>37,480</b>	<b>35,132</b>
<b>45—Civil Works—</b>						
Works { Civil Buildings ...	3,33,047	2,64,868	48,172	41,549	3,81,219	3,06,117
Works { Communication ...	...	...	...	...	...	...
Works { Miscellaneous Public Improvements ...	25,500	...	...	...	25,500	...
Establishment ...	...	...	...	...	87,506	52,453
Tools and Plant ...	...	...	...	...	7,228	3,168
Suspense ...	...	...	...	...	...	...
<i>Deduct—Expenditure in England</i> ...	...	...	...	...	...	...
<b>Total, Civil Works ...</b>	<b>3,58,547</b>	<b>2,64,868</b>	<b>48,172</b>	<b>41,549</b>	<b>5,01,453</b>	<b>3,62,043</b>
<b>Carried over ...</b>	<b>...</b>	<b>...</b>	<b>...</b>	<b>...</b>	<b>...</b>	<b>5,30,164</b>

\* Total percentage charges for Establishment and Tools and Plant on Original Works and Repairs.

## APPENDIX D—contd.

	Original works.		Repairs.		Total.	
	Grants.	Outlay.	Grant.	Outlay.	Grants.	Outlay.
1	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Brought forward ...						5,30,164
<b>PROVINCIAL.</b>						
42—Major Works—Working Expenses—						
Works ...	1,05,660	1,00,383	5,21,467	5,32,060	6,27,127	6,32,443
Establishment ...	...	...	...	...	8,15,311	7,81,631
Tools and Plant ...	...	...	...	...	25,873	15,471
Refunds of revenue ...	...	...	...	...	4,450	2,847
Suspense ...	...	...	...	...	...	2,569
Total, Major Works ...	1,05,660	1,00,383	5,21,467	5,32,060	14,72,761	14,34,961
43—Minor Works and Navigation—						
Works for which Capital and Revenue Accounts are kept ...	8,000	6,540	...	...	11,380	9,247
Works for which Revenue Accounts are kept ...	...	...	500	446	770	792
Works for which Revenue Accounts are only kept ...	...	...	17,000	16,248	31,690	33,253
Works for which neither Capital nor Revenue Accounts are kept ...	...	...	1,800	1,520	4,690	2,141
Agricultural works for which neither Capital nor Revenue Accounts are kept ...	89,053	69,912	80,429	94,709	2,25,738	2,43,166
Reserve ...	23,684	...	...	...	23,684	...
Total, Minor Works and Navigation ...	1,20,737	76,452	99,729	1,12,923	2,97,952	2,88,599
45—Civil Works—						
Civil Buildings ...	34,91,198	22,42,663	5,73,846	5,53,095	40,65,044	27,95,758
Communication ...	3,94,184	2,97,709	5,69,578	5,62,144	9,63,762	8,59,853
Miscellaneous Public Improvement ...	1,74,134	2,05,331	25,531	21,195	1,99,715	2,26,576
Establishment ...	...	...	...	...	12,01,934	9,67,805
Tools and Plant ...	...	...	...	...	83,535	67,832
Suspense ...	...	...	...	...	20,538	21,891
Total, Civil Works ...	40,59,516	27,45,753	11,69,005	11,36,434	65,39,578	49,39,715
Carried over ...						71,93,439

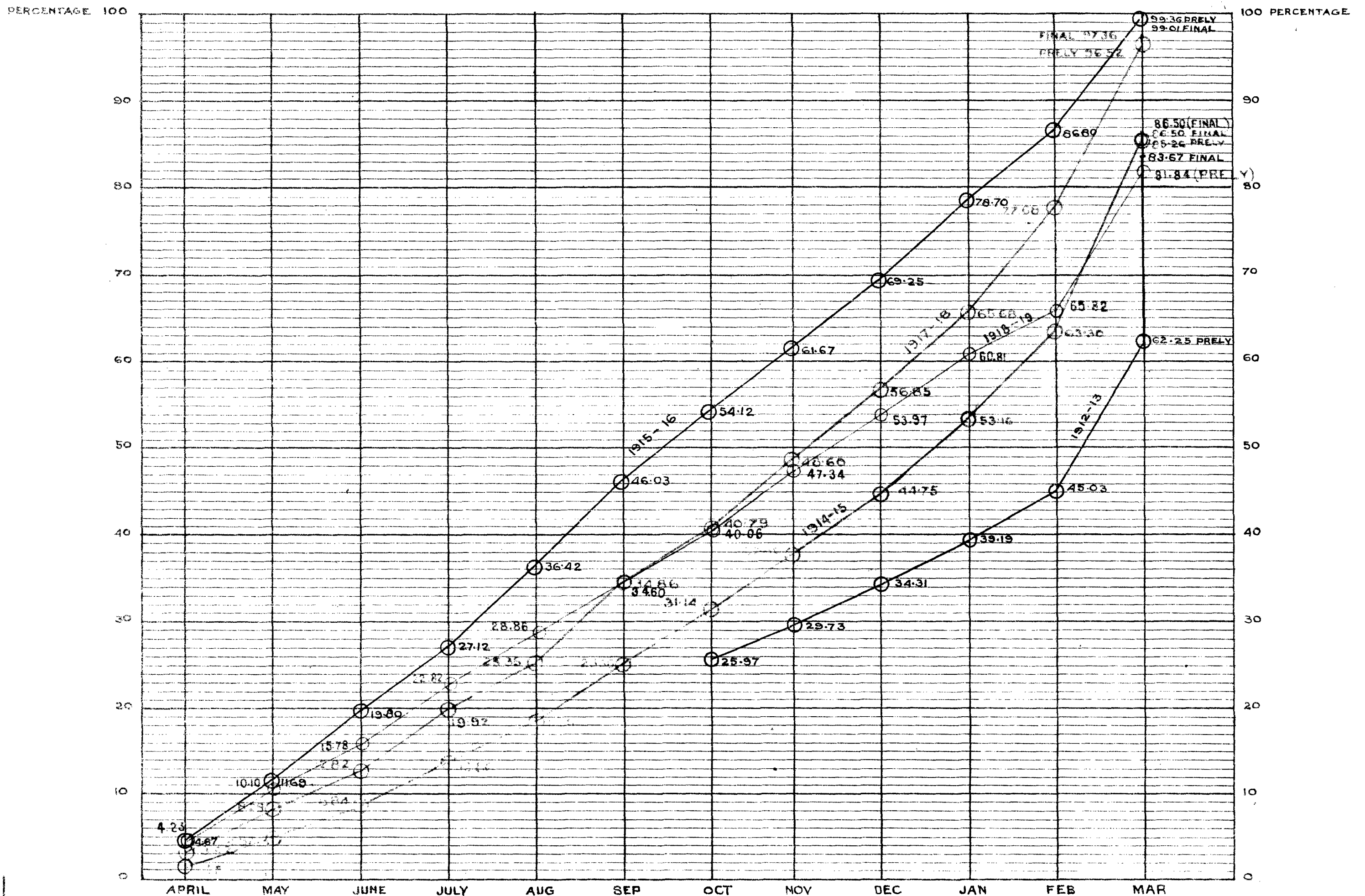
## APPENDIX D—concl'd.

	Original Works.		Repairs.		Total.	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
1	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Brought forward ...	...	...	...	...	...	71,93,439
<b>LOCAL FUNDS.</b>						
Other Local Funds ...	...	2,35,289	...	1,28,643	...	(a) 4,53,270
District Funds ...	...	...	...	...	...	(b) 48,12,919
<b>Total, Local Funds</b> ...	...	...	...	...	...	52,66,189
<b>CONTRIBUTION.</b>						
Imperial ... { Military ...	...	...	...	...	...	...
{ Civil ...	...	...	...	...	...	...
Provincial... { Civil Buildings ...	...	1,91,938	...	6,611	...	2,35,535
{ Irrigation ...	...	10,988	...	1,234	...	13,179
Minor Works and Navigation	...	...	...	...	...	...
<b>Total, Contribution</b> ...	...	2,02,926	...	7,845	...	2,49,714
<b>Grand Total</b> ...	...	...	...	...	...	1,27,08,342

(a) Includes Rs. 89,338 on account of supervising Establishment and Tools and Plant.

(b) Includes Rs. 6,89,432 for Establishment and Rs. 41,997 for Tools and Plant.

P. W. D.  
 BIHAR & ORISSA  
 CURVES SHOWING MONTHLY PERCENTAGE EXPENDITURES UNDER ALL MAJOR HEADS  
 IN THE ROADS & BUILDING BRANCH  
 (INCLUDING ESTABLISHMENT, TOOLS & PLANT & SUSPENSE)



REFERENCE.  
 1912-13

1915-16

1917-18

1918-19



# GOVERNMENT OF BIHAR AND ORISSA

PUBLIC WORKS DEPARTMENT.

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ANNUAL ADMINISTRATION REPORTS

FOR

ROADS AND BUILDINGS, IRRIGATION AND RAILWAYS

FOR THE YEAR

1919-20.



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PATNA :

PRINTED AT THE BIHAR AND ORISSA GOVERNMENT PRESS.  
1920

Price Rs. 2 annas 12.

## Agents for the Sale of Books published by the Bihar and Orissa Government.

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|--|---|

## SUMMARIES.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

Mr. F. Clayton, Chief Engineer and Secretary to Government in the Irrigation Branch, held charge of his office throughout the year. Mr. E. G. Stanley, Chief Engineer and Secretary to Government in the Buildings and Roads Branch, proceeded on combined leave preparatory to retirement at the end of April and Mr. W. S. Bremner, Superintending Engineer, who was appointed to officiate, continued in his office till the close of the year. The retention of the temporary appointment of Second Chief Engineer as a permanent measure has been sanctioned by His Majesty's Secretary of State for India. Administrative changes

Certain changes were made in the distribution of jurisdictions of the several Divisions of the Orissa Circle. Two temporary subdivisions were opened under the Sanitary Works Division. The Special Works Division was reconstituted with three subdivisions. A temporary subdivision was formed at Chauliaganj under the Cuttack Division.

The Imperial Service and the Provincial Service of Engineers were amalgamated into one service and the Public Works Department was organized in three services, viz. (i) The Indian Service of Engineers, (ii) The "Provincial" Engineering Service, (iii) The "Subordinate" Engineering Service. A revised scale of pay was also sanctioned for Engineers. Organization of the Public Works Department.

The final orders of the Government of India were received in regard to the questions of the general organization of the Public Works Department and to the questions of accounts procedure and decentralization.

#### BUILDINGS.

The expenditure of the year under Original Works Civil Buildings (Provincial) amounted to Rs. 23,12,404 against Rs. 22,42,663 of the previous year. General.

Certain additional residential buildings in connection with the New Capital were sanctioned by the Government of India during the year under review and some of them were finished. Capital Works.

A start was made with the sewerage scheme for the New Capital which was also sanctioned by the Government of India at an estimated cost of Rs. 5,35,351.

Orders were also received from the Government of India during the latter part of the year for the construction of a new Council Chamber for accommodation of the enlarged Council under the Reforms Scheme and work was started on the same towards the close of the year.

Collection of materials and manufacture of bricks for the construction of the Military buildings at Chandipur were in progress. Imperial Military Works.

The construction of Post Office building at Kanke and Post and Telegraph office at Pusa was in progress. Aviation ground at Gaya was completed and Post and Telegraph office building at Madhipura finished. Mr. Rook's Bungalow at Muzaffarpur was purchased for the joint office and residence of the Superintendent of Post Offices, Tirhut Division. Imperial Civil Works.

The spur-work at Johnson's ghat, Pusa, was completed and some progress made with the construction of the Rest House for Indian visitors there. The Residency Overseer's quarters at Raxaul was completed. Miscellaneous.

- Court.** The house of the Hon'ble Khwaja Muhammad Nur was acquired and materials collected for the Civil Court buildings, Gaya. Materials were also collected for the Subdivisional Court buildings at Latehar in the district of Palamau and for the additional Court building at Dumka.
- Jails.** The new double-storied barrack in the Central Jail at Bhagalpur was completed and work was started on the construction of Tuberculosis ward in the same Jail. The new Hospital, Tuberculosis ward and separate Female Ward in the Central Jail, Gaya, were finally completed.
- Police.** Constables' barracks at Cuttack, Chapra, Nawadah and Dhanbad and Police Out-post buildings along the Nepal Frontier in Kissenganj Sub-division, were constructed. Residence for the Principal, Constables' Training School at Chauliganj (Cuttack) and infectious ward attached to the Police Hospital at Puri were reaching completion at the close of the year. Some progress was made with the construction of Reserve Police Lines at Chapra, Town Police barrack at Khajanchihat and Police Station at Kishanganj.
- Education.** Good progress was made with the construction of the Greer Bhumihar Brahman College, Muzaffarpur, and Ravenshaw College, Cuttack, and Hostel Blocks A, B and E attached to the former Institute were completed. The residences for the Head Master, Muzaffarpur Zila School, Principal, Sanskrit College and for two Indian Educational Service officers appertaining to the Ravenshaw College were well nigh completed. Joint office and residence of the Inspector of Schools, Tirhut Division at Muzaffarpur, were completed.
- Work on the construction of Hostel with Superintendent's quarters attached to the Ranchi Training School was started and good progress was made. Progress was made with the construction of Hostels for students of the Purulia and Chaibassa Zila Schools and the High English School in the New Capital at Patna was completed.
- Medical.** The Dissecting Block in connection with the Temple Medical School, Patna, was completed and work was started on the Isolation Ward. Certain improvements were carried out to the European Lunatic Asylum at Kanke, while work on the Indian Asylum was in progress. The construction of the Leper Asylum at the Cuttack, which was in progress from the previous year, was completed.
- Registration.** A new type plan for Sub-Registry offices was approved by Government and several Sub-Registry offices of this type were built.
- Public Works Department.** The residence of the Executive Engineer, Sambalpur Division, was well-nigh completed.
- Monuments and Antiquities.** A Monument in the battlefield of Buxar was erected and special repairs to Arrah House and to certain monuments and graves at Gaya were carried out during the year under review.
- Residences.** Two gate houses with electric fittings were constructed in the Government House, Ranchi, while the work of providing additional accommodation for His Honour's suite over the second floor of Government House at Puri was almost completed. The construction of a residence for the Political Agent, Orissa Feudatory States, at Sambalpur was in progress. Mr. Kennedy's Bungalow at Muzaffarpur and the old School building at Nawadah were purchased, the former for the residence of the Civil Surgeon and the latter for that of the Second Officer.

### COMMUNICATIONS.

As in the past year only works in progress from previous years and work of an urgent character were taken up and carried out during the year.

The new road from Government House at Patna leading to the Cantonment at Dinapur was completed and opened for light traffic only. The work of raising and widening the existing Bankipur-Dinapur road also reached completion. Further improvements were effected to the new alignment of the Patna-Gaya Road. A start was made with the widening of the metalled

portion of the Grand Trunk Road between Chirkunda and Nirsa. The works of diverting the Cuttack-Sonpur Road between Harbhanga and Sitalpani and of improving the Angul-Tickerpara Road, 2nd section, remained in progress at the close of the year, while the improvements to the Cuttack-Sambalpur Road, 2nd section 3rd portion, were finished.

Additional waterways were provided in miles 283, 298 and 309 of the Grand Trunk Road. Preliminaries having been concluded, the preparation of the detailed project for the bridge over the Lilajan river was taken in hand. The bridge over the Izri river on the Chas-Gulbera road was completed, while that over the Gowain river on the same road was still in progress. A proposal was approved to bridge the Barakar river crossing the Giridih-Dumri Road. The construction of bridges over the Am Nala on the Sambalpur-Sonpur road, the Ranj river and the Tengra Nala on the Raipur Sambalpur Road and over the Nigra and the Matulia rivers on the Angul-Tickerpara Road was begun and sufficient progress made on them. The bridge over the Nigra river at Matanga on the Cuttack-Angul Road was almost completed.

The causeway over the Khorkai river on the Chaibasa-Jamshedpur road remained unfinished at the end of the year.

Certain additions were made to the Dak Bungalow at Chaibasa.

The planting and maintaining of trees alongside roads were carried out as usual.

#### MISCELLANEOUS PUBLIC IMPROVEMENTS.

No new works of importance were taken up during the year; only works in progress were completed.

The right bank of the river Ganges from the Civil Surgeon's compound to the east of the European Club at Bankipur has been protected. The revetments below the Bihar School of Engineering and the Recreation Bungalow at Gulzarbagh were reconstructed.

The drain under construction across the Race Course at Muzaffarpur was completed.

A tank was excavated at Simdega, district Ranchi.

#### RAILWAYS.

Three Light Railways are partially under the control of the Government Administration of Bihar and Orissa. The Government of India in the Railway Department (Railway Board) control the larger and more important Railway systems.

The total mileage remained unchanged during the year under review. Mileage.

Surveys of about 283 miles were sanctioned by the Railway Board for survey during the year. Surveys.

On the Bakhtiyarpur-Bihar Light Railway there were four derailments. Accidents.  
On one occasion a girl of three years of age was run over and killed by the engine of a mixed train.

On the Arrah-Sasaram Light Railway there was one collision and two derailments, without loss of life or injury either to the railway staff or travelling public. On one occasion a Travelling Ticket Examiner fell from a passenger train and received severe injuries to his right leg, whilst on another occasion a 3rd class passenger jumped from a passenger train and sustained slight injuries.

On the Bengal and North-Western Railway a woman was run over and injured while tre-passing on the line.

On the East Indian Railway there were three collisions resulting in injuries to two Railway servants and five passengers, and one derailment in which one Railway servant was injured.

On the Bengal-Nagpur Railway there were two derailments without loss of life or injury.

## CANALS.

### Productive works.

The area irrigated by the two Productive works, viz. the Orissa and Son Canals System, was 817,118 acres against 924,603 acres of the preceding year. The decrease occurred mainly in the *rabi* area irrigated on the Son Canals which although apparently low when compared with the previous year really represents the figure of a normal year and was much higher than that of the triennium immediately preceding the exceptional year 1918-19. These canals are open for navigation.

The gross receipts from all sources amounted to Rs. 28,16,313 against Rs. 25,83,632 of the previous year. The water-rate receipts from the Son Canals were about 2½ lakhs of rupees more than those collected in 1918-19. This increase is due to large *rabi* irrigation during the previous year, the demand for which was adjusted in the year under report. The receipts from navigation were less than those of the previous year; the decrease was mainly on the Orissa Canals and was due to carriage of less traffic consequent on the failure of crops.

The total working expenses (direct and indirect) amounted to Rs. 13,69,088. The net profit to Government after meeting the year's working expenses was Rs. 14,47,225 which did not fully cover the interest charges of the year, amounting to Rs. 17,86,910. Including interest charges, the Orissa Canals were worked at a loss of Rs. 8,03,404 while the Son Canals brought in a net revenue of Rs. 4,63,719.

No new works of any importance were undertaken and the canals were maintained in fair condition. The rainfall was about normal and was fairly well distributed.

### Protective Irrigation Works.

The area irrigated by the Protective Works, viz. the Tribeni and Dhaka Canals, was 94,699 acres against 66,300 acres of the preceding year. The long lease system introduced in 1918-19 met with increased popularity; the area that came under lease was about 8,000 acres higher than that of the previous year. The rate has been raised by 4 annas per acre and will be collected from next year. These canals are used for irrigation only.

The gross receipts amounted to Rs. 2,00,010, while the working expenses (direct and indirect) were Rs. 2,79,888, resulting in a net loss of Rs. 79,978 (excluding interest charges).

### Minor Works and Navigation.

The three canals falling under this class, viz., the Teur (Madhuban) Canal, Orissa Coast Canal, and Saran Canals were maintained at a total cost of Rs. 17,05 (excluding establishment and tools and plant charges). The Teur Canal irrigated an area of 3,107 acres; the Orissa Coast Canal is open for navigation only while the Saran Canals have been closed to irrigation since 1894. The gross receipts for these canals amounted to Rs. 13,412 only.

### Survey and Investigations.

Preliminary surveys and investigations in connection with certain possible irrigation schemes were carried out, but these are not yet sufficient to admit of the preparation of any detailed estimate.

## EMBANKMENT AND DRAINAGE WORKS.

The expenditure on embankment was Rs. 1,70,160 against Rs. 1,74,362 in the preceding year of this sum Rs. 1,02,043 was spent on ordinary maintenance and river protective works.

The floods in some of the river of Orissa only were high, but in other parts they were of a normal character during the year under report.

**CHAPTERS**  
**PUBLIC WORKS DEPARTMENT**  
**ESTABLISHMENT.**

The appointment of Chief Engineer and Secretary to Government in the Irrigation Branch was held by Mr. F. Clayton throughout the year. The appointment of Chief Engineer and Secretary in the Buildings and Roads Branch was held by Mr. E. G. Stanley till about the end of April when on his proceeding on combined leave preparatory to retirement he was succeeded by Mr. W. S. Bremner, Superintending Engineer. The appointment of the second Chief Engineer, which was hitherto temporary, was sanctioned permanently by the Secretary of State. Administrative changes

The services of Mr. A. Brebner, Executive Engineer and Under-Secretary to Government in the Buildings and Roads Branch, were placed temporarily at the disposal of the Government of India in the Public Works Department with effect from the 4th December and Mr. W. Albert-Samuel, Assistant Secretary, held charge of the current duties of the office till the 11th idem when Mr. N. G. Dunbar, Executive Engineer, returned from deputation under the Government of India and was appointed to officiate as Under-Secretary. Mr. Dunbar proceeded on leave by the middle of January and Mr. E. J. H. Hudson, Assistant Engineer, succeeded him on return from Military duty.

The Western and Gandak Circles remained in charge of Messrs. Edge and Huntingford, Superintending Engineers, respectively, throughout the year. Mr. C. B. Mellor, Superintending Engineer, continued in charge of the Son Circle till the end of the year except for a period of one month during which he was on privilege leave and Mr. H. H. Stevens, Executive Engineer, officiated for him. Mr. E. Blaber, Superintending Engineer, remained in charge of the Eastern Circle till about the end of May when he proceeded on combined leave and Mr. J. G. Powell, Executive Engineer, held charge of the current duties of the office until he was relieved by Mr. Bishun Svarup as Officiating Superintending Engineer. Mr. W. S. Bremner, Superintending Engineer, held charge of the Orissa Circle till the end of April when he was succeeded by Mr. Bishun Svarup as Officiating Superintending Engineer. The latter held charge till the first week of June after which he was relieved by Rai Bahadur Shish Chandra Chakravarti, Officiating Superintending Engineer, who held charge of the Circle till the close of the year.

Mr. J. F. Munnings, Government Architect on leave, resigned his appointment with effect from the middle of January and Mr. A. M. Millwood, Assistant Architect, who was officiating for him, succeeded him permanently.

Mr. F. C. Temple, Sanitary Engineer, resigned his appointment early in June and he was succeeded by Mr. J. G. Alexander as Officiating Sanitary Engineer.

Mr. S. K. P. Sinha, Lieutenant W. L. Murrell and Captain A. E. Green were appointed to the Indian Service of Engineers.

Certain changes were made in the distribution of jurisdictions of the several divisions of the Orissa Circle consequent on the proposed transfer of the Angul and Phulbani subdivisions of the Brahmini Division to the control of the Deputy Commissioner of Angul. Two temporary subdivisions were opened under the Sanitary Works Division in connection with the plumbing charge and the maintenance of drains, sewers and disposal works. On the completion of most of the capital works, the Special Works Division was reconstituted with three subdivisions. A temporary subdivision was formed at Chauliaganj in connection with the construction of the new buildings for the Ravenshaw College at Cuttack.

**Organization of the  
Public Works  
Department.**

His Majesty's Secretary of State for India sanctioned the amalgamation of the Imperial Service and the Provincial Service of Engineers into one service designated "The Indian Service of Engineers" and the organization of the Department in three services, viz. (i) The Indian service of Engineers, (ii) The "Provincial" Engineering Service and (iii) The "Subordinate" Engineering Service. A revised scale of pay was also sanctioned for the Engineers of the Department in consideration of the inadequacy of their existing rates of pay.

The final orders of the Government of India were received on the recommendations of the Public Works Department Reorganization Committee in regard to the questions of the general reorganization of the Department and the questions of accounts procedure and decentralization.

**BUILDINGS.**

**Imperial Civil  
Works.**

The construction of the Post Office building at Kanke with quarters for the Sub-Postmaster and of the Post and Telegraph Office buildings at Pusa was in progress. Combined Post and Telegraph office building at Madhipur was finished and the Aviation ground at Gaya was completed.

Mr. Rook's bungalow at Muzaffarpur was purchased for the joint office and residence of the Superintendent of Post Offices, Tirhut Division. Materials were collected for the extension of the Post Office building at Jharia.

**Miscellaneous.**

Quarters were constructed for the 3rd clerk, Draftsman-Surveyor and other staff of the Office of the Chief Inspector of Mines at Dhanbad and work was started on the construction of the European Surveyor's quarters. Progress was made with the construction of Rest House for Indian visitors, quarters for the first Assistant to the Imperial Mycologist and the river protective work at Pusa. The spur work at Johnson Ghat in the same locality was completed.

**Settlement.**

A temporary Settlement Office building with two Junch sheds was constructed at Purulia.

**Residency  
buildings.**

The construction of the Residency Overseer's quarters at Raxaul, which was in progress from the previous year, was completed, and a new spur was constructed in the river Siriswa to arrest the erosion on the banks.

**PROVINCIAL CIVIL WORKS.**

**Court buildings.**

Double Munsifi at Buxar and the construction of an additional building for the Sub-Treasury and Record Room at Banki were approaching completion when the year closed. The construction of Treasure Guards' barrack, Haja and Malkhana at Jehanabad and of additional Record Room at Purulia were in progress. Witness sheds in the Court compound at Hazaribagh, Chatra and Phulbani were erected. A new Record Room and Record Racks at Dinapur were constructed. Collection of materials was commenced for the construction of Subdivisional Buildings at Latehar in the district of Palamau and for the additional Court building at Dumka. The house of the Hon'ble Khwaja Muhammad Nur was acquired and materials were collected for the construction of the Civil Court Building at Gaya.

**Circuit House.**

The construction of a new Circuit House at Chaibasa was started during the year while certain additions and alterations were carried out to the Circuit House at Balasore.

**Jail.**

The following works in the Hazaribagh Central Jail, which were in progress from the previous year, were completed during the year :—

- (1) Certain improvements to the Central Jail,
- (2) Fixing Blanchard arc lamps for lighting the Jail at night; and
- (3) Improvement to water-supply to the Reformatory School;

The construction of the Tuberculosis ward in the Central Jail at Bhagalpur was started and the new double-storied barrack completed. The new Hospital Tuberculosis ward and separate female ward in the Central Jail, Gaya, were finally completed and the extension of the Segregation and under-trial ward



and the provision of water-pipe connection in the new Hospital in the same Jail were in progress. The Jailor's quarters in the intermediate Jail, Dumka, and a barrack for the warders of the Kendrapara Sub-Jail, which were in progress from the previous year, were finished.

The work of providing a non-inflammable roof to the Police Station building at Balasore, which was in progress from the previous year, was completed. Good progress was made with the construction of twelve Constables' barrack, one Sub-Inspector's and two Writer Constables' quarters at Nawadah and two Sub-Inspectors' and two Head Constables' quarters at Buxar. A residence for the Principal, Constables' Training School at Chauliaganj (Cuttack), an Infectious Ward and Sweepers' shed for the Police Hospital, Puri, and Thana buildings at Bettiah were reaching completion when the year closed. The work of the conversion of the old Opium Building into a Police Station at Bhabhua was well-nigh completed. Land was acquired for improving the sanitary condition and reconstruction of the Police Station buildings at Sasaram. The works on the construction of Reserve Police Lines at Chapra, Town Police barrack and subsidiary buildings at Khajanchihat in Purnea, quarters for three Sub-Inspectors and four Head Constables at Araria and Police Station buildings at Kishanganj were in progress. The following works were completed during the year under review :—

- (1) A double-storied barrack with cook-sheds for the Constables of the Reserve Police lines at Cuttack.
- (2) Quarters for the Police Inspector at Nimapara,
- (3) Constables' barrack with cook-sheds, latrine and masonry wall at Chapra.
- (4) Constables' barrack and quarters for three Sub-Inspectors and five Head Constables at Dhanbad.
- (5) Quarters for the Court Inspector at Chaibassa.
- (6) Eight Police Out-post buildings along the Nepal Frontier in the Kishanganj Subdivision, Purnea.
- (7) An out-post building at Mithapur.
- (8) Quarters for the Sowars of the Mounted Police in the Kotwali compound at Patna.

The principal works under this head are the construction of the Greer Bhumihar Brahman College, Muzaffarpur, and the Ravenshaw College, Cuttack. Work appertaining to these Colleges was in good progress. The class rooms on the first floor of the Patna Collegiate School were converted into Hall for the New College, Patna. The High English School, Patna, was completed and a second story over a portion of the building of the Training School, Cuttack, built. Progress was made with the construction of a new building for the Practising Middle English School attached to the Cuttack Training School and with the extension of the Hostel for the Chapra Zila School. Land was acquired for the construction of a new Zila School building at Sambalpur.

The residence for the Head Master, Zila School, Muzaffarpur, and that for the Principal, Sanskrit College, in the same locality were nearing completion when the year lapsed. A combined office and residence for the Inspector of Schools, Muzaffarpur, was completed.

The construction of a double storied Hostel building for 105 boys attached to the Ranchi Training School with quarters for the Hostel Superintendent and Isolation ward was taken in hand and about three-fourths of the work was done and the Hostel attached to the Industrial School in the same locality was well-nigh completed. Materials were collected for the construction of quarters for the Teachers of the Pusa High English School and for Training School for Muhammadan Teachers at Bastwara, Darbhanga.

The construction of a Hostel for 50 Hindu and Muhammadan boys with quarters for the Hostel Superintendent and certain additions to and alterations in the Purulia Zila School including the construction of a Hall were in progress.

**Medical**

The construction of Dissecting Block in connection with the Temple Medical School at Patna was nearly finished and that of the Isolation Ward was started. Certain additions to and alterations in the Power-house in the aforesaid school were carried out. A piece of ground was acquired for the play-ground for the Temple Medical School.

The following works in connection with the construction of a Central Asylum for European and Indian Insanes at Kanke were either completed or were in progress during the year:—

- (1) Construction of an enclosure wall round the cemetery attached to the European Lunatic Asylum with lych gate and approach road.
- (2) Providing standposts and pipe connections near the Indian Keepers' latrines inside the female ward and near the outside latrines in the European Lunatic Asylum.
- (3) Installing a second pump for water supply to the Lunatic Asylum.
- (4) Construction of a 10'-6" dia. well on the south side of female Hospital Indian Lunatic Asylum.
- (5) Erection of a hot-water installation in the European Lunatic Asylum.
- (6) Gate building, female enclosure of the Indian Lunatic Asylum.
- (7) Enclosure wall, male section.
- (8) Hospital as well as quiet patients' blocks in both male and female enclosures.

Some materials were collected for the construction of a Boarding House for the students of the Orissa Medical School and foundation started.

Dispensary buildings at Balandapara were completed and those at Khejuripara, Phiringia and Chandipada were in progress.

The construction of a Leper Asylum at Outtack, which was in progress from the previous year, was completed.

**Registration**

Sub-Registry office buildings at Jellasore, Phulparas, Islampur and Bikram were completed, while materials were collected for those at Dharamsala, Katra, Dalsingserai, Roserah, Basautpur, Tikari and Sherghati.

**Public Works Department Buildings**

Quarters for a Sub-Overseer at Netarhat with a godown for Public Works Department were constructed. The construction of a residence for the Executive Engineer, Sambalpur Division, was nearly completed.

The Subdivisional Office with the residence for the Subdivisional Officer at Chapra was in progress.

**Monuments and antiquities.**

An office and a godown for the Archæological Department at Nalanda were completed and thorough repairs to the monuments and graves at Gaya were carried out. A monument at the battlefield, Buxar, was erected and special repairs to Arrah House done.

**Residences for the Lieutenant-Governor and other Government officials.**

At Government House, Ranchi, two gate houses with electric fittings were constructed. The work of providing additional accommodation for His Honour's suite over the second floor of Government House at Puri was almost completed and some progress was made with the extension of electric installation to it. Materials were also collected for replacing the eternit roof of the kitchen block by reinforced brick roof. The construction of a new residence for the Political Agent, Orissa Feudatory States at Sambalpur and for the European Deputy Magistrate at Laheriasera was in progress. The Sub-Deputy Collector's residence at Gopalganj was completed.

Mr. Kennedy's bungalow at Muzaffarpur and the old school building at Nawadah were purchased, the former for the residence of the Civil Surgeon and the latter for that of the second officer.

The work on the New Council Chamber, Patna, was taken up in the second half of March, 1920. <sup>Capital.</sup>

The temporary residence originally constructed for the Government Architect was converted into a permanent residence for the Assistant Government Architect. The temporary residences for the Deputy and Assistant Registrars of the High Court were also converted into permanent ones.

Residence for the First Assistant to the Deputy Inspector-General of Police, Crime and Railways, was completed and those for two Indian Registrars of the Secretariat were reaching completion when the year closed.

The following clerks' quarters were also built during the year under review :—

25 'C' type quarters for the High Court Clerks.

1 'A' "	} quarters for the office clerks of the Government Advocate.
1 'B' "	
2 'C' "	

4 Anglo-Indian clerks' quarters.

14 sets of quarters for the clerks of the Board of Revenue.

69 'C' type, 3 'B' type, 14 'A' and 5 'A1' type quarters for the Secretariat clerks were in progress.

The levelling and dressing of the University area was taken in hand in January 1920 and work to the value of Rs. 11,000 was done. <sup>University.</sup>

The construction of the Tej Narayan Jubilee College, Bhagalpur, was in progress. Construction of quarters for the Assistant Surgeon and of an additional Indoor Ward for the Chatra Dispensary was in progress. Land was acquired for the construction of Bayley Memorial Library, Bankipur. <sup>Contribution works.</sup>

A statement of expenditure on Original Works, Civil Buildings (Provincial) including contributions is given below :—

	Rs.
Administration ... ..	5,84,986
Monuments and antiquities ... ..	19,556
Educational ... ..	7,11,353
Ecclesiastical ... ..	1,659
Law and Justice ... ..	1,62,089
Jails ... ..	93,748
Police ... ..	2,16,324
Medical ... ..	5,28,139
Miscellaneous ... ..	80,217

#### COMMUNICATIONS.

During the year under report the financial condition did not greatly improve and consequently only works of an urgent nature and those which were in progress from the previous years were undertaken and carried out as in the past two years. A number of desirable and important Road and Bridge Projects had to be kept in abeyance for want of funds, while some others had to be postponed for reasons of economy.

The main work done during the year was therefore confined to the upkeep of the existing works and the expenditure was thus incurred more on maintenance than on construction which has been allocated as follows :—

	Rs.
Construction ... ..	3,58,256
Maintenance ... ..	6,11,766

## Roads.

*Bihar.*—The road which was under construction from Government House at Patna leading to the Dinapur Cantonment with a bridge over the Patna Canal was completed and opened for light traffic only. The works of raising the surface of the existing road from the Civil station of Bankipur to the Cantonment at Dinapur and of erecting an earthen bandh along it, have been finished; the work of widening this road also reached completion. Considerable improvements were effected to the fair-weather track between Patna and Gaya *via* Khagaul, Masaurhi and Jahanabad which forms the alignment of the through trunk road between Bihar and Orissa, by raising the road and building causeways in places subject to floods.

*Chota-Nagpur.*—With a view to cope with the increased traffic on the Grand Trunk Road between Chirkunda and Nirsa, it was proposed to widen the metalled surface of this portion of the road, and the work taken in hand during the year under review. For similar reasons the road from the Barakar river to Furulia was widened and metalled in miles 5 to 7.

*Orissa.*—The improvements to the Cuttack-Sambalpur Road, second section third portion, which have been in progress during the last few years, were finished, and those to the Angul-Tickerpara Road, second section, approached completion at the close of the year. The diversion of the Cuttack-Sonpur Road between Harbhanga and Sitalpani which was taken in hand last year was still in progress. A rough project has been approved for the construction of a road from Jharsuguda to Sambalpur as a part of the through road from Sambalpur to Ranchi.

## Bridges.

*Bihar.*—Additional waterways were provided in miles 293, 298 and 309 of the Grand Trunk Road, in order to prevent it from being overtopped and breached by floods. Preliminaries were concluded for building a high level bridge over the Lilajan river at Dobhi in mile 284 of the Grand Trunk Road in place of the causeway which had been washed away by the floods of 1917, and a rough project for a girder bridge was approved at a cost of Rs. 5,45,000; the detailed plans and estimates were under preparation.

*Chota-Nagpur.*—The work of improving certain bridges and culverts on the Madhuban Branch Road was undertaken during the year. The construction of a bridge over the Izri river on the 5th mile of the Chas-Gulbera Road, started last year, was completed; while that over the Gowain river on the 11th mile of the same road remained in progress at the end of the year. A proposal to bridge the Barakar river on the 9th mile of the Giridih-Dumri Road has received approval.

*Orissa.*—The construction of three high level bridges, the first over the Am Nala on the 19th mile of the Sambalpur-Sonpur Road, the second over the Ranj river on the 124th mile of the Raipur-Sambalpur road, H.B., and the third over the Tengra Nala on the 134th mile of the latter road, was taken in hand during the year. Works were also started on the building of bridges over the Nigra and the Matulia rivers on the 2nd and 6th miles of the Angul-Tickerpara Road. The bridge over the Nigra river at Matanga on the Cuttack-Angul road, which was commenced last year, was nearly completed, while that on the 7th mile of the Harbhanga-Phulbani Road was finished. Rough projects have been approved for the construction of bridges over the Bhargovi river on the Cuttack-Puri road, and over the Jira river on the Raipur-Sambalpur road.

## Contribution work.

The construction of a causeway over the Khorkai river on the road from Chaibasa to Jamshedpur was in progress from the previous year.

## Accommodation for travellers.

Two sets of rooms were added to the Dāk Bungalow at Chaibasa. Approval has been given to certain improvements to, and extension of, the Inspection Bungalow at Puri.

## Arboiculture.

Trees and nurseries along roadsides were maintained as in previous years, so far as funds permitted; young trees were also planted to make new avenues and to fill in gaps where necessary.

### MISCELLANEOUS PUBLIC IMPROVEMENTS.

During the year under report no new work of public improvement was undertaken. Only works in progress were taken up and carried out.

The skin revetment along the right bank of the river Ganges from the compound of the Civil Surgeon's residence to the west of the Nala near the Bankipur Club, undertaken last year, was completed. The revetment below the Bihar School of Engineering at Bankipur and that below the Recreation Bungalow at Gulzarbagh, which had slipped, were re-built. Spurs have been erected in the Bur Gandak river at Muzaffarpur to protect the Church building at that station from erosion.

The drainage scheme of the Race Course at Muzaffarpur was finished during the year.

The work of improvement to the tank in the Kachabri compound at Banki in the district of Cuttack, which was in progress last year, was completed. A tank was excavated at Simdega in the Ranchi district for the use of the general public.

### RAILWAYS.

There are no railways under the direct control of the Government of Bihar and Orissa. With the exception of the three following light railways of local importance which are subject to a certain measure of control by the Local Government, all the important lines are under the direct administration of the Government of India in the Railway Department (Railway Board):—

	Gauge.	Mileage.
1. Arrah-Sasaram Light Railway ...	2' 6"	65.26
2. Bakharyapur-Bihar Light Railway ...	2' 6"	33.00
3. Dehri-Rohas Light Railway ...	2' 6"	23.83
Total ...		122.09

During the year under report no new line was opened to traffic. The total mileage on the 31st March 1920 was therefore—

	Miles.
1. Standard Gauge ...	1,660.75
2. Metre ...	1,178.66
3. 2' 6" ...	269.31
4. 2' 0" ...	39.00
Total ...	3,147.72

The following lines were under construction or sanctioned for construction during the year:—

#### Bengal-Nagpur Railway—

	Gauge.	Miles.
Portion of the Raipur-Parbatipuram Section (from a point near Gurjabota to a point near Bhowanipatna Road) ...	5' 6"	92.09
Anara-Kargali ...	5' 6"	5.80
Onajori-Sulapet with a branch to Badampahar ...	5' 6"	21.75
Fatwa-Islampur ...	2' 6"	27.00
Mayurbhanj Extension ...	2' 6"	32.71

Authority was given by the Railway Board to undertake the following surveys during the year.

To the Darjeeling-Himalayan Railway Extension Company, Limited, for—

- (a) A detailed survey for a line of railway on the metre gauge from Pachagarh to Dinajpur *via* Bodachakla Nischintipur and Bochaganj, a distance of about 55 miles.
- (b) A detailed survey for a line of railway on the metre gauge from Kissenganj to Nekomurd, a distance of about 20 miles.
- (c) A detailed survey for a line of railway on the metre gauge from Pirganj to Bochaganj, a distance of about 8 miles.

To the Bengal-Nagpur Railway for a reconnaissance survey for a line of railway on the broad gauge, connecting the proposed South Karanpura Coal-field Railway with Manharpur, a station on the Bengal-Nagpur Railway, a distance of about 200 miles.

#### BAKHTIYARPUR-BIHAR LIGHT RAILWAY.

Accidents.

At mile 8/3 near Murari Bridge, at 15-19, on the 19th June 1919, the two front wheels of empty bogie truck and four wheels of loaded covered goods wagons were derailed as the result of the sinking of the line due to rain.

At mile 8/3 near Murari Bridge, at 18-5, on the 3rd July 1919, a pair of wheels of empty covered goods wagon got derailed as the result of the sinking due to rain.

At mile 8/3 near Harnaut Station, at 6-25, on the 7th July 1919, two front wheels of empty covered goods wagon were derailed, due to the sinking of the line after rain.

At mile 17/2 near Soh Station, at 16-50, on the 13th July 1919, four wheels of empty covered goods wagon were derailed, due to the sinking of the line after rain.

A girl aged about three years of age was run over and killed by the engine of a mixed train at mile 13-2 near Bhagan Bigha Station at 9-32 on the 9th August 1919.

#### ARRAH-SASARAM LIGHT RAILWAY.

At mile 44/10 near Sujhauri Station, at 10-22, on the 5th July 1919, the leading and driving wheels of the engines of a mixed train were derailed, due to the buckling of the line owing to heat. There was no damage to stock and slight damage to the permanent way.

A Travelling Ticket Examiner whilst checking tickets and passing from one carriage to another by way of the footboards, lost his balance and fell off a passenger train on the 12th July 1919 at mile 12/12 near Garhani Station and severely injured his right leg.

The engine and two trucks loaded with ballast were derailed near Mohneekalan Station Yard on the 2nd September 1919, due to the driver running at excessive speed over the facing points.

A 3rd class passenger jumped from a train at mile 23/2 between Piru and Dhanauti and hurt his back slightly.

At Piru Station Yard on the 28th February 1920, the engines of two trains collided due to the wrong setting of facing points. There was no loss of life or injury to passengers.

#### BENGAL AND NORTH-WESTERN RAILWAY.

At Pasraha Station on the 18th December 1919 a woman was knocked down and injured while trespassing on the line.

#### BENGAL-NAGPUR RAILWAY.

At Bhalulata Station, mile 243/253, between Bisra and Jaraikela, on the 5th June 1919, a goods train was derailed due to the points at Sahoo not being correctly locked. There was considerable damage to rolling stock and permanent way.

At mile 268/15 between Kalunga and Kansbahal Station on the 2nd December 1919 a goods train was derailed, due to the bad handling of the engine. There was considerable damage to rolling stock.

#### EAST INDIAN RAILWAY.

There was a collision between a ballast train and a passenger train near Madhupur Station on the 5th May 1919, due to the engine and brake-van of the passenger train entering the siding instead of going along the Giridih main line. Two railway coolies and five passengers were slightly injured.

At mile 151/20 between Kaloobathan and Fatka Block Hut on the Grand Chord Line, a passenger train parted and the two parts collided which caused the derailment of five wagons, four of which were badly damaged.

At mile 198, near Isri Station on the 16th February 1920 a goods train rear portion parted and rolled back to Isri Station and collided with the dead end. There was damage to stock and the Guard of the train was injured.

At Gomoh Station on the 10th March 1920 the Bombay Mail passed into the coaching siding instead of on to the main line and collided with a 1st class carriage standing on the siding. The cause of the accident was difficult to determine.

The programme showing the new lines in order of urgency is given as Appendix C.

### CANALS—IRRIGATION AND NAVIGATION.

The transactions of the Irrigation branch of the Public Works Department for the year 1919-20 relating to works of Irrigation and Navigation are shown in the table below. Works which afford protection from flood or which facilitate drainage are reviewed separately and are not noticed in this report.

#### CAPITAL ACCOUNT.

Heads.	Amount of construction estimate.	Expenditure during 19.9-20.	Expenditure to end of 1919-20.	Balance for expenditure from 1st April 1920.
1	2	3	4	5
<b>Major Irrigation Works:—</b>				
<b>Productive Irrigation Works—</b>				
Direct charges	5,26,76,595	4,459	5,21,30,106	2,46,489
Indirect charges	15,25,735	223	15,31,121	—5,386
<b>Total</b>	<b>5,42,02,330</b>	<b>4,682</b>	<b>5,39,61,227</b>	<b>2,41,103</b>
<b>Protective Irrigation Works—</b>				
Direct charges	89,07,638	1,38,422	83,10,246	5,97,392
Indirect charges	2,25,222	5,742	2,34,298	—9,076
<b>Total</b>	<b>91,32,860</b>	<b>1,44,164</b>	<b>85,44,544</b>	<b>5,88,316</b>
<b>Minor Works and Navigation—</b>				
Direct charges	...	...	...	...
Indirect charges	...	...	...	...
<b>Total</b>	<b>...</b>	<b>...</b>	<b>...</b>	<b>...</b>

#### REVENUE ACCOUNT.

Heads.	Receipts.	Working expenses.			Net Revenue.
		Direct.	Indirect.	Total working expenses.	
1	2	3	4	5	6
Major Irrigation Works (a)	Rs. 30,16,823	Rs. 15,22,373	Rs. 1,26,603	Rs. 16,43,976	Rs. 13,67,347
Minor Works and Navigation—					
Works for which only Revenue Accounts are kept	5,712	25,925	1,478	27,403	—21,691
Works for which neither Capital nor Revenue Accounts are kept (b).	7,700	3,581	...	3,581	4,119

(a) Inclusive of the Dhaka and the Tribeni Canals.

(b) Teur and Saran Canals.

Irrigation.

2. The following statements show the areas irrigated during the year compared with the average of the triennial period ending with March 1919 :—

## MAJOR WORKS (PRODUCTIVE).

	ORISSA CANALS.			SON CANALS.			TOTAL.		
	Kharij inclusive of hot weather.	Rabi.	Total.	Kharij inclusive of hot weather.	Rabi.	Total.	Kharij inclusive of hot weather.	Rabi.	Total.
1	2	3	4	5	6	7	8	9	10
Average of the Triennium 1916-19.	Acres. 272,580	Acres. 5,379	Acres. 278,460	Acres. 464,257	Acres. 102,030	Acres. 536,287	Acres. 736,837	Acres. 107,909	Acres. 861,747
For 1919-20 ...	283,261	(a) 6,574	289,835	462,500	(b) 94,783	557,283	745,761	(c) 1,11,357	847,118

(a) Season lease.

(b) Includes long lease 18,712 acres and season lease 75,985 acres.

(c) Includes long lease 18,712 acres and season lease 81,650 acres.

NOTE—All collections for season leases (Rabi) are made in the following year (1920-21) but those for long leases are made during the year (1919-20).

## MAJOR WORKS (PROTECTIVE).

	TRIPURI CANAL.			DHARA CANAL.			TOTAL.		
	Kharij inclusive of hot weather.	Rabi.	Total.	Kharij inclusive of hot weather.	Rabi.	Total.	Kharij inclusive of hot weather.	Rabi.	Total.
1	2	3	4	5	6	7	8	9	10
Average of the Triennium, 1916-19.	Acres. 47,881	...	47,881	Acres. 6,045	Acres. 414	Acres. 6,459	Acres. 53,926	Acres. 414	Acres. 54,340
For 1919-20 ...	81,581	...	81,581	11,417	(a) 1,701	13,118	92,928	(a) 1,701	94,629

(a) Includes season lease 1,606 acres.

## MINOR WORKS.

	SARAN CANALS.			TRUP CANAL.			TOTAL.		
	Kharij inclusive of hot weather.	Rabi.	Total.	Kharij inclusive of hot weather.	Rabi.	Total.	Kharij inclusive of hot weather.	Rabi.	Total.
1	2	3	4	5	6	7	8	9	10
Average of the Triennium, 1916-19.	Acres. Canals	Acres. Closed	Acres. ...	Acres. 1,404	Acres. 16	Acres. 1,420*	Acres. 1,464	Acres. 16	Acres. 1,480
For 1919-20 ...	...	Ditto	...	2,853	(a) 254	3,107†	2,853	(a) 254	3,107

(a) Season lease.

\*Excludes the Madhuban samindar's siraf land.

†Includes 268 acres of the Madhuban samindar's siraf land.

NOTE—All collections for season lease (Rabi) are made in the following year (1920-21) and those for long lease are made during 1919-20.



3. The length of canals and distributaries in operation during the year 1919-20 compared with the previous year are as follows:—

	Orissa Canals.		Son Canals.		Tribeni Canal.		Dhaka Canal.		Teer Canal.		* Saran Canals.	
	1918-19.	1919-20	1918-19	1919-20	1918-19	1919-20	1918-19	1919-20	1918-19	1919-20	1918-19	1919-20
1	2	3	4	5	6	7	8	9	10	11	12	13
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Main canals (Irrigation)	223½	224½	208½	208½	61½	61½	3½	3½	6½	6½		
Branch canals (Irrigation)	103	103	148½	148½	...	...	16½	15½	...	...		
Distributaries	1,203½	1,204½	1,231½	1,234½	164½	164½	23½	23½	6½	6½		
Of above—Navigation Channel.	204½	205½	202½	199½	(b)	...	...	...	...	...		

\* Canals closed since the 1st April 1891.

(a) The figure shown in the previous report was incorrect.

(b) 9 miles of the canals between the Regulator and Bedadi lock have been closed to navigation from 24th July 1919.

4. The following statement shows the traffic on the Navigable Canals during the year 1919-20 compared with the average triennium 1916-1919:—

	Orissa Canals.		Son Canals.		Orissa Coast Canal.	
	Average for the triennium ending with March 1919.	For the year 1919-20.	Average for the triennium ending with March 1919.	For the year 1919-20.	Average for the triennium ending with March 1919.	For the year 1919-20.
1	2	3	4	5	6	7
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Length of canals open	204½	205½	208½	199½	95½	95½
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Receipts	71,391	58,896	23,398	18,958	5,466	4,718
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Tonnage of boats by canal measurement.	449,935	361,830	85,868	39,625	29,617	121,414
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Estimated value of goods	1,15,13,902	1,03,52,951	19,54,670	14,54,057	6,38,324	8,86,116
Ditto rafts	1,63,760	2,26,491	3,58,077	2,54,593	21,870	20,450

5. The classification of works dealt with in this review is as follows:—

(i) *Major Works.*—Of the four Major Irrigation Works in this Province, two, viz. the Orissa and Son Canals, are classed as Productive and the other two, viz. the Tribeni and Dhaka Canals, are Protective Irrigation Works.

(a) The Orissa and the Son Canals were originally constructed from funds under the Imperial head "49—Irrigation" and were classed as "Productive", as it was expected that the net revenue derived from them would repay the annual interest on the capital invested. The expectation has never been realized in the case of the Orissa Canals system. The Son system is, however, now paying a five per cent. interest. Further capital outlay on both these systems is now being incurred under the divided head "43—Minor Works and Navigation" and their Revenue Account is kept under the head "42—Major Works—Working Expenses" which is also a divided head. These canals are utilized both for irrigation and navigation.

(b) The Tribeni and Dhaka Canals which have been constructed from funds under the Imperial head "35" though not directly remunerative are calculated to guard against a probable future expenditure in relief during famine of the population of the tract of country served. The Tribeni Canal is almost complete, one distributary at the tail end of the canal not being yet fully constructed, and permanent outlets and some village channels yet remaining.

The additional works outside the construction estimate, which were approved by the Government of India in 1916 and which provide additional drainage facilities across the canal to enable it to withstand without damage the ordinary high floods which in one part of the tract or another occur almost annually, have been completed except the Pandai spill syphon which is under construction. The cost of these extra works is being charged to the head "35" under the Open Capital Account rules.

These canals are used for irrigation only.

(ii) *Minor Works and Navigation.*—There are three canal systems under this class :—

(a) *Orissa Coast Canal.*—No capital account is now kept; the cost of maintaining the canal is charged to the sub-head "Works for which only Revenue accounts are kept". The canal (95½ miles within this province) is used for navigation only.

(b) *Teur (Madhuban) Canal.*—Neither Capital nor Revenue Accounts are kept of this canal. It is a small work intended for irrigation only.

(c) *Saran Canals.*—These canals have been classified as works for which neither Capital nor Revenue accounts are kept. They are now maintained at the cost of two large concerns in the Saran District, the managers having agreed to pay annually Rs. 500 each towards their maintenance.

The progress of the year for the works under each of the above heads is briefly stated in the following summary compiled by Circles of Superintendence :—

#### ORISSA CIRCLE.

##### MAJOR IRRIGATION WORKS (PRODUCTIVE).

##### ORISSA CANALS.

###### Capital Account.

6. The expenditure (direct charges) debited to the Capital Account of the Orissa Canals during the year was Rs. 1,229 only. The work chargeable to the Capital Account which was in progress during the year was the construction of a minor distributary at Solanpur from 21st chain of the 1st mile of No. 2 A Distributary of the High Level Canal, Range III. Earthwork and turfing were completed except masonry work.

###### Works in progress.

###### Revenue Account Extensions and Improvements.

7. The total expenditure on new works chargeable to the Revenue Account amounted to Rs. 5,042 against Rs. 7,263 in the previous year. No work of any importance was undertaken and the expenditure was mainly incurred on certain small minor distributaries, office buildings and residences.

###### Maintenance and repairs.

The expenditure amounted to Rs. 1,86,603 against Rs. 1,58,276 in the previous year. The head works, main canals with their distributaries, drainage and protective works were maintained in fair order. The increased cost was due to the closing of a large number of breaches in the canal banks caused by the floods and to the revetment constructed to protect the Taldanda canal from the erosion of the Mahanadi.

###### Length of distributaries.

8. During the year a little over a mile of distributary channel was added.

9. The average rainfall during the year at the 13 recording stations was **Rainfall.** 67.23 inches against the average of 58.55 inches for the previous 50 years. The rainfall of the year was normal and fairly well distributed, but owing to the scanty fall in October the crops on unirrigated areas suffered considerably.

10. The area irrigated was 289,835 acres against 285,199 acres in 1918-**Irrigation.** 1919; the increase is due to the new areas having come under long lease during the year. The total assessment for water-rates on the area irrigated was Rs. 4,96,933 against Rs. 4,83,948 in 1918-19. The outstanding balance of the net demand was practically *nil* at the end of the year.

11. The receipts from navigation tolls on the Orissa Canals amounted to **Navigation.** Rs. 58,896 against Rs. 71,392 in the preceding year. There was much decrease in the tonnage of boats. The falling-off in receipts is due to less traffic mainly in consequence of failure of crops.

12. The revenue and working expenses (direct and indirect) were **Financial Results.** Rs. 5,95,604 and Rs. 4,97,092, respectively, against Rs. 5,86,802 and Rs. 4,08,748 of the previous year. Thus the net revenue, which came to Rs. 98,512, was only 37 per cent. on the capital outlay. As noticed in the previous year's report, the water-rates on the canals have been enhanced, but the improvement which will be effected in the financial position of the canal will be very slight. The percentage of increase over the old rates is detailed below :—

For lands under long term lease ... ..	25 per cent.
For lands which take water only in seasons of short rainfall...	100 "
For land under autumn rice and under provisional lease ...	16½ "

These rates are to come into force from next year.

13. The canals were closed for annual repairs for the number of days noted **Canal closure.** below :—

Name of Canal.	Period of closure.
Taldanda ... ..	30 days
Machgaon ... ..	31 "
Kendrapara ... ..	32 "
Gobri .. ..	32 "
Gobri Extension ... ..	54 "
Patamundi ... ..	32 "
High Level Canal, Range I ... ..	57 "
" " " " II ... ..	63 "
" " " " III ... ..	63 "
Jajpur ... ..	62 "

14. There were no severe storms during the year. The floods were of a **Floods.** peculiar nature, having come in succession at very short intervals, and from June to the middle of September the rivers were constantly in flood.

In years of high floods the Kushbhadra, Bhargovi and Daya cause extensive damage to agricultural lands in the Puri District. A contour survey of the country was undertaken during the year for devising means for effective drainage of the affected tract. The survey was in progress when the year ended. Levels were taken for about 30 square miles.

#### MINOR WORKS AND NAVIGATION.

##### ORISSA COAST CANAL.

15. The canal (95½ miles in this province) was maintained in fair order and was open to traffic throughout the year. Range V of the canal was badly silted up. Some silt clearance was done by dredging in 1917-18, but no progress could be effected in the year under report on account of the dredger being out of order and remaining under repairs in the Jobra workshops.

No new works were carried out. The total cost of maintenance (direct and indirect) amounted to Rs. 27,403 against Rs. 35,570 of the previous year. The gross receipts were Rs. 5,712. Export through the canal was low during the year on account of partial failure of crops. The rainfall of the year was normal and fairly well distributed.

### SON CIRCLE.

#### MAJOR IRRIGATION WORKS (PRODUCTIVE).

##### SON CANALS.

**Capital Account.** 16. The total capital outlay (direct charges) on the system up to end of 1919-20 was Rs. 2,59,64,386 of which Rs. 3,230 only represents the expenditure during 1919-20.

The total expenditure on works only in 1919-20 was Rs. 7,182 as detailed below:—

- |   |       |                |
|---|-------|----------------|
| (1) Constructing 19 permanent outlets in the Daudnagar Sub-division.                          | 2,164 | (In progress.) |
| (2) Constructing 13 permanent outlets for Chowsa branch canal                                 | 1,790 | (Completed.)   |
| (3) Constructing 37 permanent outlets in Daudnagar Sub-division.                              | 1,210 | (In abeyance.) |
| (4) Constructing 17 permanent outlets in place of temporary ones in the Bhojpur Distributary. | 1,855 | (Completed.)   |
| (5) Preliminary works in connection with irrigation project in the Bhabhua Subdivision.       | 163   | (Ditto.)       |

**Revenue Account. Extensions and Improvements.** 17. The total expenditure during the year on extensions and improvements amounted to Rs. 22,038 and was incurred mostly on quarters for the Revenue staff and on rest-sheds.

**Maintenance and repairs.** The annual repairs to the canals and head works were carried out during the year at a total expenditure of Rs. 2,57,152 against Rs. 2,64,070 in the previous year.

**Rainfall.** 18. The average rainfall of the 12 stations in the three Divisions was 47.92 inches compared with the average of 39.92 inches and 46.38 inches in 1918-19 and 1917-18, respectively, and an average of 39.67 of the previous 37 years. The rainfall during the year was well-distributed except in the month of August. No difficulty, however, was experienced in irrigation.

19. The area irrigated during the year was 557,283 acres against 639,404 acres of the preceding year. This large decrease is mainly in the *rabi* area (94,783) which in 1918-19 was exceptionally high, i.e., about three times the normal area owing to the failure of the rains in September and October.

The total assessment for water-rates amounted to Rs. 21,04,444 of which Rs. 21,03,400 were realized during the year and the balance Rs. 1,044 represents the remission of the year. Thus the demand was fully realized. The considerable increase, viz., Rs. 2,30,364 in water-rate receipts during the year under review is due to large *rabi* irrigation during 1918-19, the demand for which was adjusted during the year under report.

**Navigation Receipts.** 20. The receipts from navigation amounted to Rs. 18,958 against Rs. 28,393 of the previous year, and an average of Rs. 21,210 of the preceding five years.

**Financial Results.** 21. The gross receipts and working expenses (direct and indirect) were respectively Rs. 22,20,709 and Rs. 8,71,996 against Rs. 19,96,830 and Rs. 8,24,813 of the previous year. The net receipts after deducting working expenses amounted to Rs. 13,48,713 which was 5.01 per cent on the capital outlay, and after meeting the interest charges of the year (Rs. 8,84,994) a balance of Rs. 4,63,719 was left against the accumulated arrears of interest amounting to Rs. 1,96,89,063.

22. There were no canal closures for annual repairs during the year <sup>Canal closure.</sup> except that one branch (Patna Canal) was closed for 31 days only for this purpose.

23. There were two floods in the Son river, the first flood occurring in August <sup>Floods.</sup> 1919 when both the canals had to be kept closed for 17 days at one stretch. During the second flood, which was practically a continuation of the first, the canals remained closed for  $6\frac{7}{8}$  days. Both the floods were severe in nature and the rubble packing above the middle wall was considerably damaged at two places.

24. The Main Eastern Canal was flushed from 17th to 21st July, 21st <sup>Flushing</sup> September to 27th October and 6th to 19th November. <sup>opera-</sup> The flushing operation did not keep pace with the influx of silt in the canal. The quantity of silt removed by the flushing was 4 lakhs against  $7\frac{1}{2}$  lakhs deposited. Owing to long closure the demand for canal water was keen and therefore the quantity admitted into the canal was utilized more for irrigation than for scouring the canal bed. The maximum discharge passed down was 2,254 cusecs against 2,218 cusecs of the previous year.

The Main Western Canal was flushed thrice from 18th to 21st July, 21st to 27th September and 7th to 30th November. The flushes were useful in scouring the silt from the bed of the canal. The maximum discharge sent down the canal was 4,239 cusecs on 21st July. About 121,160 c.ft. of silt were removed.

**MINOR WORKS AND NAVIGATION WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.**

25. The survey works in connection with the possible reservoir sites in the Butana valley in the Palamau District were in progress during the year. <sup>Investigation in connection with possible irrigation schemes.</sup>

A preliminary examination was made during the year of some of the tributaries of the Son river in the Palamau District to see whether the supply in the river could be supplemented in times of low supply. The survey was completed, the report was being framed at the end of the year.

Some minor surveys in connection with the Sakri river in the Gaya District were carried out during the year under review.

**GANDAK CIRCLE.**

**MAJOR IRRIGATION WORKS (PROTECTIVE).**

**TRIBENI CANAL.**

26. Works included in the schedule of incomplete works chargeable to the <sup>Capital Account.</sup> construction estimate of the project and other works subsequently sanctioned as chargeable to the open capital account are in progress, the total expenditure (direct and indirect) debited to the capital account amounted to Rs. 1,44,164 during the year.

The construction of the Bhora Aqueduct at mile 45, 1120 feet; the syphon <sup>works completed.</sup> in the 36th mile for the Bela Babu's *pain*, and some other works which were started last year were completed during the year under report. The canal was excavated up to the full length (61 $\frac{1}{4}$  miles).

The following works were in progress:—

<sup>Works in progress.</sup>

- (1) A spill syphon at 48 mile 3,872 feet of the canal.
- (2) Two superpassages over the Lauriya distributary in connection with the Bela Babu's syphon.
- (3) Rangī Distributary.

The annual survey of the Gandak river at headworks of the canal showed that the rapid was retrograding considerably. A scheme for placing a boulder barrage across the river to eliminate the effect of the rapid and to supply water for the *rabi* season was under preparation.

Revenue Account—  
Extensions and  
Improvements,  
Maintenance and  
repairs.

27. A sum of Rs. 5,578 was spent on extensions and improvements.

The cost of ordinary maintenance of the canal including silt clearance, cutting of jungle, construction of a bell-bandh and repairs to syphons and distributaries amounted to Rs. 1,13,337 during the year.

Distributaries,  
village channels  
and drainage  
channels.

28. The construction of the Rangī distributary at the tail end of the canal was still in progress. All the masonry works of this distributary were completed and the earthwork carried out for 12 out of 18 miles during the year.

Three projects for village channels were sanctioned during the year and were awaiting formal possession of land being given to this Department.

It is interesting to note that considerable activity is now noticeable on the part of the villagers to construct village channels. Permanent outlets are also being built. When these two factors are in existence, a large increase in area and vast improvement in control and distribution are anticipated. All drainage channels proposed to be constructed for the canal were completed during the year.

Rainfall.

29. The rainfall was considerably below the normal. The year was specially remarkable on account of the keen demand for water during the *Hathia* when the rain failed, but the canal adequately met it. Ramnagar and Maniari had a rainfall of only 56.70 and 50.51 inches respectively against 83.00 and 65.51 inches of the preceding year. The total average rainfall of six stations during the year was 54.64 inches against the average of 75.68 inches of the last nine years.

Floods.

30. The floods in the river Gandak were of an ordinary nature, the highest flood, which reached a level of 969.80 during the year, was lower than that of the previous year by 0.45 or 8.15 below the highest recorded level (1902). No damage was done to the canal. It was opened for irrigation as late as the 2nd July due to the non-completion of the silt clearance work in one of its reaches owing to labour difficulties.

Irrigation.

31. The total area irrigated was 81,581 acres against 57,454 acres of the preceding year and an average of 47,881 acres of the previous three years.

Financial Results.

32. The total working expenses (direct and indirect charges) amounted to Rs. 2,61,362 while the gross receipts were Rs. 1,73,865 against Rs. 1,28,185 of the previous year. The net loss to Government was therefore Rs. 87,497 against Rs. 1,58,952 of the previous year. 8.10 per cent. of the demand remained uncollected at the end of the year. The long lease system which was introduced in 1918-19 has gained increased popularity as a larger area came under this lease during the year. The rate for long leases was increased by four annas per acre, and that for season leases by twelve annas per acre; these rates will come into force next year. It is doubtful if the canal will ever be a profitable investment as stated in the report of the preceding year (1918-19).

Tribeni Canal—  
Extension scheme.

33. The preparation of the project for the proposed extension of the Tribeni Canal was just completed at the end of the year.

#### DHAKA CANAL.

Capital Account.

34. There was no capital expenditure on the canal during the year under review.

Revenue Account—  
Extensions and  
Improvements,  
Maintenance and  
repairs.

35. No new works were executed during the year.

A sum of Rs. 8,302 was spent on ordinary maintenance.

36. The total rainfall of the year was 48·13 inches against 56·43 inches of the previous year and against the average of 55·97 inches for the last 14 years. There was a high demand for canal water in the latter part of the season owing to unfavourable rainfall. At this time the river Lalbakia fell and the supply was inadequate. The crops in the leased area were irrigated with some difficulty due to the absence of the *tatil* system which has now been introduced and no future trouble is anticipated. The construction of village channels by the cultivators will also facilitate distribution. The supply during the *rabi* season was ample.

37. There was a considerable increase in the area that came under irrigation during the year. The total area irrigated was 13,118 acre against 8,846 acres of the preceding year and against the average of 6,459 acres for the last three years.

38. The gross receipts and working expenses of the year amounted to Rs. 26,145 and Rs. 18,526 respectively against Rs. 22,137 and Rs. 24,176 respectively of the previous year. The net revenue which amounted to Rs. 7,619 was 1·30 per cent. on the capital outlay. The area which came under long lease was double that of the previous year. The rate for this lease was increased by four annas per acre, while the rates for season leases were increased by twelve annas under *khari* irrigation and four annas under *rabi* irrigation. These increased rates will come into force from next year.

MINOR WORKS AND NAVIGATION—WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

TEJ (MADHUBAN) CANAL.

39. This small canal was maintained in good order and only the necessary repairs to the regulators, bridges and bungalows were carried out at a total cost of Rs. 1,783 (excluding establishment charges).

The rainfall of the year was 37·41 against 73·70 inches of the previous year. Owing to severe drought there was a keen demand for canal water during September and October. This demand was successfully met as the supply in the river was sufficient throughout the irrigation season.

The total area irrigated during the year was 3,107 acres against 2,001 acres of the previous year. The total receipts of the year amounted to Rs. 6,602 against Rs. 4,789 of the previous year.

SARAN CANALS.

40. The canals are closed to irrigation. They were maintained at the cost of the Managers of the Maniara and Saddowa Concerns who have agreed to contribute annually Rs. 500 each towards their maintenance. The charges for maintenance amounted to Rs. 723 exclusive of the cost of establishment.

EASTERN CIRCLE.

41. Some discharge observations were taken in the rivers Kiul and Anjan in the district of Monghyr in connection with the Kiul Irrigation project and a survey of the Mokameh Tal in the Patna District was made during the year.

WESTERN CIRCLE.

42. A detailed survey was carried out for the tank project at Khunti in the Singhbhum District. Further investigations however were needed with a view to ascertain if the scheme would be financially sound.

HYDRO-ELECTRIC SURVEY.

43. Further investigations were made into the water power potentialities of the perennial hill streams in the districts of Gaya, Shahabad, Ranchi, Sambalpur and the Mayurbhanj State, but the scheme for generating electric energy therefrom were declared to be either useless, too expensive or doubtful in most cases. The only schemes that were found to be promising were—

(1) Subarnarekha fall (Ranchi District).—Expected to give 50,000 H.P. with a fall of 550 feet and discharge of 1,000 cusecs in the nine dry months.

(2) Dumargarhi fall (Ranchi District).—Expected to give some 9,000 to 10,000 H.P. with a fall of 500 feet and discharge of 200 cusecs.

Further investigation on these is proceeding.

## EMBANKMENT AND DRAINAGE.

### Classification of Embankments

The embankments are divided into the following classes :—

- (a) Embankments maintained at the expense of Government :—
  - (i) in Orissa
  - (ii) under Schedule D.
- (b) Embankments not Government property but maintained by Government under the contract system.
- (c) Embankments not Government property but maintained by Government officers as public embankments under the provisions of sections 47-53 of Act II (B.C.) of 1882.

### Expenditure.

2. The expenditure on works and repairs during the year (exclusive of the book charges on establishment and tools and plant) amounts to Rs. 1,70,160 againsts Rs. 1,74,362 in the previous year.

### Length of Embankments.

3. The total length of embankments of all classes maintained by Government in the province during the year was 816 miles 754 feet, protecting an area of 7616.90 square miles. There were the following increases in the length of embankments :—

- (a) The addition of the Chitreswar embankment\* on the left bank of the Mahanadi in the Cuttack District (opposite Cuttack).  
\* 1 mile. 720 ft. long.
- (b) The construction of an embankment, 800 feet long in the village of Daudpur in Dinapur (Patna District).

### Floods.

*In Orissa Circle.*—During the year high floods in the Orissa rivers occurred in the Mahanadi, the Katjuri, all the rivers in the Puri District and the Subarnarekha, and caused some breaches and scours in embankments. There were no storms during the year causing severe damage.

*In Eastern Circle.*—In the Chandan river the highest flood rose to within one foot of the crest of the embankment on 22nd August 1919, but the embankment stood well and was not damaged. The flood level in the Kosi river at the Madhipura Public Works Department embankment and at the Bhagalpur Road embankment was normal, only a portion of the latter being scoured by the flood water. Floods during the rains in the Panar river (Purnea district) outflanked and damaged Spurs Nos. 11 and 10A of the Panar Embankment. In the Ganges (Patna District) the flood was high in September and rose to its maximum on the 8th of the month. The outer slope of the Bankipur-Dinapur Road embankment was damaged at places. There was no difficulty in draining the capital area at Patna,—the rainfall being small in comparison with that of the preceding year.

*In Gandak Circle.*—In the Gandak river the highest flood level was much lower than that previously recorded. The Ganges, however, rose higher than it did in the previous year and the flood level on the Bazidpur and Gupta embankments in the Monghyr District was nearly equal to the highest recorded flood level.

### Breaches.

5. The following breaches occurred in the Orissa Circle :—
- (a) Dhauria left embankment (1st and 2nd miles).
  - (b) Managoni left embankment (3rd mile).
  - (c) Surlake embankment (4th mile).
  - (d) Kushbhadra left embankment (16th mile).
  - (e) Daya left embankment (30th to 33rd miles).
  - (f) Nayanadi embankment (5th mile).



In embankment No. 89B, Daib right at Erara the river encroached badly on the bank threatening the village close to it. Nearly a quarter of a mile of the Surua left embankment No. 95B (2nd mile) was completely swept away. Part of the revetment at Bogla Groynes slipped during the flood. A cut was made by some villagers in the Kushbbhadra right embankment (Puri) during the flood, and as a result a large area of land was covered up with sand, and rendered unfit for cultivation, and certain embankments, viz. Atharnala, East Kania, Surlake, Sonamai and Nayanadi were all over-topped by the floods. The culprits were prosecuted and suitably punished.

In the Gandak Circle :—

No breaches of a dangerous nature occurred on any of the embankments but scours and erosions causing damage were reported to have occurred at places noted below :—

The Tirhut embankment was badly encroached by a branch channel of the Gandak in the 39th and 40th miles. A small spur was put in to divert the current and to stop further erosion, but it was washed away by the high flood in September. The construction of a cross dam at this place was then begun when the year closed. In the 46th mile also there was a bad encroachment and the construction of a new spur there was decided upon.

The breach caused by the collapse of the Deosar sluice in mile three of this embankment was left open, with the consent of the parties directly concerned.

The Champaran embankment was again very badly attacked at village Dariya where the Lalbegia nala pierces it, namely opposite 48½ to 49½ miles. The erosion caused here was very serious and 5 special spurs were constructed to divert the course of the river and protect the affected parts. The channel in the 64th mile of the Sangrampur embankment which was showing signs of silting up during the last two years has again formed an important stream, and towards the end of the monsoon two spurs in this mile were considerably damaged. Both of these were properly repaired. The river (Gandak) has now receded from the left bank at this point and moved over to the Saran bank. The Husaini gap between 73½ and 75½ miles continued to admit flood water with no untoward consequences.

In the Bazidpur embankment (District Darbhanga) the Bhurha sluice at 5½ miles was greatly damaged and will be partially rebuilt.

In the Gupta bandh the river side slope in the first 10 miles was badly scoured and a portion below 10th mile washed away. The flood water entering through the gap did some damage to crops.

6. In the Orissa Circle a project was sanctioned for protecting certain lands in the Khurda Khasmahal from the floods of the Kuakhai by extending the Kuakhai right embankment at Manchesar (Cuttack) up to the railway embankment. A contour survey and investigation of the drainage of the Kushbbhadra-Bhargovi doab in the Puri district was in progress when the year closed. Surveys and Investigations.

In the Gandak Circle a preliminary survey was made in connection with the Punwa bandh (District Darbhanga) with the result that a contour survey was considered necessary. The project for extensions of the Gupta bandh as noticed in the previous year's report was abandoned.

7. The total outlay on original works amounted to Rs. 63,117 against Rs. 72,171 of the preceding year. Original works.

In the Orissa Circle the works that remained unfinished at the end of the previous year were completed.

In the Eastern Circle the raising of the Bankipur-Dinapur Road surface and constructing an earthen bandh on the river side was completed during the year.

In the Gandak Circle the Gogri bandh (Monghyr) has been declared a public embankment under the Bengal Embankment Act II of 1882 to be maintained by the officers of Government at the cost of the zamindars benefited.

**Repairs.**

8. The total amount spent on repairs was Rs. 1,02,043 against Rs. 1,02,191 in the preceding year. Of this Rs. 40,050 was spent in the Orissa Circle, Rs. 53,342 in the Gandak and Rs. 8,651 in the Eastern Circles.

The amount spent on ordinary maintenance and special repairs to the Gandak Takavi Embankments under contract was Rs. 42,251 exclusive of the percentage charges of establishment and tools and plant against Rs. 32,861 in the preceding year.

Four important retired lines of embankments were sanctioned for the Puri District but only two were taken up during the year under review. Two stone spurs were constructed on the Chandan embankment at Banka (Bhagalpur) and 3 earthen on Bhagalpur Road embankment at Madhipura.

Three new spurs at 8th mile (Mangerpal Charki) and 3 spurs at 21st mile of the Saran embankment were constructed and the two unfinished spurs in the Champaran embankment (47th mile) were completed during the year. Three new spurs were also constructed in the Tirhut embankment to check the scour in the 29th mile. The work of constructing a cross dam in the 40th mile was in progress when the year closed.

**Drainage.**

9. The work of providing block-pitching in the riverside slope of the Pembrandā char in the district of Darbhanga was completed during the year under report.

There are no drainage works in this province constructed under the Bengal Drainage, Sanitary Drainage or Embankment Act excepting one small scheme known as the Rajmahal Drainage Scheme completed in 1902 and maintained by the Civil Officers under the Bengal Drainage Act VI of 1880.

## APPENDIX A.

**Report on work in hand in the office of the Consulting Architect, Bihar and Orissa, during the year 1919-1920.**

Very little actual building work has been constructed from the designs prepared in the office of the Consulting Architect, Bihar and Orissa, during the year 1919-20.

Most of the new schemes taken up have been in many cases a good deal larger than in previous years. But these schemes have been merely of a preliminary nature, submitted to Government for approval.

In most cases a vast amount of detail must be collected before final plans and estimates can be prepared and it is sometimes difficult to get together this necessary detail, if it is not forthcoming rapid progress is out of the question.

In many cases the schemes entailing a large amount of work have been dropped due to fresh ideas arising as to accommodation or owing to the question of funds.

**PATNA UNIVERSITY.**

This large scheme for accommodating 1,000 students, both in college and hostel, has gone through many stages during 1919-20.

The old scheme has been completely revised to meet the present requirements of the educational authorities. A large amount of work has been done preparing line plans and preliminary schemes embodying the many new ideas for this University.

Many new site plans showing the revised arrangement of building, playing fields, have been submitted.

A portfolio of line drawings showing the whole scheme have been made and submitted to Government of India.

**GREER BHUMIHAR BRAHMAN COLLEGE, MUZAFFARPUR.**

**TEJ NARAYAN JUBILEE COLLEGE, BHAGALPUR.**

**RAVENSHAW COLLEGE, CUTTACK.**

These colleges are now being built from the designs prepared by Mr. Munnings during the year 1919-1920, the office has been employed preparing 1" 1/2" and full size details from the small scale designs.

The contractors are being supplied with these details drawings as the work proceeded.

Preliminary schemes and in some cases finished drawings and estimates have been made for the following buildings, alterations and additions to buildings.

**GOVERNMENT HOUSE, RANCHI.**

It was proposed to erect an upper story to the east wing of the existing building and provide further dwelling accommodation; finished plans and estimates were prepared and submitted. This addition is for the time being held in abeyance.

**CIVIL COURT, GAYA.**

Sketch plans embodying the suggestions made by the Hon'ble Judges of the High Court as to accommodation have from time to time been submitted to Government for this new court building. Owing to cost the original

scheme has been considerably curtailed. This court is to be built near the Kacharri on a piece of open land overlooking a large tank. The building has been designed to fill the site with court rooms facing east overlooking the tank, while the western rooms will be protected from the wind by clerks offices and record rooms. The plan is in the shape of an H, the court and records being connected by the clerks rooms (see diagram below):

#### WROUGHT IRON GATES, GOVERNMENT HOUSE, PATNA.

It is proposed to fill the openings between the gate pier at Government House, Patna, with wrought iron gates and railings.

Designs for this have been prepared in the Government Architect's office and the whole design is to be in keeping with the existing building.

Owing to the war the prices of material and workmanship has gone up by leaps and bounds and as good workmanship is necessary if this sort of work is to look well, a cheaper substitute may have to be adopted for the time being.

#### " RAJA OF KANIKA " LIBRARY, CUTTACK.

The Raja of Kanika has very generously offered half a lakh of rupees for a Library and Hall to be built at Cuttack College.

This building is to be part of the new College at present being built there and will fill vacant site between the Science and Physical blocks in the centre of the northern side of the large quadrangle. The building consists of a large reading hall (size 80' x 40'), accommodation for books and four office rooms for staff. The plans and estimates are now being prepared.

#### COUNCIL CHAMBER, PATNA.

Sketch plans of the proposed new Council Chamber to be built at Patna are now being prepared.

This building is to accommodate the members elected under the new reform scheme and will seat 150 members in one large hall with division lobbys, committee, dining, smoking room and library, also office for President, Secretary, Ministers and clerks. It is proposed to commence building operations as soon as the detail plans are ready.

The enormous amount of detail necessary for a building of this sort will keep the present staff employed until the completion of the building.

A site has been selected on the east of the Secretariat and the building is to be completed by the end of 1920.

The actual work built from the Government Architect's designs during 1919-20 is rather less than previous years.

The only complete building being a Hospital for Female patients at the Lunatic Asylum at Kanke and an addition has been made to Government House, Puri, by adding an upper story, so considerably enlarging the dwelling quarters. This addition has somewhat improved the general appearance of the building and the additional height tends to give it a more imposing facade.

A. M. MILLWOOD,

*Government Architect, Bihar and Orissa.*

Statement showing the designs prepared by the Government Architect, Bihar and Orissa, in the year 1919-20.

Serial No.	Name of project.	Where constructed.	Approximate estimated cost.	Remarks.
			Rs.	
1	Patna University ...	Patna ...	63,76,000	Immediate outlay proposed against Rs. 81,75,000, the ultimate cost of the scheme.
2	Lunatic Asylum ... (Hospital for 80 patients)	Kanke ...	1,74,555	{ Rs. 87,850 for female side. Rs. 86,705 for male side.
3	Proposed Civil Court ...	Gaya ...	2,43,801	Includes out-houses, etc.
4	Government House, 2nd floor ...	Puri ...	9,700	Detailed.
5	Ravenshaw College ...	Cuttack ...	9,16,000	Excluding Principal and I. K. S. Officers' quarters.
6	High School ...	Talbana ...	1,63,069	
6(a)	Inspector of Schools' residence ...	Area, Bhagalpur ...	25,236	
6(b)	Inspector of Schools' office ...	Ditto ...	11,154	Detailed.
7	Greer Bhumihar Brahman College	Muzaffarpur ...	3,96,954	Do.
8	Tej Narayan Jubilee College ...	Bhagalpur ...	7,22,191	Do.
9	Water Works ...	General Hospital, Patna.	...	
10	Extension to the Temporary Government House (Double-storied portion).	Ranchi ...	14,189	
11	Post and Telegraph Office ...	Cuttack ...	...	Sketch design prepared only.
12	Wrought Iron Gates, Government House.	Patna ...	8,684	
13	"Raja of Kanika" Library ...	Ravenshaw College, Cuttack.	61,300	
14	Diversion of Road near Railway Station.	Bhagalpur ...	...	} Lay-out plans only prepared.
15	Public Park ...	Ditto ...	...	
16	Council Chamber ...	Patna ...	4,73,774	

A. M. MILLWOOD,

Government Architect, Bihar and Orissa.

APPENDIX B.

Statement showing the length of road communication, excluding village roads, maintained by the public authorities in Bihar and Orissa during the year 1919-20.

[This statement does not include roads and streets within Municipal limits, and maintained from Municipal Funds.]

Name of Division.	Name of District.	Length in miles of metalled roads maintained by the Public Works Department.	Length in miles of unmetalled roads maintained by the Public Works Department.	Length in miles of metalled roads maintained by Local authorities.	Length in miles of unmetalled roads maintained by Local authorities.	Total of metalled roads.	Total of unmetalled roads.	Grand Total.
1	2	3	4	5	6	7	8	9
Patna	Patna	46	..	184	470	179	470	649
	Gaya	67	..	202	734	269	734	1,003
	Shahabad	58	..	199	468	256	458	714
	Saran	..	..	109	899	199	899	1,068
Tichuf	Champaran	1	..	35	1,178	36	1,178	1,214
	Muzaffarpur	..	1	159	1,181	159	1,182	1,341
	Darbhanga	..	2	98	1,175	98	1,177	1,279
Bhagalpur	Bhagalpur	..	..	94	1,763	94	1,763	1,847
	Monghyr	..	..	139	1,376	139	1,376	1,515
	Purnea	..	..	151	1,564	151	1,564	1,719
	Santal Parganas	..	..	46	825	46	825	871
Orissa	Cuttack	83	..	125	419	208	419	627
	Puri	118	..	125	111	243	111	354
	Balasore	104	3	65	362	169	364	433
	Angul	37	66	..	..	37	66	123
	Sambalpur	109	30	4	184	104	184	289
	Orissa Feudatory States	10	52	..	..	10	52	62
	Ranehi	117	29	23	765	140	793	939
Chota Nagpur...	Palamau	..	..	17	508	17	508	525
	Hazaribagh	213	11	62	568	305	577	883
	Manbhum	145	..	108	630	253	630	883
	Singhbhum	83	..	1	502	84	502	586
	Total	1,181	203	2,013	15,530	3,194	15,732	18,926

List showing in order of urgency, the new lines of Railways in Bihar and Orissa, which should take an early place in the programme of construction for the year 1921-22.

Order of importance.	Name of projects	Existing Railway with which the project is connected at initial point.	Initial and terminal points	Whether surveyed or not.	Gauge.	Length in miles	Estimated cost.	Remarks.
1	2	3	4	5	6	7	8	9
					Ft. in.		Lakhs of Rupees	
1	'Mohuda-Daltonganj' Railway with a siding to Hutar Coal-field.	Bengal-Nagpur Railway ...	Mohuda Junction and Daltonganj.	Surveyed in 1899-90 and 1907-98.	5 6	17½	1.68	
2	Lohardaga Extension ...	Ditto ...	Lohardaga and Longa ...	Surveyed in 1916-17 ...	2 6	25	10.2	
3	Bhadrak-Chandbali Railway ...	Ditto ...	Bhadrak Station and Chandbali	Surveyed in 1915 ...	5 6	29	25.55	
4	Amda-Jamda Railway ...	Ditto ...	Amda and Jamda ...	Surveyed in 1918-19 ...	5 6	70	...	
5	Hazaribagh Road—Hazaribagh Railway.	East Indian Railway, Grand Chord Line.	Hazaribagh Road Station and Hazaribagh Town.	Surveyed in 1911 ...	2 6	41	14.58	
6	Gaya-Sherghati Railway ...	East Indian Railway ...	Gaya Station and Sherghati ...	Surveyed in 1912 ...	5 6	22	12.80	
7	Kapilas Road—Sambalpur Railway.	Bengal-Nagpur Railway ...	Kapilas Road and Sambalpur	... ..	...	...	...	
8	Thakurgaon-Purnea Railway...	Eastern Bengal Railway ...	Thakurgaon Station in the projected Siliguri-Kishanganj line to Purnea.	Not surveyed ...	3 3½	...	...	
9	Bausi-Baidyanath Railway ...	East Indian Railway ...	Bausi to Baidyanath or Dughar	Surveyed in 1899 ...	5 6	44	32.35	
10	Bhagalpur-Nalhati (or Ahmadpur) Railway	Ditto ...	Bhagalpur to Nalhati or Ahmadpur.	Surveyed in 1895-96 ...	5 6	...	...	
11	Laheria Sarai, Singhia-Shakarpura Extension.	Bengal and North-Western Railway, Tichut Section.	Laheria Sarai and Shakarpura	.....	3 3½	...	...	
12	Muzaffarpur-Darbhanga Railway	Ditto ...	Muzaffarpur and Darbhanga	Surveyed in 1906-07 ...	3 3½	38	32.70	
13	Tewara-Sitamarhi Railway ...	Ditto ...	Tewara station in the Muzaffarpur-Darbhanga line and Sitamarhi.	Ditto ...	3 3½	30	16.53	

The 24th June 1920.

C. B. MELLOR,

Off. Secretary to the Government of Bihar and Orissa,  
Public Works Department





## APPENDIX—D.

Service Heads,	Original works,		Repairs,		Total,	
	Grants.	Outlay.	Grants,	Outlay.	Grants.	Outlay.
	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	R.	Rs.
Broughtward ...	...	...	...	...	...	4,07,788
<b>PROVINCIAL.</b>						
<b>4—MAJOR WORKS—WORKING EXPENSES.—</b>						
Works ...	33,725	32,657	5,62,545	5,65,394	5,96,270	5,98,051
Establishment ...	...	...	...	...	8,25,380	8,04,308
Tools and Plant ...	...	...	...	...	25,800	17,914
Refunds of Revenue ...	...	...	...	...	6,750	6,451
Suspense ...	...	...	...	...	...	-4,351
<b>Total Major works</b> ...	<b>33,725</b>	<b>32,657</b>	<b>5,62,545</b>	<b>5,68,394</b>	<b>14,54,200</b>	<b>18,22,373</b>
<b>43.—MINOR WORKS AND NAVIGATION.</b>						
Works for which Capital and Revenue Accounts are kept	6,000	3,449	...	...	7,360	5,160
Works for which Revenue Accounts are kept.	...	...	1,000	...	(a) 1,850	29,506
Works for which neither Capital nor Revenue Accounts are kept.	...	...	1,800	17,305	36,285	
Agricultural works for which neither Capital nor Revenue Accounts are kept.	75,552	68,569	95,163	95,649	2,23,600	2,00,436
Reserve ...	255	...	...	...	255	...
<b>Total, Minor Works and Navigation</b>	<b>1,807</b>	<b>72,009</b>	<b>1,08,963</b>	<b>1,12,954</b>	<b>2,69,350</b>	<b>2,93,152</b>
<b>45.—CIVIL WORKS.</b>						
Civil Buildings ...	24,79,627	23,12,404	6,43,060	6,24,418	31,22,637	29,36,823
Communication ...	3,76,730	3,53,256	5,93,923	6,11,766	9,70,653	9,70,023
Miscellaneous Public Improvement	3,50,990	3,43,947	43,652	24,749	3,74,642	4,05,696
Establishment ...	...	...	...	...	11,40,304	12,32,825
Tools and Plant ...	...	...	...	...	81,029	1,07,074
Suspense ...	...	...	...	...	-2,50,000	-1,87,166
<b>Total, Civil Works</b> ...	<b>32,07,347</b>	<b>30,54,607</b>	<b>12,40,635</b>	<b>12,57,933</b>	<b>54,39,315</b>	<b>54,65,273</b>
Carried over ...	...	...	...	...	...	76,93,520

(a) — Includes grants for Establishment and Tools and Plant.

APPENDIX D.—*Concl'd.*

Service Heads.	Original Works.		Repairs.		Total.	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
1	2	3	4	5	6	7
Brought forward ...	...	...	...	...	...	76,90,586
<b>LOCAL FUNDS.</b>						
Other Local Funds ...	...	7,80,432	...	3,96,668	...	11,77,100 <sup>(a)</sup>
District Funds ...	...	...	...	...	...	50,48,445 <sup>(†)</sup>
<b>Total Local Funds ...</b>	...	...	...	...	...	<b>62,25,545</b>
<b>TRIBUTION.</b>						
Imperial ... { Military ...	...	...	...	...	...	...
{ Civil ...	...	...	...	...	...	...
Provincial { Civil Buildings. ...	...	2,52,125	...	1,827	...	2,69,290 <sup>*</sup>
{ Irrigation. ...	...	...	...	...	...	...
Minor Works and Navigation ...	...	8,261	...	1,452	...	10,758 <sup>*</sup>
<b>Total Contribution ...</b>	...	<b>2,60,386</b>	...	<b>3,279</b>	...	<b>2,80,048</b>
<b>Grand Total ...</b>	...	...	...	...	...	<b>1,41,96,179</b>

\* Includes charge for Establishment and Tools and Plant.

(†) Includes Es. 8,26,101 for Establishment and Es. 81,953 for Tools and Plant.

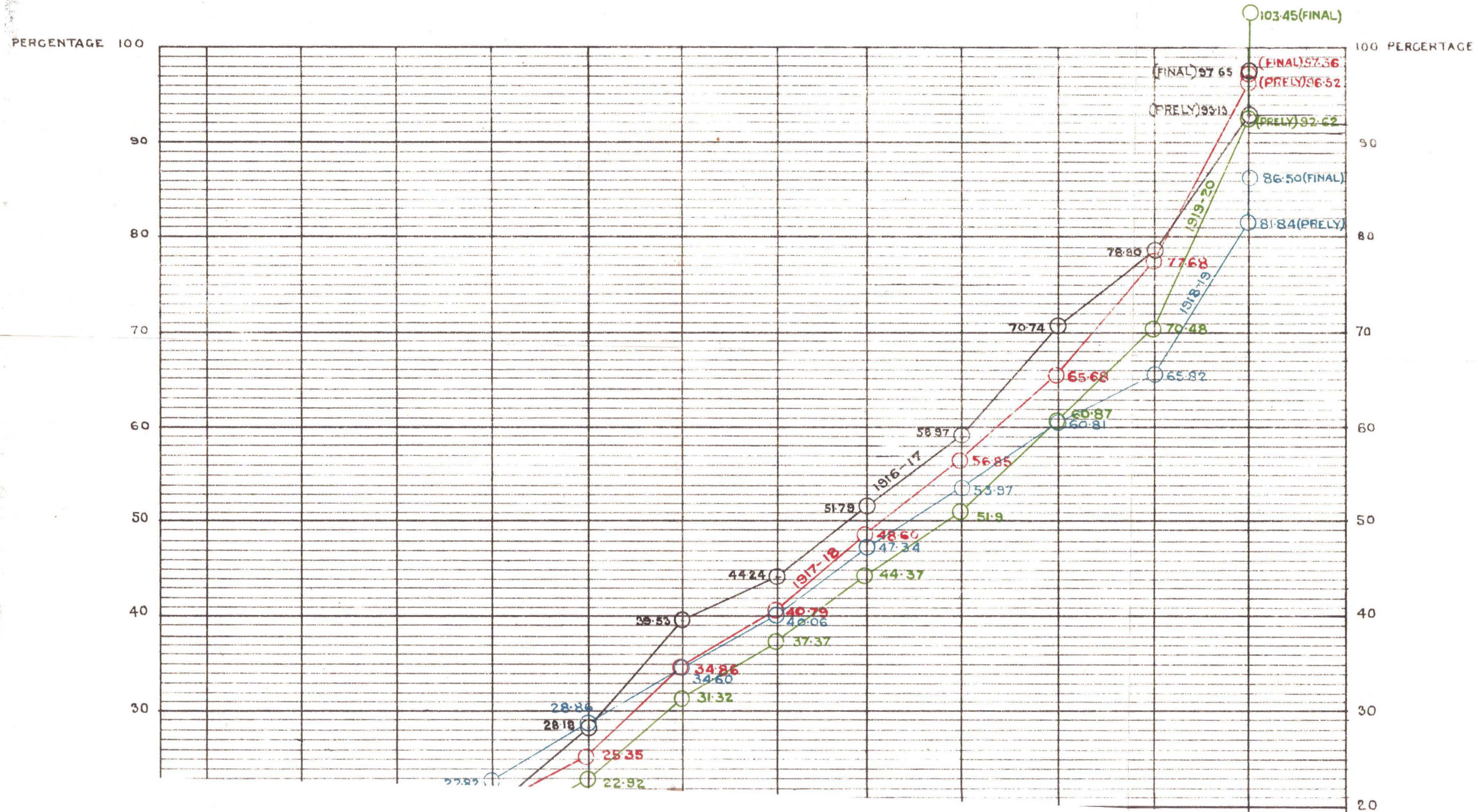
(a) Includes Es. 2,54,063 for Establishment and Tools and Plant.



P. W. D.

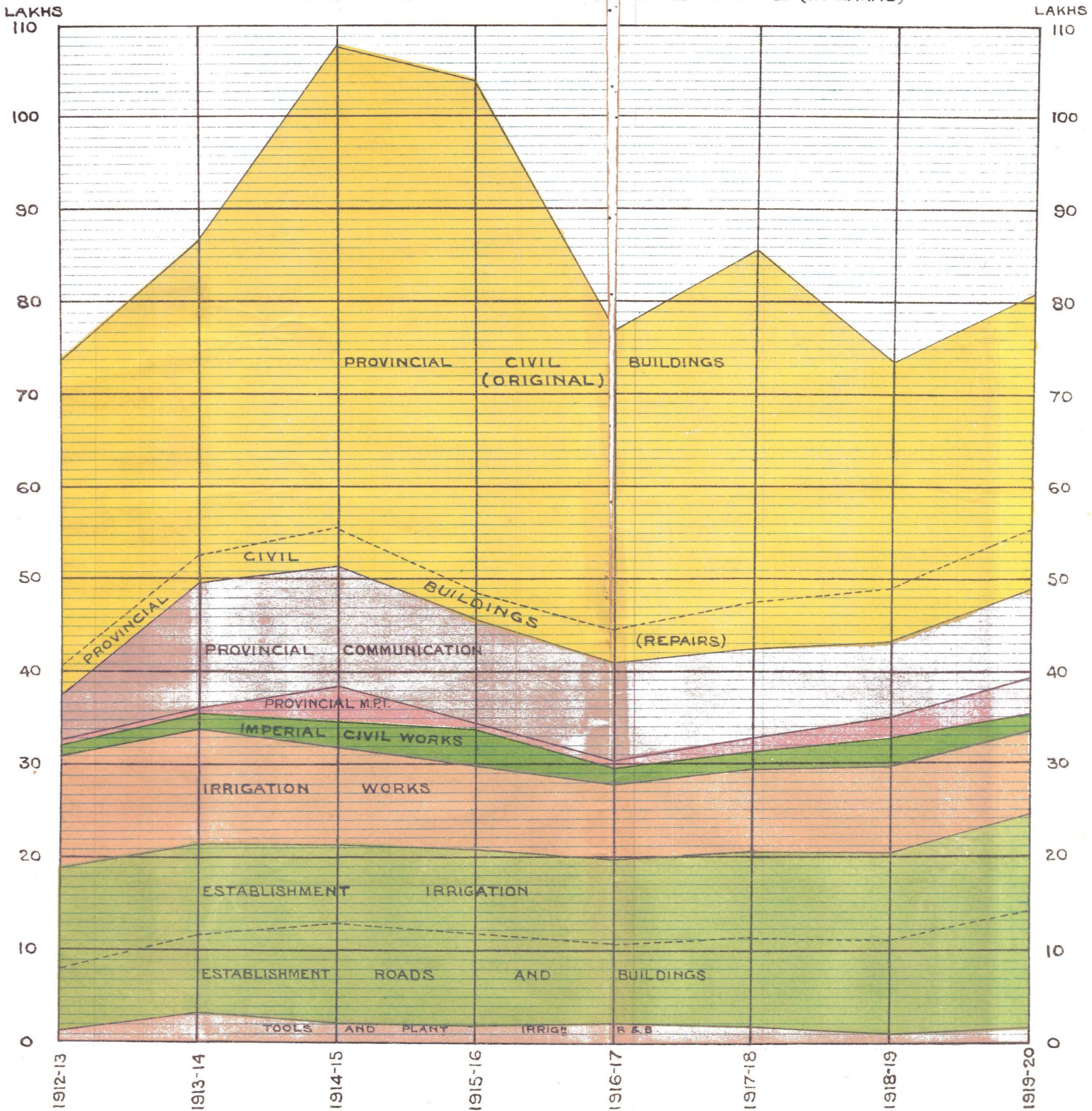
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CURVES SHOWING MONTHLY PERCENTAGE EXPENDITURES UNDER ALL MAJOR HEADS  
IN THE ROADS & BUILDING BRANCH  
(INCLUDING ESTABLISHMENT TOOLS & PLANT & SUSPENSE.)





# DIAGRAM SHOWING YEARLY PUBLIC WORKS EXPENDITURE (IN LAKHS)





**GOVERNMENT OF BIHAR AND ORISSA  
PUBLIC WORKS DEPARTMENT.**

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**ANNUAL ADMINISTRATION REPORTS**

**FOR**

**ROADS AND BUILDINGS, IRRIGATION AND RAILWAYS**

**FOR THE YEAR**

**1920-21.**



**PATNA**

**PRINTED AT THE BIHAR AND ORISSA GOVERNMENT PRESS.**

**1922**

**Price Rs. 3.**

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## SUMMARIES.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

Mr. W. S. Bremner held the office of the Chief Engineer and Secretary to Government in the Buildings and Roads Branch till the middle of April when he proceeded on privilege leave and was succeeded by Mr. E. Blaber, Superintending Engineer. Mr. F. Clayton, Chief Engineer and Secretary to Government in the Irrigation Branch, proceeded on combined leave preparatory to retirement towards the end of April and was relieved by Mr. C. B. Mellor, Superintending Engineer. The latter also proceeded on combined leave in October and was succeeded by Mr. Bremner on his return from leave. Administrative Changes.

Under orders from the Government of India stopping the recruitment to the class of Upper Subordinates, the post of Upper Subordinate guaranteed annually in the Department has been withdrawn after the students of the Bihar School of Engineering admitted to that class not later than the 31st July 1920, pass out after completing the full course prescribed.

Certain changes have been made in the distribution of the jurisdictions of the several Divisions of the Orissa Circle from the commencement of the year. Five temporary subdivisions have been formed during the year, one under each of the Special Works, the Hazaribagh, and the Mahanadi Divisions and two under the Chota Nagpur Division.

A time-scale of pay has been sanctioned by the Government of India for the Divisional Accountants employed in the Department. Time Scale of pay for Divisional Accountants.

The pay of the ministerial and certain other non-gazetted and menial establishments employed in the Department has been revised along with that of others in the province. Revision of pay of ministerial, menial and other establishments.

On the introduction of the Reforms Scheme, the Buildings and Roads work of the Department which is a transferred subject, has been placed under the control of the Hon'ble Minister in charge of the Local Self-Government. Introduction of the Reforms Scheme.

#### BUILDINGS.

So far as the building operations of the Department were concerned, the year under review was not a good one. An acute shortage of coal combined with the difficulty of its transport owing to the embargo on the supply of wagons interfered very largely with the manufacture of the most important building materials such as bricks, lime, etc., and led to the surrender of a large portion of the grant provided in the budget. The extent to which this lack of building materials affected the work of the Department is shown by the following figures :— General.

	Rs.
Budget provision under original works, Civil Buildings [ Provincial ]	49,48,800
Actual expenditure on ditto ...	34,68,996

The following is a list of the more important works undertaken during the year.

#### IMPERIAL MILITARY.

Materials were collected for several new buildings at Chandipur and the construction of a new building for the Proof officer at that station was in progress.



## IMPERIAL CIVIL.

**Post & Telegraph Office.**

The only work of any importance was the construction of a Post Office building at Kanke with quarters for the Sub-Post master.

**Miscellaneous.**

Materials were collected for the proposed expansion of the Agricultural Institute at Pusa estimated to cost Rs. 13,58,000 and a Rest House at Pusa for Indian visitors was nearing completion.

## PROVINCIAL CIVIL BUILDINGS.

**Courts.**

The project for the construction of buildings in connection with the establishment of a Civil Subdivision at Latehar was administratively approved at a cost of Rs. 1,32,116 and some materials were collected. Materials were also collected for an additional Court building at Dumka.

**Jails.**

The construction of a tuberculosis ward and enclosure walls in the Central Jail at Bhagalpur was in progress and the collection of materials for the construction of a new Hospital, Dysentery ward, Observation Cells, etc., in the same Jail was taken up.

**Police.**

The town police barracks and subsidiary buildings at Khazanchihat, Purnea and Katihar and the hospital building for the Reserve Police Lines at Bhagalpur were completed. The residence for the Principal of the Constables' Training School at Nathnagar was also completed and that of the Deputy Superintendent of Police at Dumka was nearing completion. The Reserve Police Staff quarters at Motihari which were started during the previous year were completed.

**Education.**

The works of major importance under this head were the construction of buildings in connection with the three colleges at Muzaffarpur, Bhagalpur and Cuttack. The progress on the Greer Bhumihar Brahman College at Muzaffarpur was impeded to some extent for want of bricks which the contractors could not get ready in time though departmental help was extended to them. The Tej Narayan Jubilee College buildings at Bhagalpur which were financed partly for a Government grant and partly from the munificent donation of the Banaili Raj were practically completed. The buildings in connection with the Ravenshaw College at Cuttack were also very nearly completed.

**Medical.**

Eight quiet patients' blocks and other subsidiary buildings were completed in the Indian Lunatic Asylum at Kanke, Ranchi, and several works of improvements were carried out in the European Lunatic Asylum. An isolation ward and a dissecting block in the General Hospital at Patna were completed and a hostel for the Hindu and Muhamadan students attached to the Medical School was in progress.

**Registration.**

The construction of Sub-Registry offices at Tikari and Sherghati was in progress.

**Agriculture.**

A carpenters' and fitters' workshop in the Agricultural College at Sabour and the laying out of the grounds of the College were completed. The collection of bricks for the proposed buildings in connection with the Agricultural farm at Gaya was in progress.

**Miscellaneous Public Works Department Buildings.**

The Public Works Department Subdivisional Officer's office and residence at Chapra which was started during the previous year were completed.

**Residences for the Governor and other Government Officials.**

The project of water-supply to Government House, Patna, for lawn watering and irrigation purposes was in progress.

Mr. Patel's bungalow at Muzaffarpur was acquired for the residence of the Personal Assistant to the Commissioner of the Tirhut Division and the residence for the 2nd Deputy Collector at Dhanbad was completed.

**Capital works.**

The new Council Chamber at Patna for accommodating the reformed and enlarged Council was completed.

The sewerage scheme for the New Capital area was in progress and the surface and storm drainage projects for Amlatola were almost completed.

### COMMUNICATIONS.

With the exception of works in progress, very few original works were done during the year.

The new alignment of the through road to Cuttack between Patna and Gaya was further improved. The metalled surface of the Grand Trunk Road between Chirkunda and Nirsa, was widened, and approval was given to do similar work on the length of the same road from Nirsa to Govindpur. The District Board road from Kuru to Netarhat was provincialised, and it has been proposed to improve the hill portion of this road. The diversion of the Cuttack-Sonpur Road between Harbhanga and Sitalpani was completed.

It was decided to build causeways, instead of bridges, over the Lilajan and the Jira rivers on the Grand Trunk Road, and the Raipur-Sambalpur Road, respectively, and the projects for these were under preparation.

The following bridges which had been under construction from previous years were completed :—

- (1) Bridge over the Gowain river on the Chas-Gulbera Road ;
- (2) Bridge over the Am Nala on the Sambalpur-Sonpur Road ;
- (3) Bridge over the Tengra Nala on the Raipur-Sambalpur Road ;
- (4) Bridge over the Nigra river at Matanga on the Cuttack-Angul Road.

The bridge works noted below remained in progress at the close of the year :—

- (1) Bridges over the Nigra and the Matulia Rivers on the Angul-Tickerpara Road, first section ;
- (2) Bridge over the Banj River on the Raipur-Sambalpur Road ;
- (3) Bridge over the Barakar River on the Giridih-Dumri Road ;
- (4) Bridge over the Khorkai River on the Chaibasa-Jamshedpur Road.

The management of the Pontoon bridge over the Mahanadi River at Sambalpur was resumed by the Local Government from the Bengal-Nagpur Railway Company, Limited.

It has been proposed to construct an Inspection Bungalow at Potka on the Ranchi-Chaibasa Road.

The planting and maintaining of trees alongside roads were carried out as usual.

### MISCELLANEOUS PUBLIC IMPROVEMENTS.

No important work was taken up during the year; only works in progress were gone on with.

A license was granted to the General Electric Company (India) Limited, for supplying electricity in Patna City, Bankipur and the New Capital at Patna.

Sanction was accorded to the Sijua (Jharia) Electric Supply Company, Limited, to supply electrical energy to certain coal mines, Railway Stations, and Government Offices, situated in the Manbhum District.

### RAILWAYS.

Three Light Railways are partially under the control of the Government Administration of Bihar and Orissa. The Government of India in the Railway Department (Railway Board) control the large and more important Railway systems.

**Mileage.** The total mileage was increased by 38½ miles during the year under review.

**Surveys.** Surveys of about 202 miles were sanctioned by the Railway Board during the year.

**Accidents.** On the East Indian Railway, there were two collisions resulting in injuries to three Railway servants and four passengers.

On the Bengal Nagpur Railway, there was a derailment which resulted in the death of four passengers and in injuries to seven.

### CANALS.

**Productive Works.**

The area irrigated by the two Productive Works, *viz.*, the Orissa and Son Canals system was 924,811 acres against 847,118 acres of the preceding year. The increase is due mainly to improvement in the long lease area and extensive *rabi* irrigation on the Son Canals consequent on the failure of the rains in the month of October 1920.

The gross receipts from all sources amounted to Rs. 27,56,419 against Rs. 28,16,313 of the previous year. The area irrigated during the year though larger in comparison with the previous year the receipts are less during the year under report. This is due mainly to the fact that the demand for the *rabi* irrigation will appear in the accounts of next year and the uncollected balance of water-rate receipts during the year was heavy on the Son Canals owing to the introduction of a new system of collection of water-rates there.

The total working expenses (direct and indirect) amounted to Rs. 15,90,443. The net profit to Government after meeting the year's working expenses was Rs. 11,65,976, which did not fully cover the interest charges of the year amounting to Rs. 17,43,923. Including interest charges, the Orissa Canals were worked at a loss of Rs. 9,43,138 while the Son Canals brought in a net revenue of Rs. 3,65,191.

No new works of any importance were undertaken and the canals were maintained in fair condition. The rainfall during the year was below the average.

**Protective Irrigation Works**

The area irrigated by the Protective Works, *viz.*, the Tribeni and Dhaka Canals was 100,332 acres against 94,669 acres of the preceding year. The area that came under lease was about 6,000 acres in excess of that of the previous years. These canals are used for irrigation only.

The gross receipts amounted to Rs. 2,72,160 while the working expenses (direct and indirect) were Rs. 1,85,852 resulting in a net revenue of Rs. 86,308 (excluding interest charges).

**Minor Works and Navigation.**

The three canals falling under this class, *viz.*, the Teur (Madhuban) Canal, Orissa Coast Canal and Saran Canals were maintained at a total cost of Rs. 21,368 (excluding establishment and tools and plant charges). The Teur Canal irrigated an area of 2,134 acres. The Orissa Coast Canal is open to navigation only while the Saran Canals have been closed to irrigation since 1894. The gross receipts for these canals amounted to Rs. 12,722 only.

**Surveys and Investigations.**

Preliminary surveys and investigations in connection with certain possible Irrigation Schemes are proceeding.

### EMBANKMENT AND DRAINAGE WORKS.

The expenditure on embankment was Rs. 3,02,976 against Rs. 1,70,160 in the preceding year. Of this sum Rs. 1,50,295 was spent on ordinary maintenance and river protective works. The increase in expenditure was due to making good the considerable damages done to the embankments in Orissa by the floods of August 1920. In other parts of the Province the floods were not so serious.

## CHAPTERS.

### PUBLIC WORKS DEPARTMENT.

#### ESTABLISHMENT.

The appointment of Chief Engineer and Secretary to Government in the Buildings and Roads Branch was held by Mr. W. S. Bremner till the middle of April when he proceeded on privilege leave and Mr. E. Blaber, Superintending Engineer, succeeded him. The appointment of Chief Engineer and Secretary to Government in the Irrigation Branch was held by Mr. F. Clayton till he proceeded on combined leave preparatory to retirement towards the end of April. He was succeeded by Mr. C. B. Mellor, Superintending Engineer, who also went on combined leave in October and was succeeded by Mr. Bremner on his return from leave. Mr. E. G. Stanley, Chief Engineer, Buildings and Roads, retired from the service of Government from the middle of July on the expiry of his leave. Administrative Changes.

The appointment of Under-Secretary in the Buildings and Roads Branch was held by Mr. R. J. H. Hudson, Executive Engineer, till the first week of November, when he proceeded on combined leave and was relieved by Mr. L. M. Priday, Executive Engineer. The latter also went on combined leave in December and was succeeded by Mr. N. G. Dunbar, Executive Engineer, who held the office till the close of the year.

The Eastern and the Orissâ Circles remained in charge of Rai Bahadur Bishun Svarup and Rai Bahadur Srish Chandra Chakravartti, Superintending Engineers, respectively, throughout the year. Mr. R. C. Edge, Superintending Engineer, continued in charge of the Western Circle till the end of June when he proceeded on long leave preparatory to retirement and Rai Bahadur Subhrendu Mohan Gosvami, Executive Engineer, Chota Nagpur Division, held charge of the current duties of the office in addition to his own until relieved by Babu Sharada Sundar Pal as officiating Superintending Engineer early in July. On the appointment of Mr. C. B. Mellor, Superintending Engineer, Son Circle, as officiating Chief Engineer, Mr. K. R. Beri, Executive Engineer, was placed in charge of the Circle about the middle of April and he officiated in the post for the rest of the year. Mr. G. T. Huntingford, Superintending Engineer, Gandak Circle, proceeded on combined leave at the end of April and Mr. H. H. Stevens, Executive Engineer, succeeded him as officiating Superintending Engineer on return from special duty in connection with the Hydro-Electric Survey. Mr. Stevens also went on long leave in August and Mr. Priday, Executive Engineer, was appointed to officiate as Superintending Engineer. The latter held charge till the end of October when Mr. H. Wardle, Executive Engineer, returned from leave and took charge of the Circle.

Mr. A. M. Millwood, Government Architect, proceeded on combined leave early in January and Mr. W. Albert-Samuel, Assistant Secretary to Government in the Public Works Department, held charge of the current duties of the office, in addition to his own.

Mr. H. A. Gubbay, Executive Engineer, was placed on special duty for the survey of the flooded tracts in the Orissa Circle. On his transfer to the charge of the Hazaribagh Division in January, Mr. G. Stevenson, Assistant Executive Engineer, succeeded him and took charge of the special duty. Mr. Stevens, Executive Engineer, who was on special duty for the Hydro-Electric Survey took charge of the Gandak Circle from Mr. Huntingford in April on the latter's proceeding on combined leave.

Maulavis Saiyid Ali Amir and Muhammad Sulaiman were appointed to the Indian Service of Engineers, and Babu Brahmeshvar Dayal and Mr. S. Phillips to the Provincial Engineering Service by direct appointment. Ten Upper Subordinates were also promoted to the latter service.

Under orders from the Government of India stopping the recruitment to the class of Upper Subordinates the post of Upper Subordinate guaranteed annually in the Department has been withdrawn after the students of the Bihar School of Engineering admitted to that class not later than the 31st July 1920 pass out after completing the full course prescribed.

From the beginning of the year, the headquarters of the Brahmini Division have been removed from Cuttack to Balasore and its name changed to the Balasore Division. The works in the Angul and the Phulbani subdivisions of the Brahmini Division have been transferred to the control of the Deputy Commissioner of Angul and placed in charge of a District Engineer. The Manijanga subdivision of the Mahanadi Division has been abolished and the works of the subdivision have been distributed between the Jagatsinghpur and the Jenapur subdivisions. The name of the Jenapur subdivision has been changed to the Birupa subdivision and its headquarters have been fixed at Cuttack. The headquarters of the Pipli subdivision have been removed to Puri and its name changed to the Puri subdivision. Two subdivisions have been formed under the Cuttack Division with their headquarters at Cuttack. A temporary subdivision has been formed under the Special Works Division, designated the Government House subdivision, comprising the works of the Government House section, a portion of the Dinapur road and some other works. A temporary subdivision has been formed under the Hazaribagh Division, to be called the Barakar Bridge subdivision, for the construction of a bridge over the Barakar river on the Giridih-Dumri road. A temporary subdivision with certain temporary sections has been created at Jenapur in the Mahanadi Division for carrying out the repairs of the damages done by flood to embankments and weirs. Two temporary subdivisions have been formed under the Chota Nagpur Division, one with its headquarters at Kanke for the construction of the buildings for the Lunatic Asylum there, and the other with its headquarters at Latehar for the construction of Civil subdivisional buildings at that place.

Time Scale of pay for Divisional Accountants.

A time-scale of pay rising from Rs. 80 to Rs. 270 in 22 years has been sanctioned by the Government of India for the Divisional Accountants employed in the Department with effect from the 1st of April.

Revision of pay of ministerial menial and other establishments.

The pay of ministerial and certain other non-gazetted and menial establishments employed in the Department has been revised along with that of others in the province in consideration of the rise in the cost of living.

Introduction of the Reforms Scheme.

On the introduction of the Reforms Scheme the Buildings and Roads work of the Department which is a transferred subject, together with the establishment connected with that work has been placed under the control of the Hon'ble Minister in charge of the Local Self-Government.

The control of the Sanitary Engineer and his staff has been transferred from the Public Works to the Municipal Department.

## BUILDINGS.

### IMPERIAL MILITARY.

The work of improvements to certain buildings of the Proof Department and the construction of a new building for the Proof Officer at Chandipore were in progress. Materials were collected for several new Military buildings at Chandipore.

### IMPERIAL CIVIL.

Post and Telegraph office.

The construction of a Post Office building at Kanke with quarters for the Sub-Postmaster and the extension of the Post Office building at Jharia were completed.

Miscellaneous.

Materials were collected for the project of the proposed expansion of the Agricultural Institute at Pusa estimated to cost Rs. 13,58,000. The construction of quarters for the 1st Assistant to the Imperial Mycologist and a Rest House for Indian visitors at Pusa were nearing completion and the European

quarters Nos. 13 and 14 were in progress. The quarters for the European Head Surveyor of the Mines Department at Dhanbad were almost completed and materials were collected for the construction of a residence for the Junior Inspector of Mines at that station.

#### PROVINCIAL CIVIL BUILDINGS.

The building project for the establishment of a subdivision at Latehar **Courts** was administratively approved at a cost of Rs. 1,32,116 and some materials were collected. The additional Record Room for the Collectorate at Purulia and the extension of the Civil Subdivisional Officer's Court at Dhanbad which were in progress from the previous year were completed. Land was acquired to the extent of 402 acres for the establishment of a Civil Subdivision at Dalbhum but was eventually made over to the Bengal Nagpur Railway Company and another plot of 378 acres was under acquisition for the purpose. Materials were collected for the construction of an additional court building at Dumka and the Treasury guard's barrack, hajat and malkhana at Jehanabad were nearing completion.

Clerks' quarters were constructed in the Circuit Houses at Arrah, **Circuit House**, Dhanbad and Sambalpur. A motor car shed and quarters for the Chauffeur were constructed in the compound of the Circuit House at Netarhat and motor car sheds were provided in some other Circuit Houses.

The tuberculosis ward and enclosure walls in the Central Jail at Bhagalpur were in progress and the collection of materials for the construction of a new hospital, dysentery ward, observation cells, etc., was taken up. A new workshop building in extension of Stereo foundry and an engine room and the extension of the under-trial and segregation ward in the Central Jail at Gaya were completed.

The town police barracks and subsidiary buildings at Khazanchihat, **Police**, Purnea and Katihar and the hospital building for the Reserve Police Lines at Bhagalpur were completed. The residence for the Principal of the Constables' Training School at Nathnagar was also completed and that of the Deputy Superintendent of Police at Dumka was nearing completion. Some materials were collected for the construction of a residence for the Superintendent of Police at Purulia. The acquisition of a site for improving the sanitary condition and the reconstruction of the Thana buildings at Sasaram were in progress. The barrack for 12 constables in the Police-station at Nawada and the quarters for the Sub-Inspector of Police at that station were completed. The quarters for the 2nd Sub-Inspector and two Head Constables at Buxar were also completed and the old Opium Godown at Bhabhua was converted into a Police-station. The Reserve Police Staff quarters at Motihari which were started during the previous year were completed.

The construction of the buildings in connection with the Ravenshaw **Education** College at Cuttack was almost completed with the exception of the Physical and Chemical Laboratories. The progress of the Greer Bhumihar Brahman College buildings at Muzaffarpur was retarded to some extent for want of bricks. The conversion of the lower hall of the Patna College into a Chemical Laboratory for the I. Sc. students and certain additions to and alterations in the existing Chemical Laboratory were completed. The Tej Narayan Jubilee College project at Bhagalpur which was financed partly from Government grant and partly from the contribution of the Banaili Raj was practically completed.

A temporary hostel in the compound of the Bara Nepali Kothi for the Girls' High School at Bankipur and the residence for the Lady Principal of the same institution were completed. The work of converting the building known as "Ashton Hall" into a hostel for the students of the Bihar National College at Bankipur was almost completed. A double storied hostel building for 105 boys of the 1st grade Training School at Ranchi with quarters for the Hostel Superintendent, a hostel building for 20 boys of the Industrial School at Ranchi and a hostel for 50 Hindu and Muhammadan boys of the Hazaribagh

Zila School which were in progress from the previous year were completed. Certain additions to and alterations in the Purulia Zila School including the construction of a hall were also completed.

The conversion of the opium buildings at Motihari into a hostel for the Zila School and the Hindu and Muhammadan hostels for the Chapra Zila School were completed. The Muhammadan Teachers' Training School at Basatwara (Darbhanga district) and the quarters for the Head Master and 15 teachers of the Pusa High School were half finished. The Industrial School at Phulbani was completed and the work of constructing a model girl school at Barabati in the district of Balasore was approaching completion. A second storey was added to the existing Training School building at Cuttack and the extension of the hostel attached to the said school was completed.

**Medical.**

An isolation ward and a dissecting block in the General Hospital at Patna were completed and a hostel for the Hindu and Muhammadan students of the Temple Medical School at Patna was in progress. Several works of improvements were carried out in the European Lunatic Asylum at Kanke and the following works in connection with the Indian Lunatic Asylum which were started during the previous year were completed :—

- (1) Seven quiet patients' blocks and a hospital in the male section.
- (2) One quiet patients' block and a hospital in the female section.
- (3) Eight sets of family quarters for attendants, 12 sets of quarters for single attendants and 3 sets of menials' quarters.

Good progress was made with the construction of a hostel for the male students of the Orissa Medical School. The Dispensary buildings at Balandapara with subsidiary buildings and compounder's quarters and the dispensary buildings at Khejuripara, Phiringia and Chhendipada were completed.

**Registration.**

The construction of Sub-Registry offices at Tikari and Shergati was in progress. Materials were collected for the construction of Sub-Registry offices at Bihar and Mokameh.

**Agriculture.**

The construction of a carpenters' and fitters' workshop in, and the laying out of the grounds of the Agricultural College at Sabour were completed and some materials were collected for the quarters of the Farm Mechanic. The collection of bricks for the construction of the proposed buildings in connection with the Agricultural Farm at Gaya was in progress.

**Miscellaneous  
Public Works  
Department  
Buildings.**

The Public Works Department Subdivisional officer's office and residence at Chapra which were in progress from the previous year were completed.

**Residence for the  
Governor and  
other Government  
officials.**

The project for the water supply to Government House, Patna, for lawn watering and irrigation purposes was in progress. Good progress was also made with the construction of quarters for the Head Butler and an Ayah and with the extension of the kitchen block and other works of improvements in Government House, Ranchi. The work of constructing a new reinforced brick roof over the kitchen block in Government House, Puri, was nearing completion.

Mr. Patel's bungalow at Muzaffarpur was acquired for the residence of the Personal Assistant to the Commissioner of the Tirhut Division at a cost of Rs. 14,282. The European Deputy Collector's quarters at Laheriásarai were practically completed and that of the 2nd officer's quarters at Bhabhua was in progress. The residence for the 2nd Deputy Collector at Dhanbad was completed and the construction of quarters for the Hindu and Urdu Translator to Government at Patna was taken up.

**Capital works.**

The construction of the new Council Chamber at Patna was completed.

The several clerks' quarters which were in progress at Amlatola and near the Water Tower were completed. Eight quarters were built between the serpentine and the Digha line for the accommodation of the clerks of the Accountant-General's office during the budget season.

The sewerage scheme for the New Capital at Patna was in progress. The internal water-supply scheme to the clerks' quarters at Amlatola was practically completed but the supply of water to the quarters was deferred till after the completion of the sewerage scheme. The surface and storm drainage projects at Amlatola were also completed except that the construction of the Railway culvert in connection with the latter was held up as the design was under the consideration of the Railway authorities.

The levelling and dressing of the University area at Patna was done to the extent provided for. Patna University.

The tuberculosis ward in the Sadr Hospital at Muzaffarpur was taken up but stopped for the revision of the design. Certain drains were constructed within the Patna City Municipal area. Contribution.

A statement of expenditure on original works, civil buildings (Provincial) including contributions is given below:—

	Rs.
Administration	8,71,277
Monuments and antiquities	7,232
Educational	14,98,554
Ecclesiastical	1,575
Law and Justice	53,227
Jails	97,168
Police	2,38,067
Medical	7,85,412
Miscellaneous	83,858

### COMMUNICATIONS.

A similar policy was followed as had been adopted during the past few years. Only works of an urgent nature, and those which were in progress from previous years, were taken in hand, and carried out during the year under report. General.

The chief work done during the year was consequently restricted to the maintenance of the existing roads and bridges. Expenditure was incurred more on repair works than on original construction, which compare as follows with the last year's figures:—

	1919-20.	1920-21.
	Rs.	Rs.
Original works	3,58,256	1,64,000
Repairs	6,11,766	6,85,000

*Bihar.*—Certain additional works were done to improve the road from Patna to Gaya via Khagaul, Masaurhi and Jehanabad which is being constructed as a fair weather track to form the alignment of the through trunk road between Bihar and Orissa. Roads

Some roads were constructed during the year to give access to the newly built clerks' quarters in the New Capital at Patna.

*Chota Nagpur.*—The work of widening the metalled surface of the Grand Trunk Road from Chirkunda to Nirsa in the Manbhum District which had been taken in hand last year, was completed. Approval was given to increase the metalled width of the next section of the same road from Nirsa to Govindpur, at an estimated cost of Rs. 33,215.



The road from Kuru to Lohardaga, and thence on to Ghagra, Banari and Netarhat belonging to the District Boards of Ranchi and Palamau was provincialised, and taken over for maintenance by the Public Works Department, with effect from the 1st April 1920. Considerable improvements were effected to the road by metalling some lengths of it which were unmetalled, and increasing the waterways of certain culverts. Approval was also accorded to improve the hill portion of this road.

*Orissa.*—The diversion of the Cuttack-Sonpur Road between Harbhanga and Sitalpani which was taken in hand last year, was completed, while the improvements to the Angul-Tickerpara Road were finished.

A detailed project was under preparation for the construction of a road from Jharsuguda to Sambalpur as a part of the through road from Sambalpur to Ranchi.

**Bridges.**

*Bihar.*—With a view to economy, it was decided to build a causeway, instead of a girder bridge, over the Lilajan River in mile 284 of the Grand Trunk Road, and a detailed project was under preparation.

*Chota Nagpur.*—The work of improving certain bridges and culverts on the Madhuban Branch Road was completed. The bridge over the Gowain river on the 11th mile of the Chas-Gulbera Road, which was under construction for the past few years, was also completed.

*Orissa.*—The following bridge works which were in progress from the previous years, were completed during the year under report :—

- (1) High level bridge over the Am Nala on the 19th mile of the Sambalpur-Sonpur Road ;
- (2) High level bridge over the Tengra Nala on the 134th mile of the Raipur-Sambalpur Road, IIB ;
- (3) High level bridge over the Nigra river at Matanga on the Cuttack-Angul Road.

The bridges noted below on which good progress was made, remained under construction at the close of the year :—

- (1) The bridge over the Nigra river on the 1st section of the Angul-Tickerpara Road ;
- (2) The bridge over the Matulia river on the 1st section of the Angul-Tickerpara Road ;
- (3) The bridge over the Ranj river on the 124th mile of the Raipur-Sambalpur Road.

Detailed plans and estimates for a floating causeway, instead of a High Level Bridge as previously proposed, over the Jira River, on the 138th mile of the Raipur-Sambalpur Road, were under preparation.

The bridge of boats over the Mahanadi River at Sambalpur on the Raipur-Sambalpur Road which had hitherto been maintained by the Bengal-Nagpur Railway Company, Limited, was taken over by the Local Government for better management, with effect from the 1st January 1921. Steps have been taken to improve the condition of the ferry and to give better facilities to the public by the construction of additional boats, and sheds for the accommodation of goods etc.

**Contribution Works.**

The work of the construction of an iron girder bridge of 5 spans of 100 feet with two shore spans of 60 feet each, over the Barakar River on the 9th mile of the Giridih-Dumri Road to replace the causeway at that place, was started.

Good progress was made on the building of the causeway over the Khorkai River on the road from Chaibasa to Jamshedpur.

**Accommodation for Travellers and Touring Officers.**

Some additions to, and alterations in, the Inspection Bungalow at Sasaram were carried out during the year. A well was sunk in the compound of the Inspection Bungalow at Tatisilwai on the Ranchi-Purulia Road. A proposal to construct an Inspection Bungalow at Potka on the Ranchi-Chaibasa Road, 2nd section, received the approval of the Local Government.

The planting and maintaining of trees along provincial roads was continued, and nurseries maintained as usual, so far as funds permitted. Arboriculture.

### MISCELLANEOUS PUBLIC IMPROVEMENT.

No new works of importance were taken up during the year under report. Only works in progress were carried out.

A new spur was erected in the Bur Gandak River at Muzaffarpur to protect public buildings at that station from further erosion of the river.

A nursery was laid out for growing Mahua trees which will eventually be planted on the Maidan near the village of Hatma to the north of Ranchi.

A license was granted to the General Electric Company (India) Limited, in July, 1920, for the supply of electrical energy within the limits of the Patna City Municipality, the Patna Administration Committee, and certain other adjacent areas. An extension of six months' time has been granted to the Company for performing the obligations imposed upon the licensees by the license granted to them.

Sanction under section 28(1) of the Indian Electricity Act, 1910, was accorded to the Sijua (Jharua) Electric Supply Company, Limited, to engage in the business of supplying Electrical energy to certain Coal Mining properties, railway stations, and Government offices in the district of Manbhum.

### RAILWAYS,

There are no railways under the direct control of the Government of Bihar and Orissa. With the exception of the three following light railways of local importance, which are subject to a measure of control by the Local Government, all the important lines are under the direct administration of the Government of India in the Railway Department (Railway Board):— Administration.

	Gauge.	Miles.
1. Arrah-Sassaram Light Railway ...	2' 6"	65.26
2. Bakhtiyarpur-Bihar Light Railway ...	2' 6"	33.03
3. Dehri-Rohtas Light Railway ...	2' 6"	23.83
Total		122.09

During the year under report 39½ miles of the Extension of the Mayurbhanj Railway were opened to traffic. Mileage.

The total mileage on the 31st March 1921 was therefore:—

	Miles.
1. Standard Gauge ...	1660.75
2. Metre Gauge ...	1178.66
3. 2' 6" Gauge ...	308.06
4. 2' 0" Gauge ...	39.00
Total	3186.47

Lines sanctioned  
or under  
construction.

The following lines were under construction or sanctioned for construction during the year :—

**Bengal Nagpur Railway—**

	Gauge.	Miles.
Portion of the Raipur-Parbatipuram Section (from a point near Gurjabota to a point near Bhowanipatna Road)	5' 6"	92.00
Onlajori-Sulapet with a branch to Badampahar	5' 6"	21.75
Amda-Jamda	5' 6"	65.62
Extension to Sudamdih Branch	5' 6"	0.82
Jeetpur Connection	5' 6"	1.41
Bermo-Duneya	5' 6"	18.75
Futwa-Islampur Railway	2' 6"	27.00

Surveys  
sanctioned.

Authority was given by the Railway Board to undertake the following surveys during the year :—

*To the East Indian Railway for—*

- (a) A reconnaissance survey for a line of railway on the broad gauge from a point on the Daltonganj Branch to a point on the Jubbulpur line near Katni, with possible extensions into the Rewah State.
- (b) A detailed survey for a line of railway on the broad gauge to connect Daltonganj with the Hutar Coalfields, a distance of about 18 miles.

*To the Bengal Nagpur Railway for—*

A reconnaissance survey for a line of railway on the broad gauge from Hesla to Manbharpur, a distance of about 148 miles.

*To the Darjeeling-Himalayan Railway Extension Railway Company for—*

A reconnaissance survey for a line of railway on the metre gauge from Purnea to Kissenganj, a distance of about 36 miles.

**EAST INDIAN RAILWAY.**

Accidents.

At Kusunda Station on the East Indian Railway on the 15th November 1920, as the result of carelessness on the part of the shunting staff, 19 empty wagons collided with the No. 5 Up Passenger. One railway servant and four passengers received slight injuries.

At Bansjora Station on the East Indian Railways on the 27th November 1920, due to the parting of the couplings, a part of a load (54 wagons) collided with 12 loaded wagons.

There was considerable damage to rolling stock and the driver of one of the trains was slightly injured.

**BENGAL NAGPUR RAILWAY.**

At mile 185.15 between Bara Bamboo and Amda Stations, the Bombay Mail was derailed on the 8th September 1920, due to a sag on the road combined with excessive speed.

There was some damage to rolling stock and four persons were killed and seven injured.

The programme showing the new lines in order of urgency is given as Appendix C.

## IRRIGATION AND NAVIGATION.

The transactions of the Irrigation Branch of the Public Works Department for the year 1920-21 relating to works of Irrigation and Navigation, are shown in the table below. Works which afford protection from flood or which facilitate drainage are reviewed separately and are not noticed in this report.

## CAPITAL ACCOUNTS.

Holds.	Amount of construction estimate.	Expenditure during 1920-1921.	Expenditure to end of 1920-1921.	Balance for expenditure from 1st April 1921.
1	2	3	4	5
<b>Major Irrigation Works—</b>				
<b>Productive Irrigation Works—</b>				
Direct charges ... ..	5,26,78,595	7,511	5,24,37,617	2,38,978
Indirect charges ... ..	18,25,735	242	15,31,363	—5,628
Total ... ..	5,42,02,330	7,753	5,39,68,980	2,33,350
<b>Protective Irrigation Works—</b>				
Direct charges ... ..	87,19,061	84,658	83,94,904	3,24,157
Indirect charges ... ..	2,25,222	3,795	2,38,093	—12,871
Total ... ..	89,44,283	88,453	86,32,997	3,11,286
<b>Minor Works and Navigation—</b>				
Direct charges ... ..	...	...	...	...
Indirect charges ... ..	...	...	...	...
Total ... ..	...	...	...	...

## REVENUE ACCOUNT.

Holds.	Receipts.	Working expenses.			Net Revenue.
		Direct.	Indirect.	Total working expenses.	
1	2	3	4	5	6
<b>Major Irrigation—</b>					
Works (a) ... ..	30,28,579	18,42,691	1,33,604	17,76,295	12,52,284
<b>Minor Works and Navigation—</b>					
Works for which only Revenue Accounts are kept ... ..	7,050	30,634	1,605	32,239	—25,189
Works for which neither Capital nor Revenue Accounts are kept (b) ... ..	5,572	4,600	...	4,600	1,072

(a) Inclusive of the Dhaka and the Tribeni Canals.

(b) Teur and Satan Canals.

Irrigation.

2. The following statements show the areas irrigated during the year compared with the average of the triennial period ending with March 1920 :—

## MAJOR WORKS (PRODUCTIVE).

	Orissa Canals.			Son Canals.			Total.		
	<i>Kharif</i> inclusive of hot weather	<i>Rabi</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi</i>	Total.	<i>Kharif</i> inclusive of hot weather	<i>Rabi</i>	Total.
1	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1917-20.	275,755	8,448	282,203	464,189	110,203	574,392	738,944	116,651	855,595
For 1920-21	283,040	(a) 9,044	292,084	493,456	(b) 139,373	632,727	776,405	(c) 143,316	924,911

(a) Season lease.

(b) Includes long lease 19,544 acres and season lease 119,728 acres.

(c) Includes long lease 19,544 acres and season lease 128,772 acres.

NOTE.—All collections for season leases (*rabi*) are made in the following year (1921-22) but those for long leases are made during the year (1920-21).

## MAJOR WORKS (PRODUCTIVE).

	Tribeni Canal.			Dhaka Canal.			Total.		
	<i>Kharif</i> inclusive of hot weather.	<i>Rabi</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi</i>	Total.	<i>Kharif</i> inclusive of hot weather.	<i>Rabi</i>	Total.
1	2	3	4	5	6	7	8	9	10
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Average of the Triennium 1917-20.	65,945	20	65,945	8,737	914	9,711	74,742	914	75,656
For 1920-21	92,056	178	92,234	7,298	(a) 800	8,098	99,354	978	100,332

(a) Includes season lease 787 acres.

## MINOR WORKS.

	Saran Canals.			Teur Canal.			Total.		
	Kharif inclusive of hot weather.	Rabi.	Total.	Kharif inclusive of hot weather.	Rabi.	Total.	Kharif inclusive of hot weather.	Rabi.	Total.
1	3	3	4	5	6	7	8	9	10
Average of the Triennium 1917-20.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
	Canals closed.	...	...	2,174	101	2,278	2,174	101	2,278
For 1920-21	...	Ditto.	...	1,807	(a) 227	2,034	1,807	(a) 327	2,134

(a) Season lease.

\* Includes the Madhuban zamindar's zirat land.

† Includes 150 acres of the Madhuban zamindar's zirat land.

NOTE.—All collections for season lease (Rabi) are made in the following year 1921-1922 and those for long lease are made during 1920-1921.

3. The length of canals and distributaries in operation during the year 1920-21 compared with the previous year is as follows:—

	Orissa Canals.		Son Canals.		Tribeni Canal.		Dhaka Canal.		Teur Canal.		*Saran Canals.	
	1919-20.	1920-21.	1919-20.	1920-21.	1919-20.	1920-21.	1919-20.	1920-21.	1919-20.	1920-21.	1919-20.	1920-21.
1	2	3	4	5	6	7	8	9	10	11	12	13
Main canals (Irrigation).	Miles. 224½	Miles. 224½	Miles. 208½	Miles. (b) 206½	Miles. 61½	Miles. 61½	Miles. 3½	Miles. 3½	Miles. 6½	Miles. 6½		
Branch canals (Irrigation).	103	103	148½	148½	...	...	15½	15½	...	...		
Distributaries	1,294½	1,294½	1,234½	1,234½	164½	173½	23½	32½	6½	6½		
Of above—Navigation Channel.	206½	206½	199½	(a) 199½	...	...	...	...	...	...		

\* Canals closed since the 1st April 1894.

(a) Nine miles of the canals between the Regulator and Bedadi lock have been closed to navigation from 24th July 1919.

(b) Includes 9 miles of the Main Western Canal from Dehri to Regulator where no irrigation takes place.

## Navigation.

4. The following statement shows the traffic on the Navigable Canals during the year 1920-1921 compared with the average triennium 1917-20:—

	Orissa Canals.		Son Canals.		Orissa Coast Canal.	
	Average for the triennium ending with March 1920.	For the year 1920-21.	Average for the triennium ending with March 1920.	For the year 1920-21.	Average for the triennium ending with March 1920.	For the year 1920-21.
1	2	3	4	5	6	7
Length of canals open ...	Miles. 204½	Miles. 205½	Miles. 209	Miles. 199½	Miles. 95½	Miles. 95½
Receipts ...	Rs. 67,441	Rs. 49,177	Rs. 23,333	Rs. 19,072	Rs. 5,519	Rs. 6,184
Tonnage of boats by canal measurement.	Tons. 421,041	Tons. 351,288	Tons. 62,821	Tons. 40,831	Tons. 62,033	Tons. 3,410
Estimated weight of cargo exclusive of rafts.	Rs. 141,120	Rs. 99,298	Rs. 19,403	Rs. 33,929	Rs. 11,105	Rs. 13,366
Estimated value of goods	Rs. 1,07,98,726	Rs. 1,20,06,590	Rs. 15,57,543	Rs. 18,64,381	Rs. 7,45,181	Rs. 12,99,867
Estimated value of rafts...	Rs. 2,20,271	Rs. 2,49,404	Rs. 3,22,100	Rs. 3,63,372	Rs. 19,916	Rs. 23,150

5. The classification of works dealt with in this review is as follows:—

(i) *Major Works*.—Of the four Major Irrigation Works in this Province two, *viz.*, the Orissa and Son Canals are classed as Productive and the other two, *viz.*, the Tribeni and Dhaka Canals, are Protective Irrigation Works.

(a) The Orissa and the Son Canals were originally constructed from funds under the Imperial head "49-Irrigation," and were classed as "Productive", as it was expected that the net revenue derived from them would repay the annual interest on the capital invested. The expectation has never been realized in the case of the Orissa Canals system. The Son system is, however, now paying a five per cent. interest. Further capital outlay on both these systems is now being incurred under the divided head "43-Minor Works and Navigation" and their Revenue Account is kept under the head "42-Major Works—Working Expenses" which is also a divided head. These canals are utilized both for irrigation and navigation.

(b) The Tribeni and Dhaka Canals which have been constructed from funds under the Imperial head "35" though not directly remunerative are calculated to guard against a probable future expenditure in relief during famine of the population of the tract of country served. The Tribeni Canal is almost complete, some village channels yet remaining.

The additional works outside the construction estimate, which were approved by the Government of India in 1916 and which provide additional drainage facilities across the canal to enable it to withstand without damage the ordinary high floods which in one part of the tract or another occur almost annually, have been completed. The cost of these extra works is being charged to the head "35" under the Open Capital Account rules.

These canals are used for irrigation only.

(ii) *Minor Works and Navigation*.—There are three canal systems under this class;—

(a) *Orissa Coast Canal*.—No Capital Account is now kept; the cost of maintaining the canal is charged to the sub-head "works for which only Revenue accounts are kept." The canal (95½ miles within this Province) is used for navigation only.

(b) *Teur (Madhuban) Canal*.—Neither Capital nor Revenue Accounts are kept of this canal. It is a small work intended for irrigation only.

(c) *Saran Canals*.—These canals have been classified as works for which neither Capital nor Revenue Accounts are kept. They are now maintained at the cost of two large concerns in the Saran District, the managers having agreed to pay annually Rs. 500 each towards their maintenance.

The progress of the year for the works under each of the above heads is briefly stated in the following summary compiled by Circles of Superintendence:—

### ORISSA CIRCLE.

#### MAJOR IRRIGATION WORKS (PRODUCTIVE).

##### ORISSA CANALS.

6. The expenditure (direct charges) debited to the Capital Account of the Orissa Canals during the year was Rs. 7,511 only. Capital Account.

The works chargeable to the Capital Account which were in progress during the year were two minor distributaries one at Solanpur from 21st chain of the 1st mile of No. 2-A Distributary of the High Level Canal Range III and the other at Sendpur at the 22nd mile 3,026 feet of the High Level Canal Range I. Proposals for diverting the Taldanda Canal at the 51st mile and the Machgaon Canal at the 7th mile which were damaged by floods are under consideration. Works in progress.

7. The total expenditure on new works chargeable to the Revenue Account amounted to Rs. 14,663 against Rs. 5,042 in the previous year. No work of any importance was undertaken and the expenditure was incurred mainly on certain small minor distributaries, office buildings and residences. Revenue Account.  
Extensions and  
Improvements.

The expenditure amounted to Rs. 2,87,479 against Rs. 1,86,603 in the previous year. The head works, main canals with their distributaries, drainage and protective works were maintained in a fair order. The increased cost was due to the closing of a large number of breaches in the canal banks and for making good the extensive damages caused to Brahmini, Baitarani and Burrah weirs by the floods of August-1920. Maintenance and  
Repairs.

8. The length of the distributaries remained unchanged during the year. Length of distributaries.

9. Owing to the removal of the Pipli Subdivision from Pipli to Puri under the new name Puri Subdivision, no record of rainfall was kept at Pipli during the year. Rainfall was therefore recorded at 12 stations during the year instead of 13 stations as previously done. The average rainfall during the year at these 12 recording stations was 57.63 against the average of 58.72 for the previous 51 years. The rainfall of the year was fairly well distributed during the *Kharif* season and was favourable to the rice crop both on the irrigated and unirrigated areas but owing to the scanty falls in November the *rabi* crop suffered to some extent but still the outturn was satisfactory in the flood affected areas. Rainfall.

10. The area irrigated was 292,084 acres against 289,835 acres in 1919-1920. The increase is due to the areas having come under lease during the year. The total assessment for water rates on the area irrigated was Rs 5,18,882 against Rs. 4,96,933 in 1919-1920. The outstanding balance of the net demand was practically *nil* at the end of the year. The increase is due to increase in water-rates and partly to the increase in area leased. Irrigation.



## Navigation.

11. The receipts from navigation tolls on the Orissa Canals amounted to Rs. 49,177 against Rs. 58,896 in the preceding year. The falling off in receipts is due to less traffic on account of continued dearness of food and partly to temporary closure of canals damaged by floods and consequent irregular steamer traffic.

## Financial results.

12. The revenue and working expenses (direct and indirect) were Rs. 6,17,075 and Rs. 6,79,901 respectively against Rs. 5,95,604 and Rs. 4,97,092 of the previous year. Thus the excess expenditure which came to Rs. 62,826 was 0.23 on the capital outlay.

## Canal closure.

13. The canals were closed for annual repairs for the number of days noted below:—

Name of Canal	Period of closure.
1	2
Taldanda	51 days
Machgaon	51 "
Kendrapara and Kendrapara Extension	37 "
Gobri, Gobri Extension	37 "
Pattamundi	37 "
High Level Canal, Range I	38 "
High Level Canal, Range II	68 "
High Level Canal, Range III	67 "
Jajpur	62 "

## Floods.

14. There were no storms during the year nor any earthquake. The floods during the year were rather abnormal in almost all the rivers.

The contour survey of the Kushthadra and Bhargovi doab was completed and the contour survey of the doabs of the coast districts of Orissa was taken up during the year.

## Survey of Irrigation projects

15. Preliminary surveys in connection with the Banli and Derjang Tank Irrigation projects in the Angul district were in progress.

## MINOR WORKS AND NAVIGATION.

## ORISSA COAST CANAL.

16. The canal (95½ miles in this Province) was maintained in fair order and was open to traffic throughout the year. The first twelve miles of Range V was closed for a few days for the construction of a bridge on the canal at the crossing of the Chandipur road.

No new works were carried out. The total cost of maintenance (direct and indirect) amounted to Rs. 32,239 against Rs. 27,403 of the previous year. This was mainly for some flood damage repairs to the canal and special repairs to the Locks.

The gross receipts were Rs. 7,050. Export through the canal increased on account of good crop during the year. The rainfall of the year was favourable and fairly well distributed.

**SON CIRCLE.**  
**MAJOR IRRIGATION WORKS (PRODUCTIVE).**  
**SON CANALS.**

17. The total capital outlay (direct charges) on the system up to end of 1920-21 was Rs. 2,59,64,386. No expenditure was incurred during the year 1920-21. Capital Account.

18. The total expenditure during the year on extensions and improvements amounted to Rs. 14,343 and was incurred mostly on quarters for the Revenue Staff. Revenue Account.  
Extensions and  
Improvements.

The annual repairs to the canals and head works were carried out during the year at a total expenditure of Rs. 2,61,937 against Rs. 2,57,152 in the previous year. Maintenance and  
repairs.

19. The average rainfall of the 12 stations in the three Divisions was 37.75 inches compared with the average of 47.92 inches and 39.92 inches in 1919-20 and 1918-19 and an average of 39.62 of the previous 38 years. The rainfall during the year was below the average. Rainfall.

20. The area irrigated during the year was 632,727 acres against 557,238 acres of the preceding year and was much larger during the year under review in comparison with the average of the last five years. This is due to improvement in the long lease and heavy *rabi* irrigation consequent upon the failure of the rains in October. Irrigation.

The total assessment for water-rates amounted to Rs. 20,49,587 of which Rs. 20,20,209 were realized during the year. The balance uncollected during the year was unusually heavy owing to the introduction of a new system of collection of water-rates at certain tahsil centres where rate-payers are required to come and pay on fixed dates the amount due under the direct supervision of the Deputy Collector and the Revenue Assistant.

21. The receipts from navigation amounted to Rs. 19,072 against Rs. 18,958 of the previous year and an average of Rs. 21,228 of the preceding five years. Navigation  
receipts.

22. The gross receipts and working expenses (direct and indirect) were respectively Rs. 21,39,344 and Rs. 9,10,542 against Rs. 22,20,709 and Rs. 8,71,993 of the previous year. The net receipts after deducting working expenses amounted to Rs. 12,28,802 which was 4.57 per cent. on the capital outlay and after meeting the interest charges of the year (Rs. 8,63,611) a balance of Rs. 3,65,191 was left against the accumulated arrears of interest amounting to Rs. 1,93,23,872. Financial results.

23. There was no canal closure for annual repairs during the year. Canal Closure.

24. There were altogether four floods in the Son river during the year; the 2nd and the 4th floods were practically a continuation of the 1st and the 3rd floods respectively. The duration was comparatively long as all the floods, which came in quick succession, lasted for about a month. Floods.

25. Soundings were taken daily during the rains in the first quarter mile of the Main Western Canal. In the first five miles of the canal soundings were taken every 10th day throughout the season. The Main Western Canal was flushed for the removal of silt from the 17th September to 2nd October 1920 and about one lakh c.ft. of silt was removed. Finishing opera-  
tions.

**MINOR WORKS AND NAVIGATION FOR WHICH NEITHER CAPITAL  
 NOR REVENUE ACCOUNTS ARE KEPT.**

26. The survey works in connection with the possible reservoir sites in the Butana valley in the Palamau district were completed during the year. An estimate amounting to Rs. 8,05,000 for the construction of a reservoir at the upper site of the Butana river for increasing the water supply of the Son, which has been submitted by the Superintending Engineer, Son Circle, is under consideration. Some minor surveys in connection with the Sakri river in the Gaya district were carried out during the year under review. Investigation in  
connection with  
possible irrigation  
schemes.

A small expenditure of Rs. 165 was incurred in connection with survey of the project known as "Suara and Kuara" project in the Bhabua Sub-division of the Shahabad district. A tract of 600 square miles roughly will come under irrigation if the project is carried out. The matter is still under consideration.

Tributaries of the Son.

Further investigation in connection with the tributaries of the river Son in the district of Palamau is proceeding.

## GANDAK CIRCLE.

### MAJOR IRRIGATION WORKS (PROTECTIVE)

#### TRIBENI CANAL.

**Capital Account.** 27. Works included in the Schedule of incomplete works chargeable to the construction estimate of the project and other works subsequently sanctioned as chargeable to the open capital account are in progress, the total expenditure, (direct and indirect) debited to the capital account amounted to Rs. 88,453.

**Works completed.** The construction of the two superpassages over the Lauriya distributary in connection with the Bela Babu's syphon and the Rangi distributary was completed during the year under report.

**Works in progress.** The construction of the spill syphon at 48 mile 3,512 feet of the canal was still in progress when the year closed.

The following works were in progress :--

- (1) Dhobaha village channel.
- (2) Trilokowa " "
- (3) Bikrampur " "
- (4) Lachmipur " "
- (5) Dhobaha Bazar village channel.

The scheme for constructing a boulder barage across the Gandak river was dropped owing to financial difficulties.

**Revenue Account Extensions and Improvements Maintenance and repairs.** 28. A sum of Rs. 7,725 was spent on extensions and improvements. The cost of ordinary maintenance of the canal including silt clearance, cutting of jungle, construction of a bell-bandh amounted to Rs. 58,322 during the year.

**Distributaries, Village channels and drainage channels.** 29. The construction of the Rangi distributary at the tail end of the canal, which was in progress from the previous year, was completed during the year under report.

Five projects for village channels were sanctioned and were in progress during the year. Besides these several other private channels were under construction or being repaired by the parties concerned.

**Rainfall.** 30. The rainfall during the latter part of the *kharif* season was considerably below the normal and consequently there was a heavy demand for canal water. The total rainfall of the year was 55.42 inches at Ramnagar and 58.76 inches at Maniari Subdivision against 56.70 and 50.51 inches respectively in the previous year.

**Floods.** 31. The floods in the river Gandak were normal. The highest flood level rose to 969.30 against 969.80 in the previous year. There were no high floods in any of the rivers intersected by the canal during the year under report. Owing to insufficient rainfall at the latter part of the *kharif* season, there was a very heavy demand for canal water which was met with great difficulty. The trouble experienced was partly due to the rapid fall of the river but mainly to want of village channels in the canal system.

**Irrigation.** 32. The total area irrigated was 92,234 acres against 81,581 acres of the preceding year and an average of 65,705 acres of the previous three years.

33. The total working expenses (direct and indirect charges) amounted to Rs. 1,61,073 while the gross receipts were Rs. 2,17,533 against Rs. 1,73,65 of the previous year. Thus the net revenue which came to Rs. 86,460 was 1.07 of the capital outlay. Financial Results.

As soon as the construction of Government and private village channels is completed and better control over the distribution of water obtained thereby an extension of irrigation will be possible, bringing in increased revenue to Government and benefit to the cultivators. But until these channels are completed conditions will not improve.

34. The project for the proposed extension of the Tribeni Canal was dropped. Tribeni Canal extension scheme.

#### DHAKA CANAL.

35. There was no capital expenditure on the canal during the year under report. Capital Account.

36. No new works were undertaken during the year.

A sum of Rs. 11,026 was spent on ordinary maintenance.

37. The total rainfall of the year was 54.37 inches against 48.13 of the previous year and against the average of 55.45 inches for the last 15 years. The supply of water during the hot weather failed owing to the failure of the river Lalbakia. There was sufficient water during *rabi*, but the demand was very little owing to favourable rainfall at the end of January. Revenue Account Extensions and Improvements.  
Maintenance and repairs.  
Rainfall.

38. There was a considerable decrease in the area that came under irrigation during the year. The total area irrigated was 8,098 acres against 13,118 acres of the preceding year and against the average of 9,711 acres for the last three years. The reasons for the decrease were failure of the river Lalbakia during the hot weather, increase of water-rate and favourable rainfall during the transplantation period. Irrigation.

39. The gross receipts and working expenses of the year amounted to Rs. 24,627 and Rs. 24,779, respectively, against Rs. 26,145 and Rs. 18,526, respectively, of the previous year and thus there was a net loss of Rs. 152 to Government. The decrease in revenue was partly due to the increased water-rates, which came into force during the year. Financial Results.

#### MINOR WORKS AND NAVIGATION—WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

##### TEUR (MADHUBAN) CANAL.

40. This small canal was maintained in good order and only the necessary repairs to the regulators, bridges and bungalows were carried out at a total cost of Rs. 2,111 (excluding establishment charges).

The rainfall of the year was 58.61 against 37.41 of the previous year. The supply of water in the river was sufficient to meet the demand.

The total area irrigated during the year was 2,134 acres against 3,107 acres of the previous year. The total receipts of the year amounted to Rs. 5,550. The decrease is due to the same reasons as explained in case of the Dhaka Canal.

##### SARAN CANALS.

The canals are closed to irrigation. They were maintained at the cost of the Managers of the Maniara and Saddowa concerns. The charges for maintenance amounted to Rs. 1,022 exclusive of the cost of establishment.

##### EASTERN CIRCLE.

Some discharge observations were taken in the rivers Kiul and Anjan in the district of Moughyr in connection with the Kiul Irrigation project. Preliminary Investigations.

Ganga observations of the river Ganges at Mokameh and of the flood level in the *Tal* opposite Mokameh were continued during the year under report.

## WESTERN CIRCLE.

Further investigations in connection with the tank project at Khunti in the Singhbhum district were carried out but the scheme was dropped being financially unsound.

## HYDRO-ELECTRIC SURVEY.

Discharge observations of certain perennial hill streams were taken in connection with the Hydro-Electric Scheme. Further investigation is proceeding.



## APPENDIX A—contd.

Service Heads.	Original Works.		Repairs.		Total.	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
1	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Brought forward ..	...	...	...	...	...	3,28,458
<b>PROVINCIAL.</b>						
<b>4.—MAJOR WORKS—WORKING EXPENSES.</b>						
Works ...	1,35,606	36,731	5,60,190	6,18,764	6,95,796	6,58,495
Establishment ...	...	...	...	...	8,41,964	9,52,718
Tools and Plant ...	...	...	...	...	22,040	28,473
Refunds of Revenue ...	...	...	...	...	5,200	6,001
Suspense ...	...	...	...	...	...	38
<b>Total Major Works ...</b>	<b>1,35,606</b>	<b>36,731</b>	<b>5,60,190</b>	<b>6,18,764</b>	<b>15,65,000</b>	<b>16,42,720</b>
<b>43.—MAJOR WORKS AND NAVIGATION.</b>						
Works for which Capital and Revenue Accounts are kept.	7,904	5,517	...	...	10,954	7,521
Works for which Revenue Accounts are kept.	...	...	25,000	...	40,530	35,234
Works for which neither Capital nor Revenue Accounts are kept.	...	...	3,120	21,368	7,095	
Agricultural works for which neither Capital nor Revenue Accounts are kept.	51,680	52,681	2,65,348	2,50,295	4,15,421	3,65,345
Reserve ...	...	...	...	...	...	...
<b>Total, Minor Works and Navigation</b>	<b>59,484</b>	<b>58,198</b>	<b>2,93,468</b>	<b>2,71,663</b>	<b>4,74,000</b>	<b>4,08,100</b>
<b>45.—CIVIL WORKS.</b>						
Civil Buildings ...	30,91,152	31,68,996	5,49,799	5,42,467	37,40,951	41,11,463
Communications ...	2,37,988	1,24,610	7,05,102	6,67,870	9,43,090	7,92,480
Miscellaneous Public Improvement	4,33,973	2,74,664	4,9,930	37,175	4,82,908	3,11,829
Establishment ...	...	...	...	...	12,97,506	12,33,278
Tools and Plant ...	...	...	...	...	1,28,907	1,26,363
Suspense ...	...	...	...	...	...	—38,037
<b>Total, Civil Works ...</b>	<b>37,68,113</b>	<b>34,68,270</b>	<b>13,98,831</b>	<b>13,47,512</b>	<b>63,93,351</b>	<b>63,37,386</b>
Carried over ...	...	...	...	...	...	89,16,664

(a) Includes grants for Establishment and Tools and Plant.

APPENDIX A—*contd.*

Service Heads,	Original Works,		Repairs,		Total	
	Grants.	Outlay.	Grants.	Outlay.	Grants.	Outlay.
1	2	3	4	5	6	7
Brought forward ...	Rs. ...	Rs. ...	Rs. ...	Rs. ...	Rs. ...	Rs. 89,16,664
<b>LOCAL FUNDS.</b>						
Other Local Funds ...	...	8,39,317	...	1,23,813	...	9,66,145(a)
District Funds ...	...	...	...	...	...	59,32,554†
Total Local Funds ...	...	...	...	...	...	67,98,699
<b>CONTRIBUTION.</b>						
Imperial ... { Military ...	...	...	...	...	...	...
Imperial ... { Civil ...	...	...	...	...	...	...
Provincial ... { Civil Buildings ...	...	2,58,001	...	21,649	...	3,23,523*
Provincial ... { Irrigation ...	...	...	...	...	...	...
Minor Works and Navigation ...	...	1,143	...	811	...	2,225*
Total Contribution ...	...	2,59,144	...	22,451	...	3,26,148
Grand Total ...	...	...	...	...	...	1,60,41,511

\*Includes charge for Establishment and Tools and Plant.

† Includes Rs. 9,09,778 for Establishment and Rs. 1,27,147 for Tools and Plant.

(a) Includes Rs. 2,53,668 for Establishment and Tools and Plant.



## APPENDIX B.

Statement showing the length of road communication, excluding village roads, maintained by the public authorities in Bihar and Orissa during the year 1920-21.

[This statement does not include roads and street within Municipal limits, and maintained from Municipal Funds.]

Name of Division.	Name of District.	Length in miles of metalled roads maintained by the Public Works Department.	Length in miles of unmetalled roads maintained by the Public Works Department.	Length in miles of metalled roads maintained by Local authorities.	Length in miles of unmetalled roads maintained by Local authorities.	Total of metalled roads.	Total of unmetalled roads.	Grand Total.
1	2	3	4	5	6	7	8	9
Patna	Patna	48	...	157	455	205	455	660
	Gaya	67	...	209	734	269	734	1,003
	Shahabad	58	...	198	458	256	453	714
Tirhut	Saran	...	...	261	827	201	827	1,083
	Champanah	...	...	37	1,176	38	1,176	1,214
	Muzaffarpur	...	...	162	1,179	162	1,180	1,342
	Darbhanga	...	...	69	1,175	69	1,177	1,246
	Bhagalpur	...	...	101	1,716	101	1,716	1,817
Bhagalpur	Monghyr	...	...	151	1,347	151	1,317	1,468
	Purnea	...	...	159	1,548	159	1,548	1,707
	Santal Parganas	...	...	48	835	48	835	883
Orissa	Cuttack	78	...	133	412	210	412	622
	Puri	118	...	128	122	244	122	366
	Bal asore	104	2	68	463	172	462	634
	Angul	51	17	...	...	51	77	128
	Sambalpur	100	21	4	164	104	165	269
	Orissa Feudatory States	47	53	...	...	47	53	100
	Ranchi	151	72	14	704	165	776	941
Chota Nagpur	Palamur	...	8	18	507	18	510	528
	Hazaribagh	213	17	96	612	309	639	938
	Manbhum	145	...	119	648	264	649	813
	Singhbhum	84	...	...	503	64	503	567
Total		1,265	246	2,092	15,642	3,357	15,691	19,248

APPENDIX "C"

List showing in order of urgency, the new lines of Railways in Bihar and Orissa, which should take an early place in the programme of construction for the year 1922-1923.

Order of importance.	Name of Project.	Existing railway with which the project is connected at initial point.	Initial and terminal points.	Whether surveyed or not.	Gauge.	Length in miles.	Estimated cost.
1	2	3	4	5	6	7	8
<i>A.—List showing new lines urgently required for the development of the Province.</i>							
1	Ramgarh—Manoharpur, with its continuation to Hazaribagh Road through Hazaribagh.	Bengal-Nagpur Railway.	Ramgarh and Manoharpur and Hazaribagh.	Not surveyed ...	5' 6"	...	Lakhs of Rs.
2	Kapilas Road—Sambalpur Railway.	Ditto ...	Kapilas Road and Sambalpur.	.....	5' 6"	...	...
3	Mohuda—Daltonganj Railway with a siding to Hutar Coalfields.	Ditto ...	Mohuda Junction and Daltonganj.	Surveyed in 1889-1890 and 1897-1898.	5' 6"	171	1,68,00
4	Daltonganj—Jubbulpur Railway.	East Indian Railway.	A point on the Daltonganj Branch and a point on the Jubbulpur line near Katni.	Not surveyed...	5' 6"	...	...
<i>B.—List showing new lines which are important but not urgent.</i>							
1	Lohardaga Extension	Bengal Nagpur Railway.	Lohardaga and Longa	Surveyed in 1916-1917.	2' 6"	25	10,20,00
2	Sambalpur—Sonpur-Saintela.	Ditto ...	Sambalpur and Sonpur and Saintela.	Surveyed in 1891-1892 and 1897-1898.	5' 6"	238	267 62
3	Ramgarh Gola—Jhalda Railway with the broadening of the present narrow gauge between Jhalda and Puruha.	Ditto ...	Ramgarh Gola and Jhalda.	Not surveyed ...	5' 6"	...	...
4	Hazaribagh Road—Hazaribagh Railway.	East Indian Railway.	Hazaribagh Road and Hazaribagh.	Surveyed in 1914.	2' 6"	41	14 58
5	Bhadrak—Chandbali Railway.	Bengal-Nagpur Railway.	Bhadrak and Chandbali.	Surveyed in 1915.	5' 6"	29	25 55
<i>C.—List showing subsidiary and feeder lines of local importance.</i>							
1	Gaya—Sherghati Railway.	East Indian Railway.	Gaya and Sherghati	Surveyed in 1912.	5' 6"	22	12 80
2	Thakurgaon—Purnea Railway.	Eastern Bengal Railway.	Thakurgaon in the projected Siliguri-Kishanganj line and Purnea.	Not surveyed ...	3' 3½"	...	...
3	Bausi—Baidyanath Railway.	East Indian Railway.	Bausi and Baidyanath or Deoghar.	Surveyed in 1899.	5' 6"	44	32 35
4	Bhagalpur—Nalhati (or Ahmadpur) Railway.	Ditto ...	Bhagalpur hand Nalhati or Ahmadpur.	Surveyed in 1895-1896.	5' 6"	...	...
5	Laheria Sarai, Singha—Shakarpur Extension.	Bengal and North-Western Railway.	Laheria Sarai and Stakarpura.	.....	3' 3½"	...	...
6	Muzaffarpur—Darbhanga Railway.	Ditto ...	Muzaffarpur and Darbhanga.	Surveyed in 1906-1907.	3' 3½"	38	32 70
7	Tewara—Sitamarhi Railway.	Ditto ...	Tewara and Sitamarhi.	Ditto ...	3' 3½"	30	16 53

Order of importance.	Name of Project.	Existing railway with which the project is connected at initial point.	Initial and terminal points.	Whether surveyed or not.	Gauge.	Length in miles.	Estimated cost.
1	2	3	4	5	6	7	8
							Lakhs of Rs.
<i>C.—List showing subsidiary and feeder lines of local importance—concl'd.</i>							
8	Kendrapara—Cuttack Railway.	Bengal-Nagpur Railway.	Kendrapara and Cuttack.	Not surveyed ...	5' 6"	...	...
9	Jajpur—Cuttack Railway.	Ditto ...	Jajpur and Cuttack	Ditto ...	5' 6"	...	...
10	Monghyr—Sagrampur <i>via</i> Khargpur Railway.	East Indian Railway.	Monghyr and Sagrampur.	Not surveyed ...	5' 6"	...	...
11	Bhaptiahi—Bhimnagar Railway.	Bengal and North-Western Railway.	Bhaptiahi and Bhimnagar.	Ditto ...	3' 3½"	28	16,80
12	Kursela—Forbesganj <i>via</i> Damdaha and Raniganj.	Ditto ...	Kursela and Forbesganj.	Ditto ...	2' 0"	85	39,40
13	Mashrak—Thawe Extension <i>via</i> Rajabatti, Barauli and Gopalganj.	Ditto ...	Mashrak and Thawe	Ditto ...	...	...	...
14	Maharajganj—Darauli Thana Extension.	Ditto ...	Maharajganj and Darauli Thana.	Ditto ...	...	...	...
15	Savan through Darauli Thana to Manjhi.	Ditto ...	Savan and Manjhi...	Ditto ...	...	...	...
16	Muzaffarpur—Sitamarhi.	Ditto ...	Muzaffarpur and Sitamarhi.	Ditto ...	...	35	...
17	Motipur or Mehsi to Sahebganj.	Ditto ...	Motipur or Mehsi and Sahebganj.	Ditto ...	...	...	...
18	Hajipur through Malwa or Tajpur to Wani (Pusa Road).	Ditto ...	Hajipur or Tajpur and Wani.	Ditto ...	...	...	...
19	Sitamarhi—Sonbursa.	Ditto ...	Sitamarhi and Sonbursa.	Ditto ...	...	...	...
20	Dhang to Motipur or Kanti.	Ditto ...	Dhang and Motipur or Kanti.	Ditto ...	...	...	...
21	Sugauli Junction to Govindganj.	Ditto ...	Sugauli Junction and Govindganj.	Ditto ...	...	...	...

W. S. BREMNER,

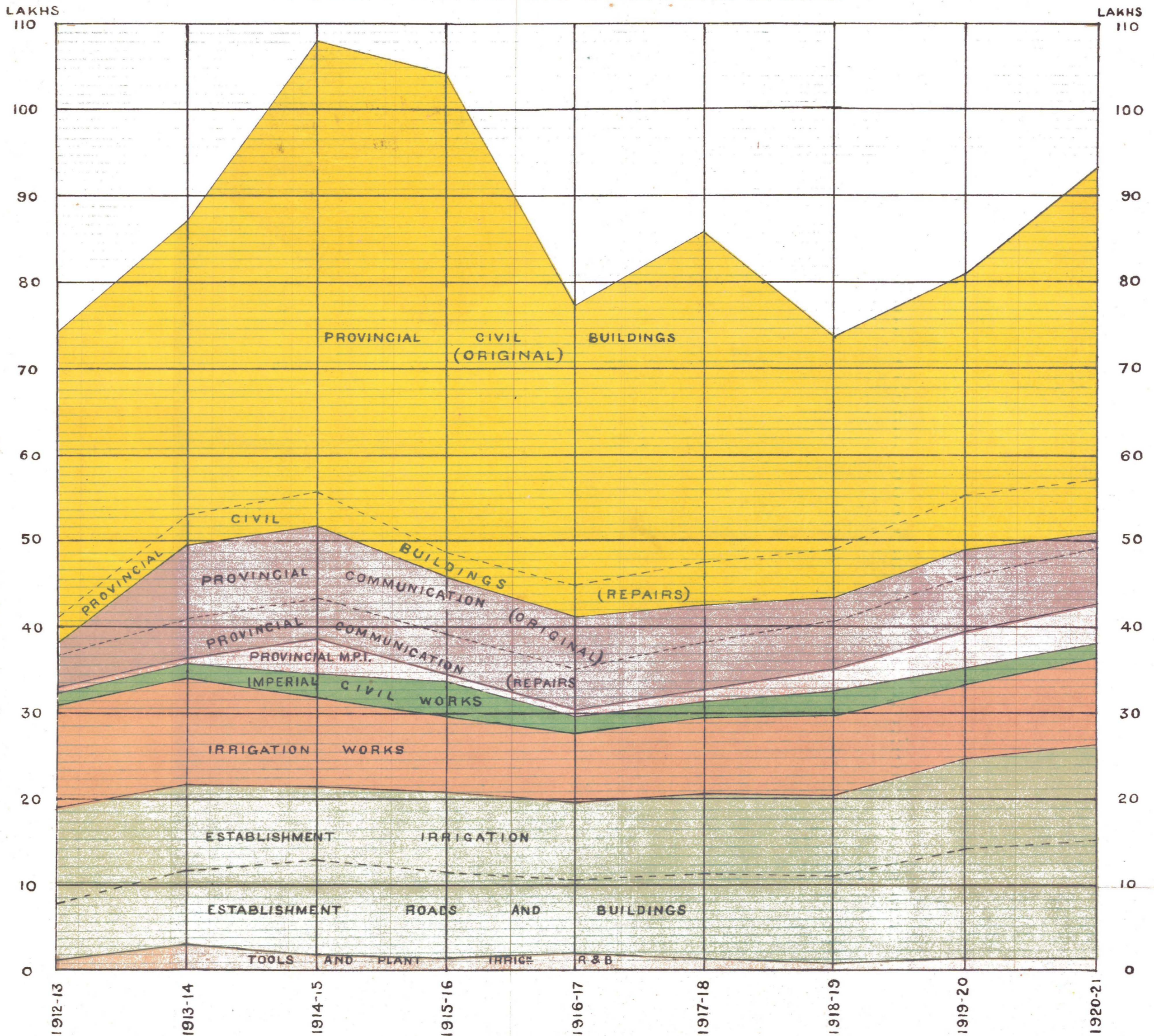
Secretary to Government, Public Works Department

RANCHI:

The 22nd June 1921.



# DIAGRAM SHOWING YEARLY PUBLIC WORKS EXPENDITURE (IN LAKHS)





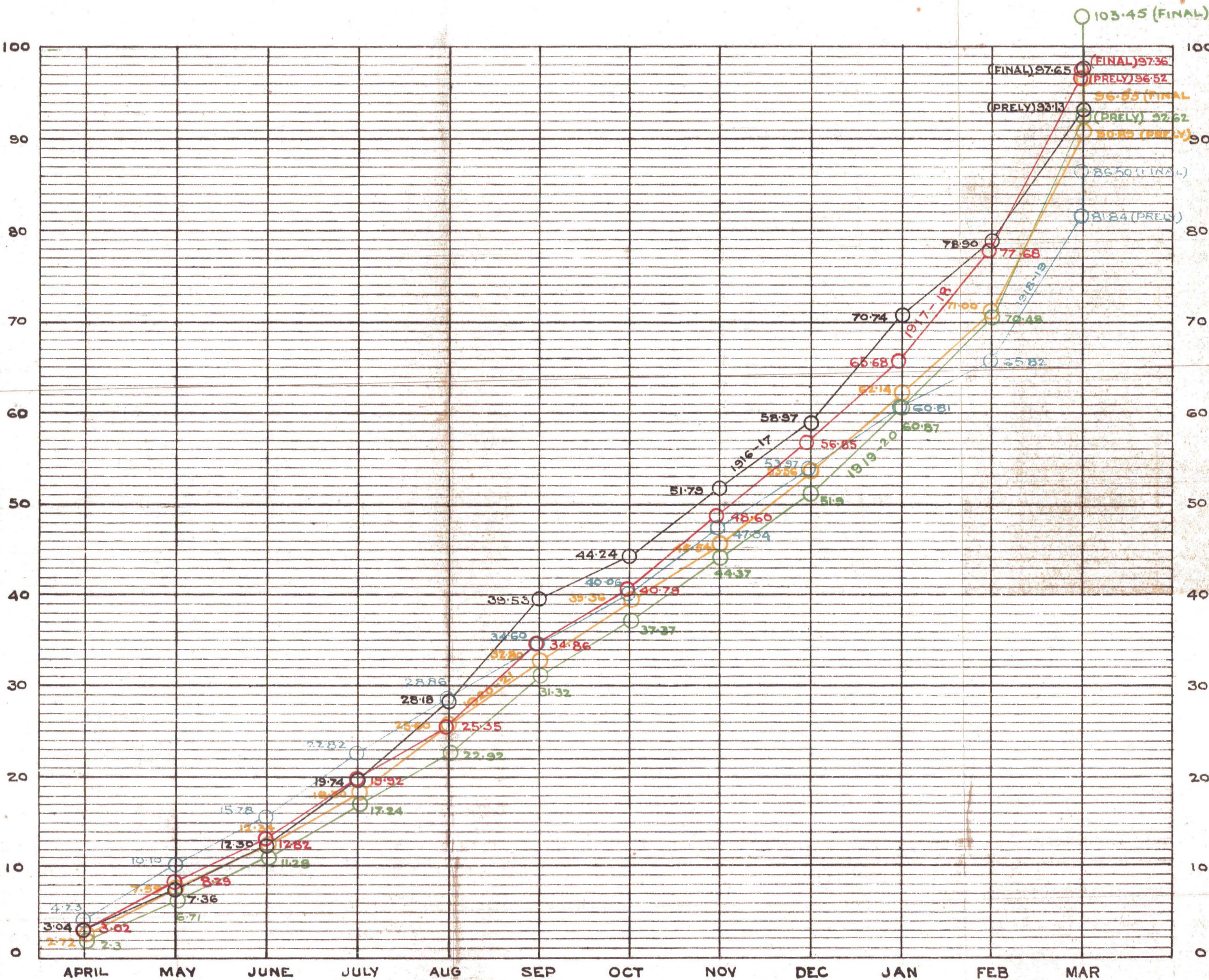
# P. W. D.

## BIHAR & ORISSA

### CURVES SHOWING MONTHLY PERCENTAGE EXPENDITURE UNDER ALL MAJOR HEADS IN THE ROADS & BUILDINGS BRANCH (INCLUDING ESTABLISHMENT, TOOLS & PLANT & SUSPENSE)

PERCENTAGE. 100

100 PERCENTAGE.



REFERENCE  
 1916-17 ———  
 1917-18 ———  
 1918-19 ———  
 1919-20 ———  
 1920-21 ———

Zincographed in the B & O D. O. Gulzarbagh