

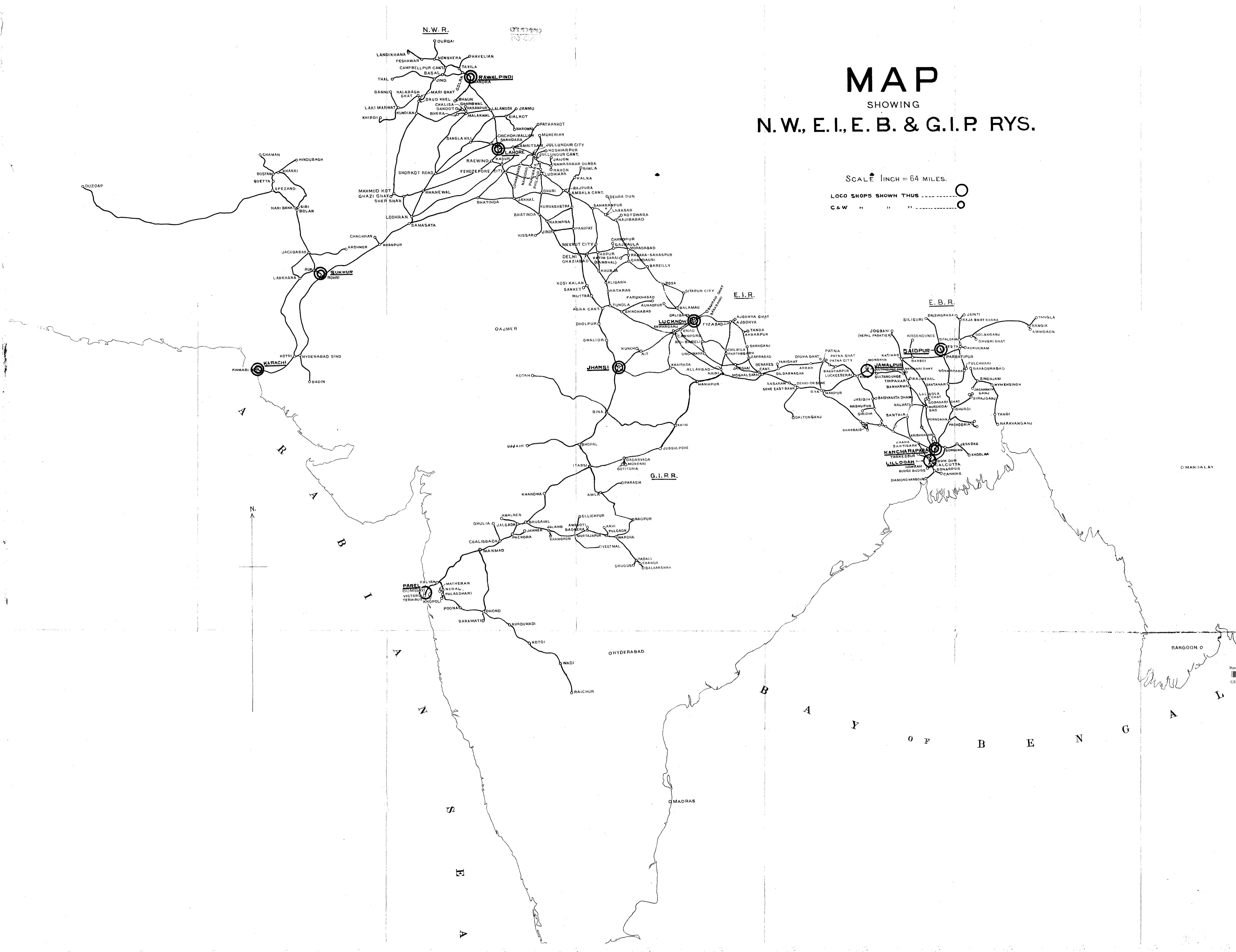


# MAP

SHOWING  
N.W., E.I., E.B. & G.I.P. RYS.

SCALE 1 INCH = 64 MILES.

LOCO SHOPS SHOWN THUS   
C & W " " " " 



6409

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**REPORT**  
**OF THE**  
**STATE RAILWAYS WORKSHOPS**  
**COMMITTEE**

appointed to enquire into  
matters connected with the  
Mechanical Departments of  
the State Railways of India.

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1926

6409

## PREFACE.

Having visited the various workshops that deal with repairs to rolling stock on the State-managed Railways of India, I wish to record a few general observations that bear on the questions investigated.

The most striking features of the shops, when compared with those in England, are their size and the strength of labour they employ, in consideration of the volume of work turned out. While aware of the disabilities that have to be contended against, with respect to climatic conditions, the low efficiency of the average Indian workman, the difficulty of obtaining suitable supervising staff and the need for the provision of longer leave, I was not altogether prepared for the marked differences that exist between the Indian and the English workshops. I have attempted to bring these out in the following table, where I have shown the number

	Indian State Railways.	London and †North Eas- tern group of Railways.
Locomotives . . . . . No.	5144	7143
Coaching Vehicles (Bogies) . . . . . „	9698	20275
Goods Vehicles (4-wheelers) . . . . . „	127076	301354
Men in Locomotive Shops . . . . . „	31890	12079
Do. to carry out same volume of work as in the L. & N. E. Ry. Shops.	46000	
Area of Locomotive Shops . . . . . sq. ft.	2569266	1928370
Men in Carriage and Wagon shops . . . . . No.	34943	11795
Do. to carry out same volume of work as in the L. & N. E. Ry. Shops.	82000	
Area of Carriage and Wagon shops . . . . . sq. ft.	3498300	2460259

of locomotives, carriages and wagons repaired, the number of workmen employed, and the areas of the workshops on the State Railways in India, side by side with the corresponding figures for one of the more important groups of railways in England. It will be seen that the number of men employed and the size of the shops in India are very much in excess of those in England.

Notwithstanding this and the defective lay-out of some of the shops, owing to additions having been made from time to time, I have pleasure in stating that most of the locomotive shops compare, in many ways, favourably with those on English Railways. I cannot, however, say the same of the Carriage and Wagon shops (with the exception of the Carriage Construction Shop at Lillooah). For some reason, the same care and consideration that have been paid to the locomotive shops, do not appear to have been given to the latter, with the result that they do not compare equally favourably with those in England.

In considering the manner of co-ordinating the work of manufacture carried on in the larger shops and in making recommendations for the

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† Figures include all building of new stock.

control of such work, I have not only supported remodelling of the workshops, but have, in view of the proposed standardization of rolling stock details and the universal use of limit gauges, also suggested that the practice of manufacturing and supplying parts in common use on the Railways from one or more central sources be adopted. This will enable special machines and methods being brought into operation and will facilitate the supply of parts direct to the Central Stores of the shops in which they are required, in such condition as would involve the minimum amount of work being done at the fitting benches.

The only true way of getting the best possible results from the different shops of the Railways now combined under the direct management of the State, is by the universal adoption of a method of progressing work under an improved organisation, and by introducing uniformity of system and practice. Success in this direction is possible of achievement only if an officer working directly under the Government of India, is endowed with the necessary powers to bring into operation such of the recommendations of the State Railways Workshops Committee, as may be finally accepted. While I realise the importance of allowing the Chief Mechanical Engineer of each railway full control of his own workshops and of encouraging him to get the best results out of his workmen and the machines at his command, the need for the co-ordination of work on the different railways both with respect to repairs and to manufacture of spare parts, makes it imperative that there should exist a central responsible source of authority.

The problem in India with respect to the manufacturing shops is little different from that which had to be solved on the English Railways, when grouping was forced upon them by Act of Parliament. It was recognised that economies would arise, as a result of the opportunities offered of standardisation on Railways and of using shops in such a way as to avoid all overlapping. Each of the four groups of Railways in England were unanimous in deciding to have one Chief over all their workshops and this decision has been carried into effect. The great distances in India may perhaps prevent an identical system being adopted here, but I cannot too strongly urge that, to get the full benefit of the economy that lies in bringing the repair facilities of the several large railways together, unified control over all the workshops under one head is indispensable.

Seeing that the divisional system now in operation has entirely separated the Transportation side of the State Railways from the Mechanical and that workshops now merely occupy the position of supplying the mechanical needs of the various railways, I would suggest the advisability of placing them under the final control of a Mechanical **Engineer-in-Chief** who could carefully examine the requirements of all the State Railways. He would be in a position to compare the work done in the various railway workshops under the several Chief Mechanical Engineers and to carry out a definite policy with respect to the standardisation of manufacture and the co-ordination of repairs. He would further relieve the Agents of much work that they are now called upon to do, of which they ordinarily have little knowledge, owing to their not having been chosen from amongst Mechanical Engineers.

Thanks to the ready way in which I and my Committee have been provided with information, we have been in a position to state as clearly as possible the reasons for the recommendations that we have made, and

I take this opportunity, on behalf of my colleagues and myself of thanking the Agents, Chief Mechanical Engineers and their staff, for the very willing and valuable assistance they have afforded us in our enquiry. It is also a great pleasure for me to add my personal thanks to my colleagues for their aid in compiling this report, and for the careful way in which all our visits had been planned, which enabled us to complete our investigations with great expedition.

VINCENT L. RAVEN,

*Chairman.*

DELHI ;

*6th April, 1926.*

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## CHAPTER I.

### Introductory.

#### *Appointment of the Committee.*

1. The appointment of our Committee was intimated in the Government of India communiqué, reproduced below :—

“ The Railway Board have decided to appoint an expert committee to investigate the problem of co-ordinating the repair facilities for locomotives and rolling stock on the State-managed railways. This question has become prominent by reason of the transfer to State management of the East Indian Railway and Great Indian Peninsula Railway which has brought the major portion of the broad gauge railways in India under the direct control of the Railway Board. The continual increase in the number of vehicles and the importance of arranging for the consequent increase in outturn of the workshops in the most economical and efficient manner, make it necessary to devise schemes of workshop improvement on a co-ordinated basis with a view to economising effort and expenditure and avoiding overlapping.

The services of Sir Vincent Raven, K.B.E., J.P., M.INST. C.E., have been obtained as Chairman of this Committee. Sir Vincent was formerly Chief Mechanical Engineer of the North-Eastern Railway and has recently been elected President of the Institution of Mechanical Engineers. The other member of the Committee is Mr. J. M. D. Wrench, Chief Mechanical Engineer, Great Indian Peninsula Railway, lately officiating Director of Mechanical Engineering, Railway Board. In addition Mr. R. McChesney, Technical Assistant to the Chief Mechanical Engineer, North-Western Railway, will act as Secretary to the Committee and a qualified officer of the Accounts Department, with a special knowledge of workshop accounts, will be attached to the Committee as a financial assistant\*. The Committee will be instructed to enquire into and report on—

- (a) The capacity or otherwise of the existing workshops of State Railways to deal economically and expeditiously with the maintenance of rolling stock at the present time.
- (b) The necessity or otherwise of enlarging and extending the existing workshops, man-power and machinery with a view to the maintenance of an increased quantity of rolling stock.
- (c) The advisability of concentrating the manufacture of spare parts in one or more of the larger workshops and to relieve the repair shops of all such manufacturing processes.

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\* This was done by the appointment of Mr. KALYAN C. SRINIVASAN, M.A., F.C.S., Indian Audit and Accounts Service, Workshop Auditor, Eastern Bengal Railway.

- (d) The alternative of establishing an entirely independent workshop wherein manufacturing work could be standardised and, if necessary, such maintenance work performed as other workshops may be unable to undertake. Consideration to be given to the question of the site or locality most likely to lead to economic manufacturing costs and expeditious output.
- (e) The question of increased utilisation of Indian products in railway workshops.
- (f) Whether the manufacture of spare parts is done at rates which shew favourable comparison with the rates at which they could be obtained from outside agencies.

It is anticipated that the work of the Committee will commence early in January and it will be in a position to submit its report within four months."

#### *Conduct of the Inquiry, Touring, etc.*

2. We assembled at Bombay on the 4th January 1926, having previously issued schedules (*cf.* Annexures I and II) to all State Railways calling for certain information required in connection with the workshops administered by them, and from Bombay we also issued two Questionnaires (*cf.* Annexures III and IV)—one General and one dealing with Transportation matters.

3. During January and February we made a tour of all State Railway Mechanical Workshops (with one or two unimportant exceptions) and several running sheds. We also visited the headquarters of all four administrations (those of the East Indian Railway and the Eastern Bengal Railway being at Calcutta and those of the North-Western Railway and the Great Indian Peninsula Railway at Lahore and Bombay respectively) where we took the opportunity of taking the evidence of their Stores and Transportation Officers.

#### *Places visited.*

4. Altogether we toured some 7,500 miles and visited, for the purpose of our inquiries, and in the order named, the following workshops :—

- Parel (Locomotive),
- Matunga (Carriage and Wagon),
- Lahore (Locomotive and Carriage and Wagon),
- Rawalpindi (Locomotive and Carriage and Wagon),
- Kanchrapara (Locomotive and Carriage and Wagon),
- Saidpur (Locomotive and Carriage and Wagon, Metre Gauge),
- Jamalpur (Locomotive),
- Lillooah (Carriage and Wagon),
- Jhansi (Locomotive and Carriage and Wagon),
- Lueknow (Locomotive and Carriage and Wagon).

and the following running sheds :—

Rawalpindi,  
Asansol,  
Jhansi,  
Lucknow,  
Agra.

5. In addition, we also visited, by invitation, the following :—

The Indian Standard Wagon Company's works at Asansol,  
Messrs. Tata Iron and Steel Company's works at Jamshedpur,  
The Peninsula Locomotive Works at Tatanagar, and  
The Locomotive and Carriage shops of the Bengal-Nagpur Railway  
at Khargpur.

*Plan of Report.*

6. We have given thought to the question as to what may be the most helpful manner in which our report may be presented and decided on the following. We state first (after giving certain tables of distribution and value, etc., of rolling stock) what we saw in the various workshops and what struck us most at the time of our visit. We next examine the figures of costs we have collected and then proceed to a detailed discussion of each term of reference. We conclude with certain remarks we feel called upon to offer upon a few points of importance, outside of, but germane to the subject of our enquiry. Plans of all Locomotive and Carriage and Wagon shops are given as annexures to the Report and also a map showing the four State Railway systems.

7. TABLE I.—*Present strength of Rolling Stock—Capital value and Cost of Maintenance :—Locomotives.*

(Note :—\*Costs in thousands of rupees.)

Railway.	Authorised stock on 1st April 1925.	Total Tractive effort on 1st April 1925. Omit- ting (000).	*Annual cost of maintenance and repairs of loco- motives (1924-25).
	No.	Lbs.	Rs.
<i>Eastern Bengal—</i>			
Broad gauge . . . . .	293	5,391	} 1655
Narrow gauge . . . . .	11	40	
Metre gauge . . . . .	241	3,272	
<i>East Indian</i> . . . . .	1,349	25,866	5850
<i>Oudh and Rohilkhand</i> . . . . .	316	5,746	1799
<i>Great Indian Peninsula</i> . . . . .	1,281	29,234	8776
<i>North-Western—</i>			
Broad gauge . . . . .	1,554	34,486	} 12169
Narrow gauge . . . . .	99	1,320	
Surplus B. G. 53 N. G. 1		..	
Total . . . . .	5,144†	1,05,355	31155

† This excludes the surplus locomotives on the N. W. R.



8. TABLE II.—*Present strength of Rolling Stock.—Coaching and Goods vehicles.*

\*(Note :—Costs in thousands of rupees.)

Railway.	Coaching Vehicles.				Goods Vehicles.			
	Authorised stock on 1st April 1925.			Annual cost of maintenance and repairs of coaching vehicles 1924-25.	Authorised stock on 1st April 1925.			Annual cost of maintenance and repairs of goods vehicles 1924-25.
	Bogies.	4 Wheelers.	Total as 4 wheelers.		Bogies.	4 Wheelers.	Total as 4 wheelers.	
<i>Eastern Bengal—</i>	No.	No.	No.	Rs.*	No.	No.	No.	Rs.
B. G. . . . .	509	456	1475	961	84	8623	8791	925
N. G. . . . .		1	27		480	1684	3468	6836
M. G. . . . .	478	472	1501					
<i>East Indian</i>	1359	1380	4098	3646	274	46575	47123	6710
<i>Oudh and Rohilkhand</i>	449	758	1636	1289	71	8334	8476	1319
<i>Great Indian Peninsula.</i>	1197	1349	3743	4377	1687	19310	22684	3838
<i>North-Western</i>			5787	4,870			31844	4875
B. G. . . . .	1986	2309	491		1772	29556	1256	
N. G. . . . .								
Total . . . . .	5978	6798	18781	15623	5572	115866	127076	18141

†Charges under Abstract C-II (4)—Repairs to Plant and machinery, etc., have been equally distributed between Carriages and Wagons; and charges on account of damages and deficiencies of pooled wagons have been excluded.

‡Six-wheelers.

9. TABLE III.—*Book value of Rolling Stock and Total Cost of Maintenance and Repairs.*

\*(Note :—Costs in thousands of rupees)

Railway.	Book value on 1st April 1925 of all rolling stock.	Total annual cost of maintenance and repairs, 1924-25.	Cost of annual repairs and maintenance as percentage on capital outlay.
	*Rs.	*Rs.	Per cent.
<i>Eastern Bengal</i> . . . . .	101119	5401	5.34
<i>East Indian</i> . . . . .	318313	16206	5.09
<i>Oudh and Rohilkhand</i> . . . . .	66306	4407	6.64
<i>Great Indian Peninsula</i> . . . . .	189500	16991	8.96
<i>North-Western</i> . . . . .	274131	21914	7.99
Total . . . . .	949369	64919	6.84 per cent.

10. Tables I, II and III show the distribution of rolling stock on the State Railways and the amounts spent annually on their maintenance and repairs. It will be seen that the capital outlay on rolling stock aggregates to no less than 94 crores of rupees and that nearly 6½ crores are being spent annually in keeping this stock in proper repair. The bulk of this expenditure is incurred in mechanical workshops which form the subject of our enquiry.

11. TABLE IV.—*Present Equipment—Plant, Machinery, and Machine Tools.* — A. *Locomotive shops.*

\*(Figures in thousands of rupees).

Workshops.	Plant and Machinery.			Machine Tools.		
	Book value.	Estimated present cost (excluding machine tools.)	Cost of proposed additions in next ten years.	Book value.	Estimated present cost.	Cost of proposed additions in next ten years.
	*Rs.	*Rs.	*Rs.	*Rs.	†Rs.	*Rs.
<i>Eastern Bengal—</i>						
Kanchrapara . . . . .	442	207	1230	1713	1053	1200
Saidpur† . . . . .	239	33	1461	600	275	550
Dacca† . . . . .	150	38	50	226	84	235
<i>East Indian—</i>						
Jamalpur . . . . .	770	460	..	4800	2900	..
<i>Oudh &amp; Rohilkhand—</i>						
Lucknow . . . . .	767	103	1531	1829	1001	900
<i>Great Indian Peninsula</i>						
Parel . . . . .	1423	753	71	3328	2296	1433
Jhansi . . . . .	290	144	50	1645	777	1836
<i>North-Western—</i>						
Moghulpura . . . . .	1454	484	500	4093	1876	1000
Rawalpindi . . . . .	326	42	100	1083	230	306
Sukkur . . . . .	338	45	1000	1234	265	2000
Karachi. . . . .	287	40	600	903	213	800
Kalka . . . . .	55	9	..	228	74	55
Total all shops . . . . .	6541	2358	6593	21682	11044	10309

†Locomotive and Carriage and Wagon shops combined.

12. TABLE V.—*Present Equipment—Plant, Machinery and Machine Tools. — B. Carriage and Wagon shops.*

\*(Figures in thousands of rupees.)

Workshops.	Plant and Machinery.			Machine Tools.		
	Book value.	Estimated present cost (excluding machine Tools.)	Cost of proposed additions in next ten years.	Book value.	Estimated present cost.	Cost of proposed additions in next ten years.
	*Rs.	*Rs.	*Rs.	*Rs.	*Rs.	*Rs.
<i>Eastern Bengal—</i>						
Kanchrapara . . . . .	201	136	50	576	326	325
<i>East Indian—</i>						
Lillooah . . . . .	852	472	..	2017	1118	808
Ondal . . . . .	264	264	50	..	..	..
<i>Oudh and Rohilkhand—</i>						
Lucknow . . . . .	225	129	71	656	412	220
<i>Great Indian Peninsula—</i>						
Matunga . . . . .	1214	656	100	959	512	2040
Jhansi . . . . .	92	49	..	330	94	1738
Bhusawal . . . . .	109	62	..	61	43	50
<i>North-Western—</i>						
Moghulpura . . . . .	847	261	200	1912	855	717
Rawalpindi . . . . .	34	5	..	154	12	..
Sukkur . . . . .	62	6	..	101	5	..
Karachi . . . . .	106	34	300	228	32	463
Kalka . . . . .	1	1	..	17	13	..
Total all shops . . . . .	4007	2075	771	7011	3422	6361

13. The amounts invested in State Railways' Workshops on plant, machinery and machine tools are brought out by Tables IV and V, which show also their approximate present value and the additional outlay likely to be incurred in the next decade. We would have preferred to include in the above tables the outlay on workshop buildings but reliable figures for each individual workshop not being available, we have refrained from publishing the figures we had collected. It will be seen that approximately four crores of rupees have already been spent on the equipment of the workshops, and that nearly two and a half crores are to be spent in the course of the next ten years.

## CHAPTER II.

### General remarks on individual workshops.

14. We now offer our general observations with respect to each of the workshops we visited.

#### *North-Western Railway.*

15. The headquarters of the North-Western Railway are at Lahore which lies more or less at the centre of the system, some 750 miles from the seaport of Karachi. At Lahore, too, are situated the two main workshops (Locomotive and Carriage and Wagon) of the railway.

16. There are no other large workshops on the North-Western Railway, but small shops, both locomotive and carriage are in existence at Karachi, Sukkur and Rawlapindi.

#### *Moghulpura Locomotive Shops, Lahore.*

17. The main locomotive shops at Lahore are comparatively new. Shops have been in existence there for many years but as the site on which they were located became incapable of further extension, entirely new workshops were built in 1912 on the present site at Moghulpura opposite the main Carriage and Wagon shops.

18. The buildings are large, well lighted and ventilated and there is ample room for extension when this becomes necessary. The layout and equipment are good and have been kept fairly up-to-date.

19. The shops employ about 5,000 men. The class of labour (mostly recruited locally) is fairly good and stable.

20. Lahore locomotive shops are required to deal with about 900 locomotives mostly operating on the central sections.

21. The shops have pit capacity for 80 locomotives.

22. The shops are under the direct control of the Chief Mechanical Engineer.

23. Except in the case of the foundry and the boiler shop, no remodelling of the existing shops is contemplated in the meantime, as they are capable of executing a sufficient number of heavy repairs to allow of all engines passing through shops in a reasonable period.

24. In the locomotive stores we found that stocks of spare parts were practically non-existent. This is undoubtedly due to the fact that there is no planning and progress department in these works, with the result that the bulk of the machines that should be dealing with large repetition orders for spares are being operated spasmodically on insignificant orders. Till a proper planning and progress department is introduced and the machines economically and efficiently operated, this hand to mouth existence will continue.

25. A lack of system was noticeable in all departments. Also the workmanship was not, in our opinion, of a sufficiently high standard and in this respect there is considerable room for improvement.

26. In the erecting shop there was no scheduling of repairs and the shop was badly organised with the result that although amply big enough for the outturn required, it was extremely congested.

27. In the machine shop, the general condition of the machines was good and they were well grouped, but in very few cases was anything like full use being made of them. There was no accurate gauging of work nor were fixed tolerances being worked to. The absence of proper system and organisation for the manufacture of spare parts was particularly noticeable.

28. It was evident that considerable sums have been spent in recent years on new machinery, but notwithstanding this we noticed a large number of old and out of date machines in the wheel shop which could with advantage be replaced.

29. The boiler shop was decidedly the worst feature of the works. A suggestion to extend this shop has been put forward by the North-Western Railway and our views on this are given in a latter para. We may anticipate here, however, by stating that in our opinion, an extension would be quite unjustifiable, this in spite of the fact that we found the shop congested with boilers. Most of these were an accumulation of old boilers, many of them long past their economic life and not worth repairing.

30. Adequate inspection of finished work, or indeed inspection of any kind, was conspicuous by its absence ; this may be said to apply generally throughout the works. As has already been stated, we found the standard of efficiency generally to be distinctly low, and this was reflected in the many complaints brought to our notice of extremely bad work turned out of these shops.

31. We have, in para. 24 above, expressed the opinion that the present state of affairs has largely resulted from the want of planning, progress and inspection departments. This is no doubt due to the lack of sufficient supervising posts, but on the other hand it was apparent that in the past the shops have concentrated entirely on outturn of engines to the exclusion of everything else.

#### *Rawalpindi Locomotive Shops.*

32. Rawalpindi locomotive shops deal with most of the engines running on the sections north of Lalamusa and also with about 50 narrow gauge locomotives from the 2' 6" gauge strategic lines on the frontier. They have a pit capacity for 12 engines and about 800 men are employed.

33. The buildings, plant and equipment are old and badly laid out to deal economically with heavy repairs to locomotives.

34. We found these shops to be hopelessly congested, particularly the boiler shop. We noticed a number of heavy repairs to boilers being carried out in the open, there being insufficient room to accommodate them within the shops. We were of the opinion too that in very many cases boilers were being repaired that had passed their economic life and ought to have been scrapped.

35. The machine shop was badly laid out, the machines for the most part obsolete, and the general conduct of the shop not conducive to efficient or economical production.

36. In the smithy, in spite of the fact that there were no forging machines or drop hammers, a considerable amount of manufacturing work was being carried out. It is obvious that to do work of this nature on anvils or under steam hammers is uneconomical but we were informed by the Chief Mechanical Engineer that it was necessary to do so, as Lahore shops were not capable of supplying their requirements.

37. The shops have an iron foundry, but the volume of work is insufficient to justify its retention.

38. No planning, progressing or inspection is carried out, with the result that the work is neither economically nor expeditiously dealt with.

*Karachi and Sukkur Locomotive Shops.*

39. We did not visit the works at Karachi or Sukkur but we were informed by the Chief Mechanical Engineer that both these shops were very similar to those at Rawalpindi, being out of date and totally inadequate to deal with the heavier types of engines it is proposed to use in the future.

*Lahore Carriage and Wagon Shops, Moghulpura.*

40. Lahore Carriage and Wagon shops are in close proximity to the main Locomotive shops. Like the latter, they are new, and the buildings are, for the most part, fine modern structures, well lighted and ventilated. The plant and machinery, too, are good, although not so up-to-date as in the locomotive shops.

41. These shops deal with repairs to about 80 per cent. of the stock on the line and, in addition, build nearly all the new coaching vehicles.

42. The shops have a capacity of 350 to 400 new coaching units per annum, and employ about 5,600 men.

43. These shops are working under the same disabilities in regard to supervision, etc., as the Locomotive shops, with somewhat similar consequences. The layout, too, is not so good as it might be; for example, the lifting shop (which deals with both goods and coaching vehicles) is some considerable distance from the carriage repair shop and on the other side of the traverser. In consequence, the practice has arisen of keeping carriage bodies waiting in the lifting shop while light repairs are carried out on the bogies. If the lifting shop adjoined the body repair shop, repairs to bogies and carriage bodies could be carried on simultaneously, and this delay obviated. We will later have occasion to refer to the time taken by these shops to execute a heavy repair to a coaching vehicle, when the importance of cutting down such delays as those mentioned above will be apparent.

44. As has been said, the plant and equipment are not so up-to-date as might be expected. This we found to be particularly the case as regards lifting appliances, neither the wagon repair nor the coaching repair shops being equipped with cranes.

45. As was our experience in the locomotive shops, we found that the absence of a planning department had resulted in the disorganisation of the machine shops and smithy for efficient and economical manufacturing work.

46. As was to be expected this state of affairs was reflected in the stores, where stocks were totally inadequate.

*Rawalpindi Carriage and Wagon Shops.*

47. Our remarks regarding the locomotive shops at Rawalpindi apply with almost equal force to the carriage and wagon shops.

48. Facilities for carrying out work expeditiously and economically were practically non-existent, and we were strongly of the opinion that short of entirely remodelling these shops, any further expenditure in respect to buildings, plant or equipment could not be justified.

*East Indian Railway.*

49. The headquarters of the East Indian Railway are at Calcutta but the office of the Chief Mechanical Engineer is at Jamalpur, about 300 miles north-west of Calcutta.

50. At Jamalpur, too, are the main locomotive shops of the East Indian Railway, the main Carriage and Wagon shops being situated at Lillooah, a suburb of Calcutta.

51. There are subsidiary shops, both locomotive and carriage and wagon, at Lucknow, the old headquarters of the Oudh and Rohilkhand Railway.

*Jamalpur Locomotive Shops.*

52. The Locomotive shops at Jamalpur are the biggest in India, and so far as State Railways are concerned, the most important.

53. By reason of its geographical position, Jamalpur enjoys many natural advantages. It is conveniently situated with respect to the coal and iron fields of Bengal and the local labour employed in the shops is good and non-migratory. We will have occasion to refer to these factors again when we discuss, under our third term of reference, the advisability of concentrating the manufacture of spare parts in one of the larger work-shops.

54. The actual site of the shops, however, is not an ideal one, as expansion can only take place easily in one direction. The existing shops, too, are congested to a degree, and the buildings and equipment are old and out of date. Their remodelling has been under consideration for some time and plans for this will be discussed later in our recommendations regarding these shops.

55. The shops, as they are at present, employ over 10,000 men. They have pit accommodation for 64 locomotives.

56. In addition to ordinary locomotive repair shops, these works have a steel plant and a rolling mill.

57. A large permanent-way points and crossings shop is also included.

58. The almost universal congestion of the shops is proving a big handicap to their efficient working. We found this particularly so in the machine shops and erecting shop. The former were working very inefficiently ; many of the machines were obsolete and all were cramped and badly grouped.

59. The smithy, too, was badly congested and seemed to be doing a great deal of unnecessary work. It was equipped with no less than 165 fires.

60. In the wheel shop we found the same state of affairs. In fact, with the exception of the boiler shop and new foundry, congestion and lack of facilities generally were universal throughout the whole works.

61. The erecting shop was, in our opinion, the most unsatisfactory shop in the works, the bays being much too narrow and inadequately equipped with cranes.

62. A noticeable, and by no means satisfactory feature of the works, was the enormous amount of work which was being undertaken in the fitting shop. This we have no hesitation in attributing to the many out-of-date practices we observed in the machine shops.

63. As we have said, the one shop not handicapped by lack of space or facilities was the boiler shop. This was, in our opinion, very good indeed,—large and well equipped and capable of turning out excellent work.

64. There are no Production or Progress Departments in Jamalpur shops, with the result that we found considerable delays common in meeting requisitions from stores.

65. Also we had occasion to comment on the very inadequate use that was being made of gauges and on the fact that no fixed tolerances were being observed.

66. Some years ago the works installed a chemical laboratory under the charge of a qualified Chemist and Metallurgist. This department is doing useful work.

#### *Lucknow Locomotive Shops.*

67. Lucknow Locomotive Shops were the headquarters shops of the old Oudh and Rohilkhand Railway before the latter was absorbed into the East Indian Railway.

68. They employ about 2,300 men and have pit accommodation for 30 locomotives.

69. As an extensive remodelling scheme has been sanctioned and is now in hand, comment on the existing shops would be superfluous. We found them, however, satisfactory on the whole, except that the erecting shop was rather congested and the method of scheduling repairs poor and inaccurate.

70. The machine shop contained a bigger percentage of modern machines than in other works we visited and with a good Planning Department it should work very efficiently. As it was, we found that supply of spare parts for stores was satisfactory so far as deliveries were concerned, but more attention will have to be paid to gauging.

71. The new foundries were, in our opinion, in excess of requirements and this question is referred to later under our recommendations in respect to the advisability of concentrating the production of castings.



*Lillooah Carriage and Wagon Shops.*

72. Lillooah Carriage and Wagon shops employ over 13,000 men and are under the direct charge of the Deputy Chief Mechanical Engineer, Carriage.

73. With the exception of the saw-mill, no extensive remodelling of these shops is contemplated, and on the whole we were of the opinion that, except for covered accommodation for wagon repairs, none would be warranted at present.

74. The saw-mill, however, certainly needs it urgently, being very cramped and equipped with out of date machinery.

75. In the building shop we were very favourably impressed with the systematic and efficient way in which the work was being done. Jigs and templets were being extensively used for the mass production of standard body sections, doors, windows, etc., and the work of assembly was very creditable.

76. Lillooah shops are capable of building 300 new coaching units per annum.

77. In respect to carriage repairs, the state of affairs was not so satisfactory and we were inclined to believe that the shops are in danger of letting this side fall behind in the effort of concentrating on carriage building. In spite of the humidity of the locality in which Lillooah shops are situated, we consider that the time taken to repair and paint a coaching vehicle (71 days) is too long, and could be very considerably reduced.

78. Wagon repairs were being carried out much more satisfactorily. The wagon repair shop was good and adequately equipped with cranes and pneumatic tools. Moreover, it was laid with three tracks in each bay, thus facilitating the expeditious handling and removal of vehicles under repair. Altogether this shop was working very efficiently and methodically. As in many other repair shops, however, we were struck with the fact that a great number of wagons that had passed their economic life were being repaired. This, we consider, is uneconomical and ought to cease.

79. The use of second-hand material was very noticeable in the under-frame shop, where we saw new underframes being built from old material obtained from condemned vehicles, to which old scroll irons, axle boxes, etc., were being fitted. These were admittedly for a small order of non-standard vehicles, but we do not consider the procedure justifiable even in isolated cases.

80. The wheel and machine shop, we consider, weak in the matter of modern high capacity tools. For the latter, too, a planning department is urgently required, the organisation for the manufacture of spare parts in large quantities being very poor and the methods of working far from efficient.

81. The foundry was badly equipped, and the volume of work not sufficient to justify its existence.

82. Lillooah Works possess an excellent tin-smith shop. We noticed, however, that they were manufacturing, among other things, at least a score of different types of lamps. We are of opinion that the

standardisation of many of the items would result in very considerable economies. Similar shops to this could advantageously be introduced on other railways.

83. We were not at all favourably impressed with the control of the stores at Lillooah. These are directly and entirely under the Deputy Chief Mechanical Engineer, which, we consider, is conducive to disorganisation of both manufacture and supply. The stores themselves were good and systematically kept, but the stocks were low and considerable difficulty seemed to be experienced in maintaining them.

*Lucknow Carriage and Wagon Shops, Alambagh.*

84. Lucknow Carriage and Wagon shops do repair work only.

85. These works are under the charge of the Deputy Chief Mechanical Engineer, Lucknow. About 3,100 men are employed.

86. The layout of the Works leaves much to be desired, but as fairly extensive alterations are in hand or about to be started, considerable improvement in this direction is anticipated.

87. The chief fault of the existing layout is in the bad balance between the shops. This was particularly noticeable between the carriage repair shop and the paint shop, the former having accommodation for 75 units and the latter for 25 units only.

88. The machine shop was good and the new wheel shop promised to be particularly so, judging by the excellent high capacity modern machines that were being laid down.

89. The smithy was well equipped with air hammers and had three drop stamps. The latter, although none of them very large, seemed excessive for a shop of this size.

90. Work generally, in our opinion, was progressing fairly efficiently considering that no attempt had been made to introduce planning or progressing methods.

*Great Indian Peninsula Railway.*

91. The headquarters of the Great Indian Peninsula Railway are at Victoria Terminus, Bombay. About 6 miles away, at Parel, are the offices of the Chief Mechanical Engineer and the main locomotive workshops. The main Carriage and Wagon shops are at Matunga, also a suburb of Bombay. Subsidiary shops, both loco. and carriage and wagon, are located at Jhansi, some 700 miles north of Bombay on the main line to Delhi.

92. There is also a small Carriage and Wagon shop at Bhusawal.

*Parel Loco. Shops.*

93. Parel Loco. shops employ about 4,750 men. The erecting shop, which was completed in 1914, is the only modern shop in the works, but the buildings are all quite suitable for the work required of them. The shops are well balanced and the machinery installed in them is good.

94. Parel shops are required to deal with about 700 locomotives and have pit accommodation for 64.

95. They are under the direct charge of the Chief Mechanical Engineer acting through a Deputy.

96. The superior supervision of the shops is adequate, there being a Works Manager with three assistants and a Production Engineer. The works have also a Metallurgical Department working under a qualified chemist. The labour employed, however, is bad and very unstable ; also the labour rate in Bombay district is higher than anywhere else on State Railways.

97. There is no remodelling of Parel shops contemplated in the near future.

98. We will later have occasion to refer to the time being taken in these shops to carry out heavy repairs to locomotives. This is certainly excessive, although in part due to the fact that a big programme of super-heater conversion is at present in progress together with extensive scrapping of non-standard details as engines pass through shops.

99. Apart from the fact that the time taken to repair a locomotive is too high, we were favourably impressed with the systematic way in which work was being executed.

100. In all shops a proper schedule for repairs was being worked to and accurate gauging of the work was universal throughout the works.

101. All manufacturing operations are controlled by a planning department working in conjunction with the Production Engineer and this side has reached a considerable degree of efficiency. Special attention has been paid to machine operation in order to get the maximum amount of work from the machinery installed and to reduce fitting work to a minimum. We found the stores excellent ; their reorganisation has only recently been carried out, but adequate stocks of most items have already been built up.

#### *Jhansi Locomotive Shops.*

102. Jhansi Locomotive Shops have repair accommodation for 55 locomotives, although this number of pits is not actually in use. They are required to deal with 600 locomotives, and employ about 3,150 men.

103. They are under the direct charge of a Deputy Chief Mechanical Engineer, who has also the Jhansi Carriage and Wagon shops under his control.

104. The present shops are badly congested and are not capable of carrying out repairs to the larger types of engines running on the Great Indian Peninsula Railway. Remodelling proposals are, however, under consideration. The pit accommodation will not be increased (in fact it will be reduced to 50), but much more space will be given to the machine, erecting and boiler shops.

105. These shops are working very efficiently indeed in spite of many disabilities of layout and equipment.

106. We were pleased with the systematic way in which all repair work is being scheduled, particularly in the erecting shop, which was well organised and was turning out excellent work.

107. The machine shop was very good indeed, and it was clear that the utmost endeavour was being made to get the maximum amount of work out of every machine and to introduce the most up-to-date methods and appliances. Jigs and fixtures were being extensively employed and free use was being made of gauges wherever practicable.

108. The fitting shop, too, was turning out very good work, the repairs to motion parts being particularly creditable. The care taken to insure that axle-boxes were machined accurately was another feature which impressed us considerably both in the erecting and machine shops.

109. As in the case of Parel, we found that in the erecting shop at Jhansi the system of "one squad one job" was being worked to.

#### *Matunga Carriage and Wagon Shops.*

110. Matunga Carriage and Wagon shops are the newest of their kind in India, and the buildings, with one or two minor exceptions, are all modern, well ventilated structures, very suitable indeed for their purpose. The equipment, however, is not so good.

111. These shops employ about 4,000 men, and are under the direct charge of a Deputy Chief Mechanical Engineer as in the case of Parel. Unlike the latter, however, the supervision is poor, there being only one Assistant Works Manager and no Production Engineer. This shortage of supervising staff is reflected very clearly in the working of the shop.

112. Matunga is also under the same disadvantages as Parel in the way of labour which is poor and the turnover high.

113. There are certain extensions contemplated in the near future to the carriage and wagon repair shops.

114. We were not at all favourably impressed with these works and we found them a very striking contrast to the locomotive shops at Parel.

115. The saw-mill seemed adequate in size, but appeared to be finding difficulties in keeping up stocks of wood details. The latter were very low indeed and untidily stored.

116. The stores were generally inadequate and the bins and racks clumsy and dilapidated.

117. The machine shop was badly equipped and functioning indifferently, there being no organisation for the systematic or economical manufacture of spare parts.

118. The body building was not, in our opinion, satisfactory. The quality of the work turned out, however, was good, but the outturn absurdly low. The same must be said in respect to the paint shop.

119. The carriage repair shop was also poor and the time taken to execute repairs excessive.

120. The wagon repair shop, however, was distinctly the worst feature of the works. Most of the work was being done out of doors upon long lines with practically no lifting facilities or mechanical appliances of any description. Many wagons, too, which were in state of dilapidation, were being repaired or rebuilt; also the general standard of workmanship was poor in the extreme.

*Jhansi Carriage and Wagon Works.*

121. These works are under the control of the Deputy Chief Mechanical Engineer.

122. They are poorly equipped, and available space is seriously restricted. About 2,000 men are employed.

123. As it is intended to rebuild these on an entirely new site, any detailed description of the existing shops would be superfluous.

124. The shops are badly handicapped by lack of space, inadequate machinery, and insufficient covered accommodation, but are on the whole working as efficiently as can be expected.

*Eastern Bengal Railway.*

125. The headquarters of the Eastern Bengal Railway are at Calcutta, the office of the Locomotive Superintendent being at Kanchrapara, 30 miles away. At Kanchrapara, too, are the broad gauge shops, both locomotive and carriage and wagon. The metre gauge locomotive and carriage and wagon shops are at Saidpur, 215 miles north of Kanchrapara. There are also small shops at Dacca.

126. The Eastern Bengal Railway is the only State line still working on the old departmental system with the running in addition to the workshops under the Locomotive and Carriage and Wagon Superintendent.

*Kanchrapara Locomotive Shops.*

127. Kanchrapara Locomotive shops are under the direct control of the Locomotive and Carriage and Wagon Superintendent of the line. They are required to deal with all broad gauge locomotives and have pit accommodation for 22. About 2,500 men are employed.

128. The existing shops are old and out of date, but a remodelling scheme has already been put in hand.

129. As was to be expected, we found that the dismantling of old shops was causing considerable dislocation of the work. The boiler shop was very congested and in our opinion this was largely due to the fact that repairs were being undertaken on a number of old boilers which had exceeded their economic life.

130. The erecting shop was the worst feature of the works and owing to inadequate crane facilities it constituted a serious handicap to repairs being expeditiously carried out.

131. The machine shop equipment was on the whole fairly modern but we did not consider the methods employed were conducive to economical production.

132. There was no scheduling of work in the shop with the result that the time taken to effect heavy repairs was excessive.

133. The working of the shops on the whole was not at all satisfactory which in our opinion was due both to bad facilities and defective organisation.

134. On the other hand the workshop stores appeared to be well conducted and carried considerable stocks of duplicate parts.

*Saidpur Locomotive Shops.*

135. These shops deal with repairs to all metre gauge locomotives on the Eastern Bengal Railway and have a pit capacity of 16.

136. The buildings, plant and equipment of these shops are very old and in view of our recommendations for their complete rebuilding, we do not propose to discuss them in any detail here.

137. We found them very poorly laid out and equipped, and in our opinion, quite incapable of really efficient working. There was no planning or inspection, and the scheduling system in force was very inadequate.

138. We noticed that the shops were engaged in the manufacture of considerable quantities of spare parts, which in our opinion, should not be undertaken in any shop of this size.

*Kanchrapara Carriage and Wagon Shops.*

139. Kanchrapara Carriage and Wagon shops deal with the broad gauge stock of the Eastern Bengal Railway.

140. They are under the direct control of the Locomotive and Carriage and Wagon Superintendent and the superior supervision, we were told, is adequate.

141. About 2,700 men are employed, labour being fairly good and stable.

142. We were particularly struck in these works with the extraordinary lack of balance that exists between the various shops. Many of them are big enough to deal with considerably more vehicles than the Eastern Bengal Railway are likely to have for many years, while others are too small for even the present requirements. This was so obvious that we were at a loss to understand why no effort appears to have been made to rectify matters.

143. The saw-mill was the best and most up-to-date we saw anywhere on our tour. It is a new building equipped with some excellent machinery. In the latter respect, however, it was the exception as the equipment in other shops left much to be desired.

144. Considering the size of the carriage repair shop, very little work seemed to be in progress. This impression was confirmed by the Locomotive and Carriage and Wagon Superintendent, who stated that he could undertake more than he was receiving, this in spite of the fact that he was already doing quite a lot of work for the Great Indian Peninsula Railway.

145. A similar state of affairs was observed in the Paint and Body Building shops and these are also capable of undertaking considerably more work.

146. In the Machine and Wheel shops, however, the reverse was the case ; added to which no scheduling was in force with the result that these shops were working very inefficiently and not capable of keeping pace with the rest of the works.

147. The covered repair accommodation for wagons (although excellent) was, we considered, too small, being sufficient for 60 wagons only out of a total of 480 in the shops. Also the time taken to execute repairs was excessive.

148. The outturn from the Carriage Repair Shops was, in our opinion, unsatisfactory, both in quantity and in time taken. Only 50 units of coaching and 324 wagons per month were being turned out, the average time being 84 and 58 days respectively.

*Saidpur Shops.*

149. Saidpur Carriage and Wagon shops deal with all the stock on the metre gauge system of the Eastern Bengal Railway. About 1,100 men are employed.

150. Our remarks in respect to the locomotive shops at Saidpur are applicable in general to the carriage and wagon shops.

151. In our opinion, any attempt to improve the present works short of complete remodelling would be inadvisable.

152. The general layout was bad and equipment quite inadequate. The wagon repair facilities were practically *nil*, all the work being done by hand in the open.

## CHAPTER III.

### Comparative Costs of Maintenance and Repairs.

#### *Cost Data.*

153. We may now consider the costs of maintenance and repairs to rolling stock on State Railways. Before instituting comparisons between these and the corresponding figures of other railways in England, Australia and South Africa we have attempted, to the extent it was possible, to make them comparable. This has been no easy task and we would here enter a caution against any suggestion, that we have placed too great a reliance on cost data. Carried out with due conservatism, the intelligent comparison of costs will not only usefully supplement conclusions arrived at as the result of a detailed personal survey of facts, but will often provide important clues that would lead to fresh investigation in useful channels. We may be allowed to anticipate our findings to this extent, that our conclusions have been generally borne out by the figures supplied to us.

154. Annexures I and II are copies of the schedules of questions which were circulated to the several railway administrations in advance of our tour with a request that the information called for therein might be kept ready for discussion during our visit. We found that on every railway considerable difficulties had been experienced in getting the figures together and that even such figures as had been collected were, owing to the difference in the methods of accounting procedure employed, not comparable with each other. It will be seen from an examination of the items of the schedules referred to above that all the information called for was such as the Chief Mechanical Engineer of a Railway would ordinarily require to have put up to him regularly in some form or other, in order to enable him to carry out the necessary round of his duties ; and the difficulties said to have been experienced either imply that the best use is not being made of the cost figures compiled or that there are certain defects in the organisation or in the accounts system itself that demand early investigation.

#### *No Regular Correlation of Costs and Outturn.*

155. The most noticeable shortcoming appears to be the absence of regular progressive correlation between the cost and statistical data that are being worked out year in, year out, at the expense of much time and money. Reliable information on points of fundamental importance, such as the comparative repair costs of different classes of engines and the cost of workshop repairs per engine-mile run between periodical overhauls, is, in most cases, not to be had at all. Locomotives of improved types are being purchased from time to time, but no attempt appears to have been made to keep track of the expenditure incurred on the maintenance and repairs of these locomotives. Increasing amounts are being spent upon improved mechanical plant and up-to-date machine tools with the object of reducing the repair costs, but little has been done to have the effect of such additions reflected in the costs themselves.



The monthly returns of expenditure that are being put up to the Chief Mechanical Engineer are such as would merely enable him to watch the progress of expenditure against the grant for the year under the various heads of account ; they fail to bring the expenditure incurred during the month in juxtaposition with the amount of work turned out in the period. The inevitable result of this arrangement is that, provided the grant for the year is adequate, there is little to induce the Chief Mechanical Engineer to take any particular trouble. We consider this extremely unfortunate as it leads to uneconomical expenditure in times of easy money, regardless of the adequacy of the results achieved. We feel sure that were greater discrimination exercised, costs could be kept down.

*The Locomotive as the Unit of Cost.*

156. We cannot take exception to the existing fabric of Workshop Accounts, which is apparently cast on more or less up-to-date models, but we consider it necessary to express our disapproval of the practice that has in recent years been adopted of charging all repairs to engines to one Standing Work Order. This has practically resulted in the costing system running to seed and in the Standing Work Orders for repairs being used as a dumping ground for outstanding balances. It is a pity that, while history sheets of locomotives appear to be carefully maintained and show mileages and details of periodical overhaul and of other repairs, the lumping up of work orders has rendered it impossible to indicate simultaneously on the history sheet, the cost of such repairs. The extra expense that may be involved in the cost of allocating charges to each locomotive or various types of locomotives would, in our opinion, be fully justified, as the extremely valuable information that will be rendered available thereby would allow of a close and incessant watch being kept over the expenditure on repairs. The recommendations made in this connection by the Workshops Accounts Committee of 1915, in para. 9 page 21 of their Proceedings of Meetings and in para. 24 of page 16 of their Report do not appear to warrant the practice now prevailing on all State railways (except the Eastern Bengal Railway) of having only one Standing Work Order for engine repairs and one for boiler repairs.

*Lack of Uniformity in Accounting.*

157. The analysis of the expenditure incurred in the shops as between labour, stores and general charges is not being carried out as completely as it might be. In distributing the general charges as between labour and stores, an arbitrary ratio is adopted on some railways which vitiates the significance of the analysis of expenditure as between wages and materials. Nor are the general charges of the different railways either worked out or distributed on a uniform basis. This lack of uniformity in accounting procedure has made it exceedingly difficult for us to institute comparisons between the rates at which the different workshops have been turning out spare parts or manufacturing articles in bulk. The variations in the prices at which stores are charged to manufacture render it necessary to compare the expenditure incurred under all the three elements of cost *viz.*, labour, materials and general charges ; and this can be done only when a uniform method of compilation is in existence.

*A Heavy Repair.*

158. We recognise the difficulty in defining a standard heavy repair and fully appreciate the action taken by the Railway Board in arriving at a formula for this purpose. This standard unit of heavy repair should be adopted ; and the work out-turned by the Mechanical Workshops should be analysed in such a manner as to distinguish between the heavy repair units in connection with periodical (scheduled) overhauls and the units of other work, of a light or special nature. The different and hazy notions that now exist as to what may be a light, a medium, a special or a heavy repair must give way to a single and well known concept of a standard unit of heavy repair, with the aid of which the units of work done on scheduled overhauls may be measured separately, at the same time as other work of a lighter nature.

*Repairs to Plant and Machinery.*

159. Repairs to Machinery and Plant in railway workshops total up to large sums of money per annum for each railway and affect directly the costs of maintenance and repairs of rolling stock. The recognised practice in works costing is to treat these charges as elements of oncost that would enter finally into the cost of repairs. The practice that obtains of allocating these charges to a final head of account in the Financial (as distinguished from Cost) Accounts, is responsible for this important factor being lost sight of in considering the cost of a unit of heavy repair. It would certainly be more satisfactory if a method were devised to allow the expenditure on repairs to machinery in workshops to be included in arriving at the cost of repairs.

*Other Items of Oncost.*

160. There are other similar items of expenditure which find their way to different detailed final heads under different ' Abstracts ' of Revenue Expenditure, which may profitably be worked into workshops repair costs, for instance, provident fund bonus to workshop employees and customs duty and freight charges incurred on stores supplied from Stores Depôts for work on revenue account. Expenditure incurred in the Stores and Accounts Departments, with respect to the services rendered by these Departments to the workshops, as well as expenditure on certain classes of superior supervising and clerical staff, now charged to ' General Administration ' may perhaps be susceptible of like treatment in accounts. In any case, such charges have to be considered in instituting comparisons, as between any two workshops with regard to the economy and efficiency with which repair work is being carried out. Further, were the indirect charges of the nature we have spoken of above caught up in the routine of costing and presented to the Chief Mechanical Engineer he would have, in our opinion, considered it in many cases, cheaper to replace with new stock than to carry out repairs. We have noticed, specially in the case of boilers and wagons, repairs being carried out at a stage when they ought to have been condemned and broken up. So long as the final administrative control is vested in the Government of India and the principle of healthy emulation as between railways is recognised, the advantages of making cost or financial results comparable in some more detail will be manifest and will afford a satisfactory rejoinder to the naive protest commonly met with, that these are refinements in accounting that are not justified in actual practice.

*Need for Immediate Action.*

161. These are not the only difficulties we have experienced in attempting to institute comparisons as between railway workshops. The want of uniformity in the classification of labour, in the nomenclature of trades, skilled, semi-skilled and unskilled, and in the accounts forms in use, have all presented to us problems less only in degree than the diversity in accounting procedure. We would emphasise the importance of the necessary spade-work being commenced without delay in order that the different problems in accounting organisation and methods, we have mentioned incidentally, may be either solved or kept readily assimilated in suitable form for examination by the firm of Chartered Accountants who are expected shortly to examine and report upon Indian Railway Accounts.

*Average Cost of a Locomotive Heavy Repair.*

162. The average cost of a heavy repair of a locomotive in each Mechanical Workshop is shown below. The figures are those supplied by the different railways and though not exactly comparable, for reasons we have mentioned above, do not fail to be instructive, when considered along with the average monthly outturn of such repairs and the average tractive effort of the locomotives repaired. They also bear out generally our conclusions with respect to the efficiency of the work carried out at the different places.

163. TABLE VI.—*Average cost of a heavy repair.—A. Locomotives.*

Railway.	Monthly outturn of heavy repairs and average tractive effort.		Wages.	Materials.	Total.	
	Rs.	Lbs.				
<i>Eastern Bengal.</i>						
Kanchrapara . . . . .	6·2	18,890	5,930	9,300	15,230	
	<i>N. G.</i>	4	3,569			
Saidpur . . . . .	<i>M. G.</i>	5·25	14,125	3,210	3,563	6,773
	<i>N. G.</i>	2	3,034			
Dacca . . . . .		·75	12,263		5,700	
<i>East Indian.</i>						
Jamalpur . . . . .		29	19,110	3,764	4,754	8,518
<i>Oudh and Rohilkhand.</i>						
Lucknow . . . . .		11·95	17,980	*6,692	4,009	10,701
<i>Great Indian Peninsula.</i>						
Parel . . . . .		21·6	25,193	7,188	5,317	12,505
Jhansi . . . . .		21·3	17,936	3,127	4,654	7,781
<i>North-Western.</i>						
Moghulpura . . . . .		33·3	20,478	5,358	6,916	12,274
	<i>N. G.</i>	25				
Rawalpindi . . . . .		6·3	19,837	6,060	3,353	9,413
	<i>N. G.</i>	1·4	11,286	1,463	2,891	4,354
Sukkur . . . . .		6·2	22,022	3,801	4,208	8,009
	<i>N. G.</i>	5	5,520			
Karachi . . . . .		5·5	22,672	6,861	4,721	11,582
Kalka . . . . .	<i>N. G.</i>	1·6	14,112	6,492	2,754	9,246

\* All general charges are included under 'wages' at Lucknow.

*Average Cost of a Repair—Carriages and Wagons.*

164. The average cost of a repair (heavy and light) to coaching vehicles and goods vehicles in each Mechanical Workshop has likewise been compiled and is shown below.

165. TABLE VII.—Average cost of repair.—B. Coaching and Goods Vehicles.

Railway.	Cost of repair per coaching vehicle. 4 wheeler.			Cost of repair per Goods wagon. 4 wheeler.		
	Wages.	Materials.	Total.	Wages.	Materials.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Eastern Bengal.</i>						
Kanchrapara . . . .	61	723	1,184	80	126	206
Saidpur . . . . .	241	302	643	87	154	241
Dacca . . . . .	134	104	238	35	32	67
<i>East Indian.</i>						
Lillooah . . . . .	351	433	784	54	107	161
Ondal . . . . .	..	..	..	58	95	153
<i>Oudh and Rohilkhand.</i>						
Lucknow . . . . .	..	..	609	..	..	214
<i>Great Indian Peninsula.</i>						
Matunga . . . . .	1,293	1,584	2,877	74	151	225
Jhansi . . . . .	715	905	1,620	45	90	135
Bhusawal . . . . .	1,004	639	1,643	70	43	113
<i>North-Western.</i>						
Moghulpura . . . .	342	599	941	47	135	182
Rawalpindi . . . .	161	72	233	37	14	51
Karachi . . . . .	615	423	1,038	111	58	169
Sukkur . . . . .	266	319	585	54	81	135
Kalka . . . . .	635	178	813	226	25	251

*Cost of Repairs—Workshops and Running Sheds.*

166. The above are figures supplied by the different railways and do not in most cases take into account the cost of repairs to plant and machinery in the different workshops. We give below the costs of maintenance and repairs of rolling stock in 1924-25 for each railway (not each workshop), as worked out from the published accounts and from figures we have obtained from the Deputy Director of Statistics. These are based on what we consider to be very much more reliable data and serve to bring out in high contrast the costs of the different railways. We have worked out also the cost of unit repairs in workshops by dividing the total expenditure incurred in workshops by the outturn of repairs each railway has claimed from its workshops.

167. TABLE VIII.—*Cost of Maintenance and Repairs of Locomotives in 1924-25.*

Railway.	Per 1,000 engine miles.		Per locomotive per annum.		Per 1,000 lbs. tractive effort per annum.		Cost of heavy repair in workshops.	
	Work-shop repairs.	All re-pairs.	Work-shop repairs.	All re-pairs.	Work-shop repairs.	All re-pairs.		
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	*Rs.	†Rs.
Eastern Bengal—								
B. G.	181	221	4,160	5,073	197	240	12,883	15,913
M. G.	116	175	2,350	3,560	163	247	5,835	7,106
East Indian . . .	110	159	2,973	4,308	154	223	10,282	11,510
Oudh & Rohilkhand.	241	265	5,116	5,622	281	309	9,114	11,227
Great Indian Peninsula.	231	330	4,786	6,837	210	300	10,394	11,511
North-Western .	301	412	5,348	7,326	266	364	12,288	13,261

\* Exclusive of repairs to plant, machinery and machine tools.

† Inclusive of repairs to plant, machinery and machine tools.

168. TABLE IX.—*Cost of Maintenance and Repairs of Coaching Vehicles in 1924-25.*

Railway.	Cost per 1,000 vehicle miles.		Per four-wheeler per annum.		*Cost per repair (in workshops) per four wheeler.	
	Work-shop repairs.	All re-pairs.	Work-shop repairs.	All re-pairs.		
	Rs.	Rs.	Rs.	Rs.	Rs. †	Rs. ‡
Eastern Bengal—						
B. G.	10	11.75	606	705	1,273	1,367
M. G.	7	7.71	244	284	559	569
East Indian . . .	15	18.13	763	930	704	745
Oudh and Rohilkhand	18	22.19	652	795	494	501
Great Indian Peninsula	20	25.64	992	1,272	2,192	2,275
North-Western .	16	19.79	643	775	500	542

\* Arrived at by dividing the total workshop repair expenditure during the year by the annual outturn of all repairs.

† Exclusive of Repairs to Plant and Machinery.

‡ Inclusive of Repairs to Plant and Machinery.

169. TABLE X.—*Cost of Maintenance and Repairs of Goods Vehicles in 1924-25.*

Railway.	Cost per 1,000 goods vehicle miles.		Per four-wheeler per annum.		*Cost per repair (in workshops) per four-wheeler.	
	Workshop repairs.	All repairs.	Workshop repairs.	All repairs.		
	Rs.	Rs.	Rs.	Rs.	Rs. †	Rs. ‡
<b>Eastern Bengal—</b>						
B. G.	10·3	12·47	87	105	182	197
M. G.	5·7	6·81	57	69	173	176
East Indian ..	5·6	8·62	80	123	145	152
Oudh and Rohilkhand	7·3	13·04	86	153	170	184
Great Indian Peninsula	5·4	10·06	82	152	203	216
North-Western ..	10·1	10·81	137	147	234	252

\* By dividing total workshop expenditure by total annual outturn of all repairs.

† Exclusive of Repairs to Plant and Machinery.

‡ Inclusive of Repairs to Plant and Machinery.

*Average Annual Cost of Maintenance and Repairs.*

170. The scale of expenditure on repairs and maintenance is so greatly susceptible of increase or decrease within short periods of time, that the consideration of the results of a single year might lead to wrong conclusions. Further, the figures we have given above do not analyse the expenditure between wages and materials, and repair costs may have been largely inflated owing to prevailing prices for raw material. We have consequently thought it desirable to work out for a longer period, the cost of maintenance and repairs. We have analysed the expenditure in the four years 1919-20 to 1923-24 as, during this period, the extent of repair work undertaken on these railways may be considered comparable to some extent, and any fluctuations in costs of material would be largely common to all the railways and will not affect the expenditure under wages. We would invite a study of the figures contained in Annexures V to IX, which cannot fail to be instructive in this connection.

171. TABLE XI.—Average Annual Cost of Maintenance—Locomotives.

Railway.	Per Locomotive.			Per 1,000 lbs. tractive effort.	Per 1,000 engine miles run.	Average period between heavy repairs.	
	Wages.	Materials.	Total.			Days.	Mileage.
	Rs.	Rs.	Rs.	Rs.	Rs.	Days.	Mileage.
Eastern Bengal—							
B. G.	*2,727	2,615	5,342	281	246	943	75,000
M. G.	*1,584	1,340	2,924	209	154	1,127	76,000
East Indian	2,179	2,571	4,750	270†	172	1,197	95,000
Oudh & Rohilkhand.	..	..	5,980	326†	284	..	..
Great Indian Peninsula.	4,112	3,435	7,547	340	357	1,048	62,000
North-Western.	3,801	3,783	7,584	381	461	750	49,000

NOTE :—B. G. includes N. G.

\*Allocation between wages and materials made on the proportion these bear, irrespective of gauge.

†Average of two years only.

172. TABLE XII.—Average Annual Cost of Maintenance.—Coaching Vehicles.

Railway.	Coaching Vehicles.				
	Per four-wheeler.			Per 1,000 vehicle miles.	Average period between heavy repairs.
	Wages.	Materials.	Total.		
	Rs.	Rs.	Rs.	Rs.	Days.
Eastern Bengal—					
B. G.	310	418	728	16.56	840
M. G.	147	198	345	10.71	878
East Indian . . .	360	435	795	16.60	1,642
Oudh and Rohilkhand	..	..	642	19.69	730
Great Indian Peninsula	711	924	1,635	28.69	905
North-Western .	402	444	846	21.22	446

173. TABLE XIII.—Average Annual Cost of Maintenance—Goods Vehicles.

Railway.	Goods Vehicles.				
	Per four wheeler.			Cost per 1,000 vehicle miles.	Average period between heavy repairs.
	Wages.	* Materials.	Total.		
	Rs.	Rs.	Rs.	Rs.	Days.
Eastern Bengal—					
B. G.	35	69	104	11·60	845
M. G.	19	38	57	8·23	878
East India . . . . .	39	113	152	11·12	1,095
Oudh and Rohilkhand . . . . .	..	..	77	7·71	750
Great Indian Peninsula . . . . .	69	179	248	20·10	833
North-Western . . . . .	43	95	138	13·28	541

*General Charges.*

174. The cost figures of Indian Railways are not directly comparable with the costs on Railways outside India. For instance, the figures of costs and maintenance that have been published in the Report of the Departmental Workshops Commission on the South African Railways, show the expenditure that has been incurred under the three heads, wages, materials and general charges. Under "general charges" is shown the expenditure incurred on the items shown below.

	Approximate per cent.
" (A) Departmental or Shop Charges—	
Staff, including Mechanical Engineer, Draughtsmen and clerical.	5.25
Foremen and Assistant Foremen . . . . .	3.20
Foremen's clerks . . . . .	1.45
Chargemen and Acting Chargemen . . . . .	9.00
Telegraph and Telephone Expenses . . . . .	.18
Office equipment and stationery, &c. . . . .	.10
Shop Wages (stores running shop, cleaning, &c.) . . . . .	4.85
Tool store clerks . . . . .	.15
Upkeep and repair of Tool store tools . . . . .	1.20
Driving overhead cranes . . . . .	.50
Watchmen's Wages . . . . .	.75
Native Wages—general labour . . . . .	9.00
Removal of ashes . . . . .	.05
Shop material, hand tools, oil and waste, oxygen and acetylene, &c. . . . .	5.10
Worn out and broken tools . . . . .	.65



	Approximate per cent.
Spoiled work .. .. .	.05
Upkeep of machinery, wages .. .. .	4.30
Upkeep of machinery, material .. .. .	3.30
Electric current .. .. .	2.00
Upkeep of Motors .. .. .	.80
Proportion of cost of boiler house .. .. .	.60
Depreciation of machinery .. .. .	3.50
Proportion of Fire Brigade expenditure .. .. .	.08
Repairs to buildings .. .. .	.50
Insurance of buildings .. .. .	.10
Depreciation of buildings .. .. .	1.35
Leave and holiday pay .. .. .	5.35
Special leave (Defence Force) .. .. .	.08
Compensation for injuries .. .. .	.25
Injury on duty pay .. .. .	.40
Sick fund contributions (departmental) .. .. .	1.50
Sick Fund and other allowances .. .. .	.05
Sick Fund meetings .. .. .	.01
Sick Fund accounts .. .. .	.07
Ambulance Services .. .. .	.15
Shunting .. .. .	.75
Sanitary Services .. .. .	.25
Feeding and accommodation of natives .. .. .	1.50
Miscellaneous .. .. .	.05
	68.42
Interest on capital invested in land, buildings, sidings and stores materials, say .. .. .	9.50
<b>(B) Expenses of Administration—</b>	
Head office expenditure (proportion of Chief Mechanical Engineer's Office) .. .. .	3.15
Interest on capital invested in offices, &c. .. .. .	.50
	81.57 "

175. On Indian Railways, only expenditure on account of the charges mentioned below is ordinarily included under the head "general charges" :—

- (a) Pay of monthly paid Mistries and Chargemen.
- (b) Pay of European and Indian Apprentices.
- (c) Pay of Gate Sergeants and Chowkidars.
- (d) Wages of Bhisties, Sweepers and Yard Coolies.
- (e) Cost of electric power in shops.
- (f) Cost of steam power in shops.
- (g) Cost of repairs to perishable tools.

- (h) Cost of working and maintenance of traversers, shunting engines and lorries in shops.
- (i) Cost of supply of water and electric light to shops.

*“Indirect Charges.”*

176. The influence on costs of the other important items of overheads is not ordinarily considered; but whenever other railways or private parties have to be charged with the cost of the work, an “over-all” percentage on labour *and* materials of 5 per cent. for supervision and 5 per cent. for depreciation and interest on buildings is added under Article 12 of the Advanced Chapter on Workshops of the State Railway Code. This is an arbitrary ratio, which tends, when applied to the erection of rolling stock or manufacture of spares, to give a figure for overheads, higher than would have been arrived at on the basis of an individual percentage of labour for each workshop and the advisability of adopting the latter and bringing it into force is being considered.

*Certain Accounting Difficulties.*

177. The cost accounts interlock with the financial accounts. The latter have displayed up to 1924-25 the costs separately under *wages, overtime and materials*, but not separately for workshops and running sheds. In the accounts of 1924-25 and of succeeding years, however, the financial accounts show the expenditure in workshops distinct from that incurred in running sheds, but fail to show the expenditure under “wages” and “materials”, the classification of “cash” and “stores” being substituted instead. There is a difference between these two classifications of expenditure, and this will be evident from the fact that under “stores” is included all the expenditure on *wages* in Railway Workshops.

178. It is seen from the foregoing that the expenditure on repairs and maintenance of rolling stock in India—

- (i) has at no time been shown in the published accounts analysed under wages, materials and general charges;
- (ii) has not, previous to 1924-25 been shown separately for running repairs and for workshop repairs;
- (iii) has not, after 1923-24, been shown separately under wages and materials; and that
- (iv) the ‘general charges’ that have been shown in the cost accounts (as distinguished from the financial accounts) do not include items of expenditure taken into account by railways of other countries, the costs of which, it would have been instructive to compare.

179. It is not impossible to separate from the workshop accounts of each railway the expenditure incurred in each workshop on the maintenance and repairs of rolling stock under the heads—labour, stores and general charges. We had this done with respect to the Eastern Bengal Railway, but finding that the items of expenditure allocated to the work orders for ‘general charges’ and the methods of distribution of such expenditure among the other work orders differed on different railways, we did not consider it useful to have the like figures for other railways worked out.

*Percentages of Oncost.*

180. We have, however, attempted to find out what percentage of the expenditure on labour should be added, to make the costs comparable with those quoted by outside agencies. To this end, we called upon each railway to furnish us with figures of the capital and present cost of buildings, plant and equipment and machine tools. We were aware that these costs were not readily available and we suggested that in cases where the original costs could not be obtained straight from existing records, they might be assessed. Railways have experienced great difficulties in ascertaining the book value of workshop buildings and the figures eventually furnished appeared to us to be far from correct. We have had, consequently, to adopt an arbitrary percentage to cover the charges on account of interest, depreciation and repairs, with respect to workshop buildings. The book value of plant and machine tools, having been arrived at from the registers of tools and plant maintained by each workshop, appear to be fairly reliable and we have taken these latter into account, in arriving at the percentage on labour, that has to be added on to the cost of work done in the workshops.

181. TABLE XIV.—*Percentage of oncost in Locomotive Workshops.*

Name of charge.	Jamalpur. E. I. Ry.		Parel. G. I. P. Ry.		Moghulpura. N. W. Ry.		Lucknow. O. & R. Ry.	
	Thou- sands of Rs.	Percen- tage on direct wages.	Thou- sands of Rs.	Percen- tage on direct wages.	Thou- sands of Rs.	Percen- tage on direct wages.	Thou- sands of Rs.	Percen- tage on direct wages.
1. Direct wages	3194	..	2042	..	2614	..	867	..
2. ' General Char- ges '.	1410	44·14	1366	66·90	706	27·01	453	52·25
3. Repairs to Plant and Machinery.	369	11·55	428	20·96	328	12·54	158	18·22
4. Supervision in cluding pro- vision for leave, fund payments, etc.	1068	33·44	483	23·65	373	14·25	223	25·72
5 Interest (5%) and Deprecia- tion (5%) on Plant and Machine tools.	557	17·44	475	23·26	555	21·23	260	29·99
6. Repairs, Inte- rest and De- preciation on Workshop buildings, say,	..	10·00	..	10·00	..	10·00	..	10·00
Total Oncost	..	116·57	..	144·77	..	85·03	..	136·18

182. TABLE XV.—Percentage of Oncost in Carriage and Wagon Workshops.

Name of charge.	Lillooah including Ondal). E. I. Ry.		Matunga. G. I. P. Ry.		Moghulpura. N. W. Ry.		Lucknow. O. & R. Ry.	
	Thousands of Rs.	Percentage on labour.	Thousands of Rs.	Percentage on labour.	Thousands of Rs.	Percentage on labour.	Thousands of Rs.	Percentage on labour.
1. Direct wages	3751	..	1916	..	2427	..	771	..
2. 'General charges'.	1625	43·32	1187	61·93	611	25·28	361	46·82
3. Repairs to Plant and Machinery.	329	8·77	330	17·22	309	12·73	83	10·77
4. Supervision including 25% for leave, fund payments, etc.	513	13·67	433	22·60	456	18·80	181	23·47
5. Interest (5%) and Depreciation (5%) on Plant and Equipment.	169	4·24	217	11·32	276	11·37	88	11·41
6. Interest and Depreciation and Repairs on Workshop Buildings, say.	..	10·00	..	10·00	..	10·00	..	10·00
7. Total Oncost	..	80·00 p. c.	..	123·07 p. c.	..	78·18 p. c.	..	102·47 p. c.

183. From these statements it will be noticed that the highest percentage of general charges on labour is about **145**, which compares favourably with the **200** per cent. on labour charged by certain engineering firms in India as their *normal* oncost to cover overhead expenditure.

184. We show below for convenience of reference the average annual cost of maintenance and repairs of locomotives on the three bigger State Railways.

Railway.	LOCOMOTIVES.			COACHING VEHICLES.			GOODS VEHICLES.		
	Wages.	Materials.	Total.	Wages.	Materials.	Total.	Wages.	Materials.	Total.
East Indian	Rs. 2,179	Rs. 2,571	Rs. 4,750	Rs. 360	Rs. 435	Rs. 795	Rs. 39	Rs. 113	Rs. 152
Great Indian Peninsula.	4,112	3,435	7,547	711	924	1,635	69	179	248
North-Western	3,801	3,783	7,584	402	444	846	43	95	138

*Costs of Maintenance and Repairs compared.*

185. The figures show the expenditure (exclusive of the expenditure on renewals and replacements) incurred on repairs and maintenance both in the workshops and on the line (in running sheds) and are the average of the four years 1919-20 to 1923-24. They include the cost of repairs to plant and machinery. It will be seen that 'wages' account for nearly half the total cost of repairs on almost all the railways. The 'general charges' left out of account are, if repairs to plant and machinery are excluded, from 45 to 66 per cent. of the expenditure on labour in the case of locomotive shops and 28 to 45 per cent. in the case of carriage and wagon shops. If these charges were taken into consideration, the costs of maintenance would be higher. Before the average maintenance costs, arrived at after including these charges, can be compared with those referred to in the Reports on the Railways in New South Wales and South Africa, the revenue expenditure on the replacements and renewals of rolling stock will have to be divided up over the stock on the line. We have arrived below at the costs per unit of rolling stock, which we consider should be included on account of the above, during the period under consideration.

	Original	Life.	Provision	£
	cost.		for	
	Rs.	Years.	Rs.	
B. G. Locomotives :—Engine and Tender	30,000	35	857	} 94
B. G. Boiler . . . . .	10,000	25	400	
B. G. Carriages (Bogie) . . . . .	21,000	30	700	53
B. G. Wagons (4 wheeler) . . . . .	2,400	40	60	5

186. These figures are necessarily rough averages brought in merely for purposes of comparison. In the tabular statements below, we have shown the costs of maintenance and repairs arrived at on the basis indicated above, on the East Indian, Great Indian Peninsula and North-Western Railway, converted into sterling at 1s. 6d. per rupee; in juxtaposition with figures for South African, Australian and English Railways.

187. TABLE XVI.—*Maintenance of Locomotives, Coaching and Goods Vehicles per annum.*

Railways.*	Average cost per locomotive.	Average cost per coaching vehicle.	Average cost per goods vehicle.
<i>South African Railways.</i>	£	£	£
South African . . . . .	1,111	197	32
<i>Australian Railways.</i>			
New South Wales . . . . .	1,246	192	20
Victoria . . . . .	849	157	20
Queensland . . . . .	656	146	14
South Australia . . . . .	798	179	17
Western Australia . . . . .	528	124	9
New Zealand . . . . .	784	128	13

Railways*.	Average cost per locomotive.	Average cost per coaching vehicle.	Average cost per goods vehicle.
<i>English Railways.</i>			
	£	£	£
Great Western . . . . .	518	80	9
London and North Eastern . . . . .	506	85	10
London Midland and Scottish . . . . .	521	75	6
Southern . . . . .	503	71	9
<i>Indian Railways†.</i>			
East Indian . . . . .	530	190	17
Great Indian Peninsula . . . . .	795	330	25
North-Western . . . . .	770	200	16

\* Figures for other than Indian Railways are taken from the Report on South African Railway Workshops and are for the year 1923.

† Figures are for the period 1919-23; similar figures for any year between 1915 and 1925 can be worked from data given in Annexure X.

188. The costs that we have worked out above for Indian Railways are necessarily very approximate; but they need not be accurate to lead to the inference that the work of maintenance and repairs of rolling stock is *not* being conducted economically. The expenditure on coaching vehicles is particularly high and bears out what we have been led to expect from an examination of the carriage and wagon shops we have visited. We feel sure that with better organisation and methods of production, the adoption of which we suggest in the next two chapters, it would be possible to work to well within English Railways' costs in India, thus bringing about substantial economies in working.

#### *Extent of Workshop Repairs.*

189. The figures that we have just considered are with respect to the expenditure on maintenance and repairs incurred on the whole line. What portion of this expenditure (exclusive of that on renewals, which is all incurred in workshops) is incurred in workshops will be evident from the following:—

190. TABLE XVII.—*Workshop Repairs and Running Repairs. (Locomotives) 1924-1925.*

Railways.	Percentage of running repairs to Total repairs.	Percentage of workshop repairs to Total repairs.
Eastern Bengal—		
<i>Broad Gauge</i> . . . . .	18	82
<i>Metre Gauge</i> . . . . .	34	66
East Indian . . . . .	31	69
Oudh and Rohilkhand . . . . .	9	91
Great Indian Peninsula . . . . .	30	70
North-Western . . . . .	27	73

191. TABLE XVIII.—*Workshop Repairs and Running Repairs (Carriage and Wagon Stock).*

Railway.	Coaching Vehicles.		Goods Vehicles.	
	Percentage of running repairs to Total repairs.	Percentage of workshop repairs to Total repairs.	Percentage of running repairs to Total repairs.	Percentage of workshop repairs to Total repairs.
Eastern Bengal—				
B. G.	14	86	17	83
M. G.	14	86	17	83
East Indian . . . . .	18	82	35	65
Oudh & Rohilkhand . . . . .	18	82	44	56
Great Indian Peninsula . . . . .	22	78	46	54
North-Western . . . . .	17	83	7	93

*Staff per Heavy Repair.*

192. The staff employed per heavy repair on Indian and other Railways is shown below and is instructive as it gives a broad indication of the efficiency of labour in India as compared with that in other countries.

193. TABLE XIX.—*Staff employed on Repairs to Locomotives.*

Railways.	Workshops.	Total staff.	Number of heavy repairs per annum.	Staff per heavy repair.	Engines built.
<i>Indian Railways.</i>					
Eastern Bengal . . . . .	Kanchrapra . . . . .	2,444	79	30·83	Nil.
	Saidpur . . . . .	1,107	63	17·5	Nil.
East Indian . . . . .	Jamalpur . . . . .	9,984	348	28·66	Nil.
	Lucknow . . . . .	2,370	156	15·16	Nil.
Great Indian Peninsula . . . . .	Parel . . . . .	4,909	259	18·91	Nil.
	Jhansi . . . . .	3,234	256	12·58	Nil.
North Western . . . . .	Moghalpura . . . . .	5,297	399	13·25	Nil.
	Rawalpindi . . . . .	839	92	9·08	Nil.
	Sukkar . . . . .	1,099	80	13·66	Nil.
	Karachi . . . . .	1,179	66	17·83	Nil.
<i>South African</i> * . . . . .		3,182	780	4·08	Nil.
<i>New South Wales</i> . . . . .	Eveleigh . . . . .	3,476	352	9·88	5
	Honeysuckle . . . . .	410	35	11·71	Nil.
<i>London Midland and Scottish</i>	Horwich . . . . .	3,885	808	4·81	21
	Crewe . . . . .	7,687	1,478	5·20	30
	Derby . . . . .	4,659	1,300	3·58	10
	St. Rollox . . . . .	1,779	359	4·96	..

\*The staff (South African Railways) figures are for Europeans only. Natives (1527) represent approximate 48% additional.

*Percentage of Supervision.*

194 We have attempted to ascertain the percentage of supervision over work done in the different railway workshops and we subjoin a statement which brings out the results. The percentages have been worked out both with respect to numbers and the amount of wages paid and bring about interesting comparisons as between the railways. The detailed method of arriving at these figures will be evident from a study of annexures XIV and XV in which the strength and wages of supervising staff, skilled and unskilled labour have been worked out for each shop, *e.g.*, Boiler Shop, Erecting Shop, etc. These annexures will repay careful examination. Superior supervising establishment (above the rank of foremen) has been excluded in all cases. It will be instructive, however, to refer back to item 4 in Tables XIV & XV, paras. 181 & 182 where the cost of superior supervising establishment, (including Foremen, Assistant Foremen, Clerical and Accounts Establishment) has been given and the percentage it bears on *direct* wages worked out.

195. TABLE XX.—*Supervision in Locomotive Shops.*

Railway.	Workshop.	Percentage on Numbers.	Percentage on Wages.
Eastern Bengal . . . . .	Kanchrapara . . . . .	1·45	15·97
" " . . . . .	Saipdur . . . . .	1·19	14·43
" " . . . . .	Dacca . . . . .	.72	13·34
East Indian . . . . .	Jamalpur . . . . .	3·29	34·96
Oudh & Rohilkhand . . . . .	Lucknow . . . . .	3·77	37·51
Great Indian Peninsula . . . . .	Parel . . . . .	3·15	19·08
" " . . . . .	Jhansi . . . . .	2·86	20·07
North-Western . . . . .	Moghalpura . . . . .	3·42	16·41
" " . . . . .	Karachi . . . . .	4·61	19·14
" " . . . . .	Kalka . . . . .	7·96	35·07
" " . . . . .	Rawalpindi . . . . .	3·71	20·11
" " . . . . .	Sukkur . . . . .	3·88	18·84

196. TABLE XXI.—*Supervision in Carriage and Wagon Shops.*

Railway.	Workshop.	Percentage on Numbers.	Percentage on Wages.
Eastern Bengal . . . . .	Kanchrapara . . . . .	.75	10·80
" " . . . . .	Saipdur . . . . .	.50	7·86
East Indian . . . . .	Lillooah . . . . .	1·60	10·52
" " . . . . .	Ondal . . . . .	1·05	13·92
Oudh & Rohilkhand . . . . .	Lucknow . . . . .	3·26	20·19
Great Indian Peninsula . . . . .	Matunga . . . . .	3·29	16·27
" " . . . . .	Jhansi . . . . .	2·08	13·76
North-Western . . . . .	Moghalpura . . . . .	3·66	17·22
" " . . . . .	Karachi . . . . .	1·02	10·33
" " . . . . .	Kalka . . . . .	4·66	9·07
" " . . . . .	Rawalpindi . . . . .	2·88	12·30
" " . . . . .	Sukkur . . . . .	2·96	12·22



197. We have, in this chapter, examined the costs of maintenance and repairs of rolling stock in the workshops of the different railways. We have taken into careful consideration the factors that determine the making up of costs before instituting comparisons with similar figures for railways outside India, that we were in a position to quote. It will be noticed that the cost figures bear out in a remarkable way the observations we have made in the previous chapter on each of the workshops that we had visited and lead logically to our recommendations on the terms of our reference, that we make in the pages that follow.

## CHAPTER IV.

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**Term I.—The capacity or otherwise of the existing workshops of State Railways to deal economically and expeditiously with the maintenance of rolling stock at the present time.—Locomotive Shops.**

198. In order that we might be in a position to judge whether or not the existing workshops of State Railways are in a position to deal adequately with the work required of them at present, it has been necessary to adopt a general empirical estimate of what repair facilities are required in relation to the total rolling stock, both locomotives and carriages and wagons, on all four systems.

### *Formula for Shop Accommodation.*

199. So far as locomotives are concerned, it has been arrived at as follows.

200. The period that an engine remains in service between repairs varies with the work on which it is engaged, its age, and many other factors. Apart, therefore, from abnormal cases of accidents or breakage of important parts such as cylinders, etc., the question of whether or not an engine requires repairs will depend mainly on the mileage that it has run since it was last in the shops.

201. A mileage basis, however, is useless for the purpose of determining the size of the shops required to deal with the total locomotive stock on any system. It is necessary, therefore, to fix an average period of time after which engines can reasonably be expected to have run their specified mileage and to require repairs. After careful consideration we have fixed on a period of  $2\frac{1}{2}$  years, which has been found to be satisfactory on the majority of railways in the past.

202. The next point is the outturn that ought to be obtained from each unit of repair accommodation provided in mechanical workshops. This resolves itself into two factors—firstly, the outturn per erecting shop pit per annum and secondly, the period each engine should require to remain in shops for heavy repairs. The latter differs from the former in that it is a total time—covering the period before repairs are put in hand, actual time on the pit, and time taken after the engine has left the erection shop for painting, steaming, trial, etc.

203. For the former we have taken six engines per pit per annum, and for the total period in workshops a figure of  $2\frac{1}{4}$  months.

204. We thus arrive at a period of  $32\frac{1}{4}$  months for the total turn round of an engine, and calculating on this basis, it will be found that one pit is required to maintain 16 engines. To this we have added one extra pit in every hundred locomotives as provision for special repairs due to accidents, etc., which gives a total of one pit required for every 14 engines on any particular system.

205. Further, for the sake of uniformity between all railways, we have had to take into consideration that on some systems there is a considerable excess of locomotives over actual requirements, and we have been compelled to devise some method of assessing this on a common basis, before attempting to decide on the adequacy or otherwise of the existing repair facilities on each railway. This has been done by assuming that not less than 65 per cent. of the total stock of engines should be in use daily. Where this percentage has not been attained, we have reduced the figure of authorised stock accordingly, before calculating the repair accommodation required.

206. In none of the foregoing, however, should it be assumed that the figures represent the maximum efficiency to be aimed at.

#### *North-Western Railway.*

207. The North-Western Railway have an authorised stock of 1553 broad gauge and 100 narrow gauge locomotives, a total of 1,653. This figure, however, is admittedly considerably in excess of requirements, a fact which statistics of percentage of engines in daily use amply prove. The percentage for the North-Western Railway averages 54, and calculating as indicated in paragraph 205 above, we have arrived at a figure of 1,451 broad and narrow gauge locomotives as a reasonable estimate of the present day requirements of the North-Western Railway.

208. For this number of locomotives, on the basis of one pit for every 14 engines, the total repair accommodation required is 104 pits.

209. In the existing loco. shops of the North-Western Railway there is the following pit accommodation :—

Moghulpura	..	..	..	..	80 pits.
Rawalpindi	..	..	..	..	12 pits.
Sukkur	..	..	..	..	12 pits.
Karachi	..	..	..	..	16 pits.

a total of 120 pits in all.

210. This would indicate that the North-Western Railway have at present ample shop accommodation for all the locomotives they have in use, and this, moreover, was the decision we arrived at in our inspection of the shops on that system.

211. We give below figures of time taken to repair a locomotive in all shops from which it will be seen that, on the whole, repairs in workshops on the North-Western Railway, are being carried out fairly expeditiously as far as broad gauge locomotives are concerned. The same cannot be said about narrow gauge engines and the figures for these should be reduced to the same as for broad gauge.

212. TABLE XXII.—Locomotives.—Outturn of repairs.

Workshops.	Average period between heavy repairs.		Average monthly outturn of heavy repairs.	Average days taken per heavy repair.	Average days all engines are out of service for all repairs.
	Days.	Mileage.			
<b>Eastern Bengal Railway—</b>					
Kanchrapara . . . . .	F.G. 943	74,795	6.2	141	115
	N.G. 1,070	35,815	.4		
Saidpur . . . . .	M.G. 1,127	76,179	5.25	161	143
	N.G. 725	32,945	.2		
Dacca . . . . .	M.G. 1,658	92,837	.75	148	67
<b>East Indian Railway—</b>					
Jamalpur . . . . .	B.G. 1,197	92,457	29	101	101
<b>Oudh and Rohilkhand Railway—</b>					
Lucknow . . . . .	..	..	13	98	..
<b>Great Indian Peninsula Railway—</b>					
Parel . . . . .	B.G. 1,048	61,879	21.6	144	111
Jhansi . . . . .	" ..	..	21.3	69	..
<b>North-Western Railway—</b>					
Moghalpura . . . . .	" 750	49,121	33.3	77	83
	N.G.	..	.25	..	..
Rawalpindi . . . . .	B.G. 1,050	48,599	6.3	61	75
	N.G. 960	43,656	1.4	171	..
Sukkur . . . . .	B.G. 863	47,578	6.2	74	104
	N.G. 480	35,879	.5	132	..
Karachi . . . . .	B.G. 930	40,439	5.5	69	78
Kalka . . . . .	N.G. 600	31,254	1.6	52	51

213. When, however, the question of whether repairs are being carried out *economically* is investigated, a very different state of affairs is, unfortunately revealed. In this respect the North-Western Railway, is distinctly bad.

214. In tables VI and VIII, paragraphs 163 and 167, the figures of cost of a heavy repair, and cost of maintenance and repairs per thousand engine miles, will be found, which clearly demonstrate the very inefficient and uneconomical manner in which the shops are at present functioning.

215. As far as the Moghalpura shops are concerned, we attribute this to their many inherent weaknesses, reference to which we have already made in the description of these works and our visit to them.

216. We have already referred to the paucity of superior supervising posts for the administration of the mechanical workshops on the North-Western Railway, and this we consider will have to be rectified promptly if adequate effect is to be given to our other recommendations.

217. These latter are—

I. The immediate introduction of—

- (a) a progress system for the scheduling of engine repairs, throughout the works,
- (b) a planning and production department. This department is most urgently required and its first duty will be to organise the shops for the manufacture of spare parts for stock and for supply to all subsidiary shops.

II. The placing of inspection work on a proper footing.

III. The use of gauges to be extended throughout the shops and improved methods introduced in respect to machining operations.

218. A further recommendation regarding these shops, namely the introduction of a metallurgical department, will be referred to later, when the advisability of instituting such a department on all large railways is considered.

219. The only remodelling contemplated in Moghulpura shops at present is for extensions to the boiler shop and the iron foundry, and in neither case do we consider that the proposal can be justified. We have in paragraph No. 29 referred to the state of affairs in the boiler shop and we are decidedly of the opinion that the present congestion in this shop is entirely due to the cause we cited—namely the accumulation of old boilers, repairs to which had been neglected. Moreover, we are recommending later in paragraph No. 415 that the accepted economic life of a locomotive boiler should be considerably reduced and if effect is given to this recommendation, the state of affairs should materially improve. The case of the foundry will be covered by our general recommendations regarding centralising foundry work.

#### *Rawalpindi Shops.*

220. The position as regards Rawalpindi shops is somewhat different. We noticed the same deficiencies in respect to the organisation as at Moghulpura, but the shops are so laid out as to be incapable of much improvement short of entire rebuilding. Moreover, we are rather sceptical of shops of this size—even if equipped on up-to-date lines—being able to undertake heavy repairs to locomotives as economically as in large shops. We, therefore recommend that the loco. shops at Rawalpindi be closed down entirely. The only objection to this that we can anticipate is the fact that these shops deal with the narrow gauge engines on the frontier lines. This objection is not, in our opinion, of much consideration as the narrow gauge engines for repairs in Rawalpindi shops have in any case to be loaded up in trucks and they can easily be sent the additional 190 miles to Moghulpura shops. Our recommendations regarding the use of the vacated site at Rawalpindi will be given when we discuss the question of locating a wagon repair shop there.

#### *Karachi and Sukkur Shops.*

221. As regards the question of repair facilities on the Southern section, we have already remarked on the existing loco. shops at Karachi and Sukkur. We note, too, that the North-Western Railway have put forward

proposals to remodel both of these shops. This is, in our opinion, inadvisable and we recommend that Karachi loco. shops be closed down entirely and a new 40 pit shop laid down at Sukkur. This latter should be thoroughly up-to-date and capable of dealing with the largest types of engines likely to be used on the North-Western Railway, in future years. It should, too, be laid out in such a way as to be capable of expansion at any time to not less than 80 pits.

*East Indian Railway.*

222. The authorised stock of locomotives on the combined East Indian Railway system is 1,684.

223. To deal with this stock, shop accommodation to the extent of 121 pits appears to be necessary but the actual existing accommodation falls considerably short of this, there being a total of only 94 pits—64 at Jamalpur and 30 at Lucknow. An extension to the latter bringing it up to 60 pits is already well in hand and should be ample for present requirements.

*Jamalpur Shops.*

224. Referring again to Table XXII, paragraph 212 it will be seen that the time taken to repair an engine is high at both Jamalpur and Lucknow. Figures of cost, however (*vide* Table VI, paragraph 163) are considerably in favour of the former. This is to a large extent due to abnormally low cost of labour at Jamalpur, and should not be taken to indicate any special efficiency in the working of these shops. In fact, this would be an erroneous conclusion as these works are labouring under such extraordinary disadvantages, due to bad and congested layout and poor equipment that the low cost of labour has been their saving factor. In spite, therefore, of the favourable figures of cost, Jamalpur shops are certainly not dealing as expeditiously or economically, as they might, with the work required of them.

225. We have already referred in sufficient detail to the factors that have brought about this state of affairs and in recommending a very extensive remodelling of these shops, we are only confirming a course of action which has long been realised to be inevitable. The question of what accommodation will be required in the remodelled shops falls more appropriately under our second term of reference and we will confine ourselves here to the more immediate necessities of the shops in the way of organisation for efficient handling of the work.

226. In this connection, our remarks regarding Moghulpura loco. shops apply to Jamalpur shops with almost equal force. The Jamalpur shops already have a Metallurgical Department, but planning, progressing of work, and inspection are little better than on the North-Western Railway. Their introduction is urgently required and will, we are convinced, result in very considerable economies. We would particularly emphasise the necessity for these departments at Jamalpur as the works in addition to carrying out repairs to locomotives, are utilised for the manufacture of very large quantities of other railway material.

*Lucknow Shops.*

227. As regards Lucknow, we are in a position to say very little, as the extensions to these shops are already in hand. We are inclined to think,

however, that these new shops have been designed with the express intention of being strictly self-contained. At the risk of over-stressing the advantages of Jamalpur, we are of the opinion that this has been a not altogether wise step. The figures of time taken and cost of heavy repair at Lucknow are not good, and a considerable amount of work is being done at these shops which might with advantage have been diverted gradually to Jamalpur. For the same reason we are of opinion that the auxiliary shops at Lucknow, more particularly the machine shop, smithy, and foundries have been laid out too generously in size and equipment in view of the fact that centralisation of manufacturing work at the cheapest centre is desirable. As has been stated, however, the remodelling of Lucknow shops is already in hand and we are, perforce, compelled to confine our recommendations to the questions of planning and progressing of work. The necessity for these is as vital as in other shops and should be instituted without undue delay.

#### *Great Indian Peninsula Railway.*

228. Like the North-Western Railway, the Great Indian Peninsula Railway have more locomotives than they require, and the existing repair accommodation is also in excess.

229. The authorised stock of locomotives is 1,281 broad gauge and 15 narrow gauge, but working on the basis mentioned in paragraph 205, we have assessed their requirements at a total of 1,181 locomotives. For the maintenance of this stock, 84 pits are required, whereas the actual existing shops have 119 pits—64 at Parel and 55 at Jhansi. Referring again to Table XXII, paragraph 212, it will be seen that there are considerable differences in the results being achieved at the two locomotive workshops, Parel and Jhansi, more particularly with respect to the time taken for a heavy repair. Parel is taking 144 days which is, in our opinion, an absurdly high figure, and one which can readily be reduced.

#### *Parel Shops.*

230. As regards costs, the labour charges per heavy repair at Parel are Rs. 7,000. This figure although startlingly high at first glance, is not excessive when the very high labour rate and tractive force of locomotives dealt with are taken into consideration. The average monthly wage of a workman at Parel is Rs. 44.62 as against Rs. 20.8 at Jamalpur, and if the labour cost per heavy repair at Parel be reduced in the same ratio, the effect of this factor is very strikingly demonstrated. Also in further mitigation of the high cost at Parel (and the excessive time taken), it must be borne in mind that the shops have been carrying out a very extensive programme of superheating and they are also spending large sums on the replacement of non-standard parts as engines pass through shops. As far as Parel, therefore, is concerned, we consider that, although not carrying out repairs as expeditiously as they might, they are, nevertheless, working fairly efficiently. As regards the standard of workmanship, this is very good indeed, and the methods of working in the shops are excellent.

231. Parel is the only shop in which properly organised Planning and Progress departments are in operation and from what we saw of the results that had been achieved since their introduction we are perfectly satisfied that something on similar lines is urgently required for all the larger workshops on other railways.

Also the Parel system of scheduling engine repairs might, in our opinion, usefully serve as a pattern (with modifications to suit the particular circumstances) for other shops.

232. There is no large remodelling of Parel shops contemplated in the near future and none that we can usefully recommend.

*Jhansi Loco. Shops.*

233. As regards Jhansi, the position is still more satisfactory. From the figures in Tables XXII and VI, paragraphs 212 and 163, it will be seen that the time taken to carry out a heavy repair is 69 days—(we were given to understand that this is now being reduced to 50)—and that the labour costs for the same are the lowest of any shop on State Railways. This is no doubt partly due to the low labour rate in Jhansi district, but mostly, we are convinced, to the thoroughly efficient lines in which the shops are being run. For the economical and expeditious carrying out of the repair work required of it, we are decidedly of the opinion that Jhansi Loco. Shops are far and away the best visited by us in the course of our tour.

234. We have already referred in some detail to a few of the practices in vogue in these shops and to the systematic endeavours that have been made to eliminate all obsolete and haphazard methods of working. These are meeting with a very considerable measure of success, and we strongly recommend their enforcement in other workshops. The existing loco. shops at Jhansi are unfortunately not big enough to deal with anything but the smaller types of engines. A remodelling scheme to remove this disability is, however, in hand and, with certain modifications referred to in paragraph 325, we recommend its expedition.

235. Also we are of the opinion that consideration might profitably be given to the suggestion that the remodelling should include facilities for the gradual transference of as much manufacturing work as possible from Parel to Jhansi. The labour rate at the former is not likely to decrease, and although its reduction as a repair shop is not advocated, we consider that it would be economical to relieve it of all work that could possibly be done in a workshop where labour rates are more favourable.

*Eastern Bengal Railway.*

236. The Eastern Bengal Railway have an authorised stock of 309 broad gauge and 231 metre gauge locomotives. For this they have pit accommodation at Kanchrapara for 22 and at Saidpur for 21 as against requirements of 22 and 17 respectively, as calculated by the empirical formula.

237. This would seem to indicate that the Eastern Bengal Railway have sufficient accommodation to deal with all their locomotives, but actually owing to the congestion and inefficiency of the shops, this is not strictly correct.

*Kanchrapara Loco. Shops.*

238. So far as Kanchrapara is concerned, we have already noted on the state of the shops there, and under the Second Term of Reference we are giving our views on the remodelling scheme now in hand. That this remodelling scheme, however, needs to be expedited, is made abundantly clear by an examination of the figures of cost and time taken given in Tables XXII and VI, paragraphs 212 and 163. The time taken for a heavy



repair (141 days) is of course, absurdly high, and the cost equally so—especially when it is borne in mind that the labour rate at Kanchrapara is comparatively low.

239. There is no doubt that this state of affairs is largely due to the hopeless congestion and inadequate equipment of the existing shops. Much more than remodelling, however, will have to be done to put the work on a really satisfactory basis. The internal organisation of the shops is very poor indeed and the recommendations we made in the case of Moghulpura Loco. Shops regarding Progress, Inspection and Planning are equally applicable to Kanchrapara. So far as the actual pit accommodation is concerned, we do not consider that any more than exists at present is required, but the remodelling and reorganisation must be completed without delay if the present unsatisfactory state of affairs is not to continue.

#### *Saidpur Loco. Shops.*

240. The condition of Saidpur shops has already been fairly clearly indicated and the figures in Table XXII are sufficient testimony to their inadequacy for the work required of them.

241. The present site, layout and equipment are all against any attempt to improve the shops as they stand, and we are, therefore, emphatically of the opinion that complete rebuilding is the only adequate way of dealing with the situation. There is no doubt that Saidpur must be retained as a repair centre and we consider that a really efficient, up-to-date shop of about 15 pit capacity would meet requirements. In view of the fact that the Broad Gauge Section of the Eastern Bengal Railway is being extended, we are of the opinion that a shop of this size would be sufficient, but to meet the eventuality of the Dacca section being connected with the rest of the Metre Gauge system, the layout should be such as would allow easy expansion. We have not, however, had laid before us any plans of the proposed alterations to these shops that we could definitely approve of.

## CHAPTER V.

**Term I (contd.).—The capacity or otherwise of the existing workshops of State Railways to deal economically and expeditiously with the maintenance of Rolling Stock at the present time.—Carriage and Wagon Shops.**

242. In exactly the same way as for locomotives we have adopted an empirical estimate of the total shop accommodation required on each system to deal with the total stock of coaching and goods vehicles. This we have done as follows :—

### *Formula for Shop Accommodation.*

243. For coaching vehicles, we have assumed that these are required to pass through shops for repairs every 18 months. In some cases, this period is probably too long and in others too short, but as an average for all classes of coaching vehicles it represents, in our opinion, a fair estimate of what ought to be done.

244. To deal with the coaching vehicles coming in after this period the total covered accommodation in all the workshops on any particular system should provide for the following percentages of the authorised stock :—

(a) In repair shop and lifting shop ..	..	3 per cent.
(b) In paint shop, excluding accommodation for painting new vehicles ..	..	4 per cent.
		—
Total ..	..	7 per cent.
		—

245. This accommodation allows an average of 40 days for coaching vehicles to remain in shops for all classes of repairs.

246. For goods vehicles, we have assumed a figure of 2 years as the period after which they should ordinarily require to come to shops for repairs, and for this, covered accommodation in all workshops of the system should provide for 1.25 per cent. of the authorised stock.

247. This accommodation allows an average of 10 days for goods vehicles to remain in shops for all classes of repairs.

248. As regards carriage-building, the accommodation provided should be sufficient to allow of 12½ per cent. of the annual programme of new building being laid down at any one time.

249. We would repeat again that the above estimate is not to be treated as an irreducible minimum.

250. Before proceeding to discuss the capabilities of the carriage and wagon shops on each railway, it would perhaps be as well if we stated here the general principle underlying our recommendations for the repairs of rolling stock generally.

*Concentration of Repairs.*

251. In the case of locomotives, we have followed the generally accepted idea that concentration of repairs in one, or at the most two, large workshops is best, and except in the case of the North-Western Railway, we found that all railways had distributed their repair facilities on this principle.

252. As regards coaching vehicles, we are also of the opinion that repairs are best executed in large workshops and at as few places as the size of the line will economically permit.

253. In the case of goods vehicles, however, we consider that the reverse holds good, and that it is advantageous to provide repair shops for these at several points on the system. In this we are departing somewhat from the practice that seems to have prevailed on State Railways in the past, but our views in this connection are nevertheless in keeping with the best modern practice.

*North-Western Railway.*

254. On the basis mentioned in paragraphs 243 to 248, the position on the North-Western Railway is that the shops all round have sufficient accommodation for the repairs to the stock of coaching vehicles, but the *distribution* of the repair facilities for these is, in our opinion, not as good as it might be.

255. Covered repair accommodation for wagons is, on the other hand, very deficient and we will deal with this later in our recommendations.

256. Below are given figures of time taken to execute repairs to both coaching and goods vehicles; figures of cost are shown at table VII. From these it will be seen that, although the North-Western Railway shops compare quite favourably with other railways, they could not, by any means, be said to be working either expeditiously or economically.

257. TABLE XXIII.—*Carriage and Wagon Stock—Outturn of Repairs.*  
(Coaching Vehicles).

Workshop.	Average period between heavy repairs.	Average monthly outturn in four-wheeler.	Average days taken per repair.	Average days all vehicles are out of service for all repairs.
<i>Eastern Bengal Railway—</i>				
Kanchrapara . . . . .	Days.			
Saidpur . . . . . M. G.	840	50	84	58
. . . . . N. G.	878	60	132	80
. . . . . M. G.	824		89	
Dacca . . . . .	878	56	46	..
<i>East Indian Railway—</i>				
Lillooah . . . . .	1,642	331	71	56
<i>Outh and Rohilkhand Railway—</i>				
Lucknow . . . . .	730	168	38	..
<i>Great Indian Peninsula Railway—</i>				
Matunga . . . . .	894	69	159	91
Jhansi . . . . .		41	38	38
Bhusawal . . . . .		14	134	134
<i>North-Western Railway—</i>				
Moghulpura . . . . .	..	419	76	21
Rawalpindi . . . . .	..	92	70	
Sukkur . . . . .	446	56	44	
Karachi . . . . .	..	38	34	
Kalka . . . . . N. G.	281	13	56	

258. TABLE XXIV-B.—*Carriage and Wagon Stock—Outturn of Repairs. (Wagons).*

Workshop.	Average period between heavy repairs.	Average monthly outturn in four-wheelers.	Average days taken per repair.	Average days all goods vehicles are out of service for all repairs.	
	Days.				
<i>E. B. Railway—</i>					
Kanchrapara . . . . .	843	324	58	54	
Saidpur . . . . .	M. G. 878	} 148	89	66	
	N. G. 1,108		35	..	
Dacca . . . . .	M. G. 878	37	76	66	
<i>E. I. Railway—</i>					
Lillooah . . . . .	1,095	1,908	10	6	
Ondal . . . . .	1,095	132	37	21	
<i>O. and R. Railway—</i>					
Lucknow . . . . .	730	328	84	..	
<i>G. I. P. Railway—</i>					
Matunga . . . . .	} 822	} 352	30	29	
Jhansi . . . . .			274	14	13
Bhusawal . . . . .			169	21	21
<i>N. W. Railway—</i>					
Moghulpura . . . . .	} 541	} 798	52	.	
Rawalpindi . . . . .			210	25	.
Sukkur . . . . .	} 282	} 205	20	..	
Karachi . . . . .			250	24	..
Kalka . . . . .			15	37	..

*Moghulpura Carriage and Wagon Shops.*

259. We would here invite a reference to our earlier remarks on these shops. These shops have, as we stated, the same inherent weaknesses of organisation as the Moghulpura Loco. Shops, and our recommendations for the one apply to the other. The carriage shops are well equipped—and except for one or two minor defects already referred to—well laid out. With adequate planning and progressing of work, therefore, great improvements should be possible. Again, however, as in the case of the loco. shops, we have to call attention to the total inadequacy of the existing supervision as far as superior posts are concerned, and we are strongly of the opinion that, if this is not rectified promptly, the effect of our other recommendations will be seriously impaired, if not rendered quite impossible.

260. As far as the new shops required by the North-Western Railway—and the remodelling of the existing ones—are concerned, we are not in entire agreement with the proposals put forward by the railway administration. Our objections principally follow the lines of the opinions expressed by us in paragraph 263.

*Rawalpindi, Karachi and Sukkur Shops.*

261. As regards carriage repair shops, we agree that the work now being done at Rawalpindi, Karachi and Sukkur should be concentrated in one shop, but we do not concur that Karachi is the best location; in our opinion, Sukkur is preferable in every way. Labour is cheaper (by over 25 per cent.) ; fuel is less costly ; and the humidity is much lower—resulting in a saving of time in the paint shop. Moreover, Sukkur is, in our opinion, a more favourable centre for the collection of coaching stock requiring repairs, situated as it is at the junction of the Quetta Section with the main Lahore-Karachi line.

262. We therefore recommend that a new and up-to-date carriage repair shop be put down at Sukkur, with covered accommodation for about 75 units. This would be sufficient to deal with all the work now being done by the three small shops, and Karachi and Rawalpindi could be closed down as carriage repair centres.

263. We recommend, however, the retention of both Karachi and Rawalpindi as wagon repair shops. As we have already said, we are strongly of the opinion that distribution of wagon repairs at several places on a big system like the North-Western Railway, is very advisable, and as the wagon repair accommodation on this railway is extremely poor, we recommend that this be rectified by providing considerably increased facilities at the three stations—Sukkur, Karachi and Rawalpindi. The total covered accommodation in the existing shops is all at Moghulpura and this is only sufficient for 180 wagons, as against requirements of nearly 400. Moghulpura shops, in our opinion, are dealing with more than their proper share of wagon repairs for the line, and no additional facilities should be provided there. Karachi, we consider, is the next best centre for this work. Wagons are always liable to damage at a port, and we recommend that a well equipped shop capable of accommodating 100 wagons should be laid down there.

264. Accommodation for still another 100 wagons is required on the North-Western Railway, and this, we consider, should be divided equally between Rawalpindi and Sukkur. A shop of this size at Rawalpindi (that is, for 50) ought to be capable of dealing with the whole of the Northern Section, and should relieve Moghulpura considerably. As regards Sukkur, we are of the opinion that it would be inadvisable to make the wagon repair shop there bigger than the 50-wagon capacity suggested, as the concentration on carriage repair work would otherwise be interfered with.

265. Our recommendations provide covered accommodation for a total of 380 wagons. The proposed wagon repair shops should be laid out in such a way as to be capable of easy expansion at a future date.

266. Summarised, therefore, our recommendations for repair work in the North-Western Railway carriage and wagon shops are :—

*I.—Administration.*

Re-organisation of the workshops on the same lines as recommended for the loco. shops.

## II.—*Rebuilding and Remodelling.*

- (a) Karachi and Rawalpindi to be closed down as carriage repair shops.
- (b) An up-to-date carriage repair shop to be laid down at Sukkur capable of dealing with all the coaching stock previously repaired at the smaller shops.
- (c) Wagon repair shops to be provided at the following places in addition to the existing shop at Moghulpura :—
- |                |    |  |
|----------------|----|--|
| (i) Rawalpindi | .. | With covered accommodation for 50 wagons.  |
| (ii) Sukkur    | .. | With covered accommodation for 50 wagons.  |
| (iii) Karachi  | .. | With covered accommodation for 100 wagons. |

267. As regards building of new coaching vehicles, this question is referred to later, under our recommendations in regard to concentration of manufacturing work.

### *East Indian Railway.*

268. The position in the two carriage and wagon shops of the East Indian Railway—Lillooah and Lucknow,—is as follows :—

269. The total covered accommodation for coaching repairs is deficient, but not excessively so. The balance, however, between this and the paint shop accommodation is very bad. Of the latter, Lillooah is in excess and Lucknow is deficient. This will, however, be put right as far as Lucknow is concerned in the remodelling of these shops now in hand, leaving a considerable excess of paint shop accommodation at Lillooah, but this will be rectified if the recommendations we are making in a later paragraph regarding an increased amount of new building being undertaken at Lillooah, are given effect to.

### *Lillooah and Lucknow Shops.*

270. As regards the manner in which repairs to carriages are being carried out, both shops compare very favourably with those on other railways. Tables VI and XXIII, paras. 165 and 257 give figures of cost of repair and time taken respectively. The latter for Lillooah is, we consider, too high, whereas the figure for Lucknow (38 days) is very good indeed.

271. As regards costs, both shops are good, and if our general recommendations for the placing of the work on an organised basis are carried out, these figures should be further reduced.

272. Except on the carriage building side, the existing organisation (in both shops) is very weak, and has the same deficiency of planning, inspection, gauging, and progressing of work, noticed in the majority of shops both loco. and carriage.

273. In the case of wagons, the East Indian Railway possess very inadequate accommodation, and we are recommending that this be considerably increased. The cost of wagon repairs, both at Lillooah

and Lucknow, is not excessive when compared with other railways but the time taken at the latter shop is absurdly high and will have to be brought down.

274. We have already outlined the remodelling schemes proposed for these shops and we also noted that Lucknow was to be used for repair work only. With this we agree ; in fact on account of the slightly lower labour rate prevailing at Lucknow, we recommend that any future extensions for carriage repairs should be made at this shop rather than at Lillooah, leaving the latter free to concentrate on new building and wagon repairs.

275. As regards wagon repair facilities, we recommend that the capacity of Lillooah for this work should be increased by 50 per cent. Even when this is done, the East Indian Railway will still be nearly 300 units capacity in deficit and this, we recommend should be distributed between Lucknow and Ondal in such proportion as may be considered advantageous.

#### *Great Indian Peninsula Railway.*

276. The position on the Great Indian Peninsula Railway with regard to carriage and wagon repairs is unsatisfactory. The accommodation specifically allotted to carriage repairs is insufficient, but actually with a re-arrangement of the existing shops at Matunga, ample accommodation can be made available almost immediately. Wagon repair facilities, as on all other railways, are inadequate.

277. In our description of Matunga we remarked on the inefficient manner in which these works were functioning, in spite of the fact that they are modern and well laid out shops.

278. A heavy repair to a coaching vehicle in Matunga shops takes 159 days and costs Rs. 2,877, being the highest figures of any shop on State Railways.

279. In Jhansi carriage and wagon shops the cost of a heavy repair to a coaching vehicle is higher than it should be, but the time taken is satisfactory ; also the figures for wagon repairs are very good indeed. On the whole, Jhansi can be said to be carrying out its share of the work economically and expeditiously.

#### *Matunga Carriage and Wagon Shops.*

280. As far as Matunga is concerned, the reasons for the present state of affairs are not difficult to trace ; firstly, there are the natural disadvantages of expensive and unstable labour ; secondly, the manpower of the shops has for some time back been kept very low ; thirdly, the superior supervision is distinctly inadequate.

281. Still another reason could be found in the tremendous arrears of repairs to coaching vehicles that have accumulated during the last ten years, but whether this is cause or effect, it would be difficult to say.

282. Any reorganisation of these shops will necessarily be a long business, but much can be done immediately by the introduction of properly organised planning and production ; and in this connection, we understand that a Production Engineer has recently been appointed.

283. In paragraph 276, we spoke of the inadequacy of the accommodation actually allotted to coaching repairs. The carriage shop at Matunga is certainly too small for the work it is required to do (having covered accommodation for 48 units only), but immediately adjoining is a large steel-work erecting shop. The use to which it was originally intended to put this shop is rather a mystery, but that it is not all required for the purpose for which it has been used is certain, and we recommend that a part of this shop be commandeered for carriage repairs—sufficient to bring the total covered accommodation up to 80 units.

284. Apart from this, one or two other proposals have been submitted. One of these is for a new train-lighting shop which we recommend should be carried out. Another is for an extension to the sawmill which is certainly not justifiable and, in our opinion, should not be proceeded with. We consider, however, that the lifting facilities both on the Carriage and on the Wagon sides are inadequate and provision should be made for additional crane power.

#### *Jhansi Carriage and Wagon Shops.*

285. Jhansi shop remodelling proposals provide for 96 units, but this is, in our opinion, excessive, and we recommend that it be cut down to 48. The total of 128 thus made available for carriage repairs should be ample for increased requirements during the next ten years.

286. As regards wagons, there is covered repair accommodation at Matunga sufficient for 72 wagons only. We recommend, therefore, that the existing shop be extended by four bays bringing the total capacity up to approximately 105.

287. In addition to this, covered accommodation for nearly 200 wagons is required on the Great Indian Peninsula Railway, and for this, we recommend that the new shops at Jhansi should be of 120 capacity, and that an up-to-date shop of 75 wagons capacity be put down at Bhusawal.

288. We are dealing separately with the building of new coaching vehicles for all State Railways, but we may state here that in view of the high cost of labour in the Matunga shops, we are recommending that they be relieved of all new building except for their requirements in respect to upper class bogies.

#### *Eastern Bengal Railway.*

289. In the carriage and wagon works of the Eastern Bengal Railway, we had occasion to remark on the extraordinary lack of balance between the various shops, especially at Kanchrapara. This defect has seriously affected their efficiency.

#### *Kanchrapara Carriage and Wagon Shops.*

290. Taking broad gauge stock first, the carriage repair shop at Kanchrapara is big enough to deal with more than  $2\frac{1}{2}$  times the number of coaching vehicles now running on the system, whereas the wheel shop and machine shop are inadequate to deal with present requirements.

291. This, coupled with the fact that there is no proper organisation for repair work or manufacture of spare parts, has resulted in coaching repairs being both costly and slow. The first requirement is that the proper balance of the various shops for carriage repair work should be restored by increasing the plant and equipment in the wheel and machine



shops. This has not up to now been put forward, but is, in our opinion, imperative.

292. In the case of wagons, matters are somewhat similar. The repair shop is good, but inadequate in size. The time for a repair is, moreover, absurdly high, and the cost considerably more than it should be.

293. We recommend that the existing repair shop accommodation be doubled, bringing the total capacity up to 120.

294. The whole shop, too, should be re-organised on an efficient basis, work must be progressed, and planning and production departments instituted as soon as staff for this purpose is available.

#### *Saidpur Carriage and Wagon Shops.*

295. As regards the metre gauge stock, we have already remarked on the extremely inefficient and uneconomical way in which we found the Saidpur shops to be working. The impressions received at the time of our visit are amply confirmed by figures of time taken to, and cost of, repairs—both coaching and goods. We have, moreover, already expressed the opinion that the existing layout, equipment, and facilities generally are such as to make remodelling of the shops as they stand impossible, except at prohibitive cost.

296. We, therefore, recommend that Saidpur carriage and wagon shops be entirely rebuilt on modern up-to-date lines properly laid out and equipped. The size of this shop should be about the same as at present for coaching stock (namely of 45 and 50 units capacity), but the wagon repair shop accommodation will have to be increased considerably—up to about 80-wagon capacity.

297. In the meantime, Saidpur shops should be relieved of as much manufacturing work as possible.

#### *Dacca Shops.*

298. There is a small metre gauge repair shop at Dacca which will have to be retained in the meantime, but when this section is joined up to the rest of the metre gauge line, Dacca shops should be closed down ; they should, moreover, be relieved of all manufacturing work at once.

#### *The Present Position.*

299. In the preceding paragraphs, we have examined each of the important mechanical workshops in detail and recommended measures, the adoption of which would enable them to deal with the work of maintenance and repairs economically and expeditiously. We regret to have to record that, (with the exception of one or two workshops) the work of repairs and maintenance of rolling stock is not being carried out either economically or expeditiously, for reasons we have stated. That the existing workshops have been able to maintain the rolling stock in safe running condition, there is not a vestige of a doubt ; but this has been accomplished at the expense of more time and money than is called for by the conditions that prevail on each railway. Our recommendations contemplate in cases, rebuilding and remodelling of workshops, and lay stress upon the need for revised organisation with respect to the methods of production, the adoption of a universal system of progressing work through the shops, and the more adequate use of cost data.

## CHAPTER VI.

**Term II.—The necessity or otherwise of enlarging and extending the existing workshops, man-power and machinery with a view to the maintenance of an increased quantity of rolling stock.**

300. From our remarks in respect to the First Term of Reference, it will have been noted that we frequently, for the sake of continuity of narrative, had to anticipate on certain points that ought, strictly speaking, to have been reserved for our Second Term of Reference.

301. Moreover, our recommendations were so frequently for remodeling, and in some cases for rebuilding of the existing shops, that it would have been manifestly impracticable for us to have specified only such remodeling as was strictly necessary for immediate requirements.

302. As a result, therefore, our recommendations under this Term of Reference will be, in many cases, a repetition of our remarks under Term I, or at most an elaboration of them.

303. No specific period has been laid down with regard to possible increased requirements of repair facilities, but for convenience, we have confined ourselves to the ten years ending 1935. We have chosen this period partly because we felt that it is the longest for which it is safe to make definite predictions, but principally on account of railways not being able to supply us with figures of estimated requirements of rolling stock beyond 1935. As it is, many of the figures supplied us as the probable requirements at this latter date seem to us to have been calculated in a very arbitrary fashion, but we have had perforce to accept them, in default of more reliable data.

304. TABLE XXV.—*Locomotives—Anticipated increase in the next ten years.*

Railways.	Number		Average tractive effort		Percentage of increase	
	on 1-4-25	on 1-4-35	on 1-4-25	on 1-4-35	on number.	on tractive power.
			lbs.	lbs.		
<i>E. B. Railway—</i>						
B. G. . . . .	293	335	12,398	24,852	14.3	35
M. G. . . . .	241	214	13,578	16,281	—11.2	19.9
N. G. . . . .	11	12	3,614	3,817	9.1	5.6
<i>E. I. Railway</i> . . . . .	1,349	1,472	19,174	24,060	9.1	25.5
<i>O. and R. Railway</i> . . . . .	316	316	18,183	18,183	..	..
<i>G. I. P. Railway</i> . . . . .	1,281	1,222	22,975	28,330	—4.6	23.6
<i>N.-W. Railway—</i>						
B. G. . . . .	1,554 (plus 53)	1,965	21,460	25,613	26	19.4
N. G. . . . .	99 (plus 1)	129	13,200	12,450	30	—5.7

305. TABLE XXVI.—*Carriage and Wagon Stock—Anticipated Increase in the next ten years.*

Railways.	Coaching vehicles in four-wheelers			Goods vehicles in four-wheelers.		
	on 1-4-25.	on 1-4-35.	Increase per cent.	on 1-4-25.	on 1-4-35.	Increase per cent.
E. B. Railway—						
B. G. . . . .	1,475	1,903	29·00	8,791	8,791	..
M. G. . . . .	1,501	1,503	·13	6,836	6,836	..
N. G. . . . .	27	27	..	66	66	..
E. I. Railway . . . . .	4,098	5,100	24·4	47,123	55,200	17
O. and R. Railway . . . . .	1,656	1,666	·60	8,476	8,476	..
G. I. P. Railway . . . . .	3,743	4,253	13·6	22,684	24,844	9·5
N.-W. Railway—						
B. G. . . . .	5,787	6,762	16·8	31,844	41,115	29·1
N. G. . . . .	494	527	6·8	1,256	1,326	5·6

*North-Western Railway Locomotive Shops.*

306. The estimated stock of locomotives, both broad gauge and narrow gauge, on the North-Western Railway in 1935 totals 2,094. This figure seems high and on the basis of the formula given in paragraph 205, will require repair accommodation of 150 pits,—that is, nearly 50 per cent. more than present requirements.

307. We have already recommended the distribution of all locomotive repairs between Moghulpura and Sukkur and we further stipulated that the new shop at Sukkur should provide 40 pits in the first instance, but be capable of expansion to 80. The first stage,—namely the existing 80 pits at Moghulpura and a new 40 pit shop at Sukkur will be sufficient for the repairs of nearly 1,700 locomotives, which is, in our opinion, more than will be required for several years to come.

308. In the event of the North-Western Railway's predictions of requirements in 1935 materialising, the total of 150 pits could be made up by extending Sukkur, but we recommend that this should be done only as, and when, necessity arises.

*Carriage and Wagon Shops.*

309. We have nothing further to add to the recommendations we have already made regarding these shops.

310. Carriage repairs will continue to be distributed between Moghulpura and Sukkur and any increased accommodation that may be required should be provided by extending the latter.

311. Wagon repairs will be carried out at the four centres previously mentioned, and as all are to be laid out so that they will be readily capable of expansion, it would be absurd for us to stipulate which shop ought to be extended to cope with future requirements. This should be done at the place where facilities are found to be most urgently needed or at which the best results are being obtained.

*East Indian Railway Locomotive Shops.*

312. The estimated stock of locomotives on the East Indian Railway in 1935 is 1,788. For these, accommodation of 128 pits will be required as against the present capacity of 94. Remodelling of Lucknow shops is already in progress, and the new shop of 60-pit capacity will relieve the immediate shortage of locomotive repair accommodation on the East Indian Railway. Jamalpur remodelling scheme is under consideration, but the proposals are for an erecting shop of 96 pits. This, in our opinion, is in excess of requirements and should be reduced to 70, which together with Lucknow will provide a total accommodation of 130 and should be sufficient for requirements up to 1935.

313. Had the remodelling at Lucknow not been so far advanced, we would have recommended a reduction in the size of these shops and accepted the proposals for more capacity at Jamalpur.

314. As things stand, however, the only recommendation we can make regarding Lucknow shops is that manufacture should be kept down as much as possible and that no further extensions should be contemplated there.

*Remodelling of Jamalpur Shops.*

315. Reverting to the problem to be dealt with at Jamalpur, we took the opportunity, when there, of examining the plans that have been got out for the rebuilding of these shops. We have already made it clear that we consider a very extensive remodelling unavoidable, but we are certainly not prepared to endorse the sweeping proposals at present under consideration. The plans that were put before us were for practically the complete demolition of the existing shops and their entire rebuilding, and we are decidedly of the opinion that no considerations could ever justify the enormous expenditure that such action would certainly entail.

316. Some of the existing shops will, we believe, certainly have to be pulled down, and at the present stage we are prepared to recommend that this should be done in the case of the large block of very old buildings comprising the brass foundry, wheel shop, general machine shop, boiler mounting and structural shop, loco. machine shop, brass finishing shop, and tin and copper smith shop. This site when cleared, would provide abundant accommodation for new erecting, tender and wheel shops, (as well as the smaller shops), with ample space for future extensions.

317. Moreover, still more space could, if ever required, be made available by extending this block on to the ground occupied by the old "round house" now being used as a stores building. This, however, we mention only as a possibility as we find it difficult to imagine that the present available area of over 3,00,000 square feet is ever likely to prove insufficient—at any rate for many years to come.

318. The present erecting shop is quite unsuitable for its duties, but it would make excellent machine and fitting shops, and we recommend that it be equipped for this purpose.

319. These constitute the only radical changes that we are prepared to recommend on the repair side of the works, unless possibly the question of extending the boiler shop be considered. We do not believe that this is required at present, but in the event of it becoming so, it should be extended on to the site now occupied by the signal and interlocking shop, and this latter—which is old and cramped for space—rebuilt elsewhere. The

plans we saw showed the boiler shop extended in the other direction necessitating the pulling down of the Loco. Superintendent's Office. This, in our opinion, would be quite unjustifiable, and should certainly not be contemplated. It will, however, certainly be necessary to provide increased crane capacity in the existing shop and this should be taken in hand irrespective of any extension.

320. As regards the manufacturing side of the shops, remodelling of this will depend on the decision that is come to regarding our recommendations on the subject of Jamalpur Shops undertaking the manufacture of spare parts for other railways, but the repair side is at present the portion of the shops that most urgently calls for remodelling and this work should be taken in hand without undue delay.

#### *Carriage and Wagon Shops.*

321. The question of the carriage and wagon shops on the East Indian Railway calls for no further comment than that already made under first term of reference.

322. Lucknow should continue to concentrate on carriage repairs and any increased facilities for this work should be made there.

323. As regards wagons, the question of whether any extensions required should be made at Lillooah, Lucknow or Ondal will naturally depend on the conditions prevailing at the time the necessity for extension arises.

#### *Great Indian Peninsula Railway Locomotive Shops.*

324. The estimated stock of steam locomotives on the Great Indian Peninsula Railway in 1935 is 1,260. For these, on the basis of 1 pit for every 14 engines on the line, 90 pits will be required. In addition, it is anticipated that the stock of electric locomotives will be 227. The latter will be dealt with at Parel where 14 pits will be utilised for this purpose, the number of pits for steam locomotives being reduced to 40. This will entail provision for 50 steam engine pits elsewhere, and will be provided at Jhansi.

#### *Remodelling of Jhansi Shops.*

325. We have examined the plans for the remodelling of the Jhansi loco. shops and are of the opinion that the proposals are in excess of requirements. We agree that the new erecting, boiler and tender shops are necessary, but we are unable to support the proposal to extend these in order to make provision for new paint and coppersmith's shops. A large increase in area available for the auxiliary shops will be brought about as a result of the removal of the erecting, boiler, tender and carriage shops, and this, in our opinion, will be more than sufficient for all requirements. Further, if our recommendations regarding Jhansi undertaking the manufacture of "spares" for other railways is given effect to, we consider the existing shops remodelled on the above lines will provide sufficient accommodation for the additional work that will have to be undertaken. On the other hand, in the event of Jhansi not being developed as a manufacturing shop, that portion of the carriage and wagon shop which it is proposed to utilise as brass and iron foundries will not be required and might be utilised elsewhere.

326. It will be seen, therefore, that the remodelled shop at Jhansi (which will have 50 pits) together with 40-pit accommodation left at Parel will be sufficient to deal with the anticipated stock of locomotives during the next ten years.

*Carriage and Wagon Shops.*

327. The recommendations that we have already made regarding the remodelling of the carriage and wagon shops on the Great Indian Peninsula Railway together with our proposal for the laying down of a new wagon repair shop at Bhusawal are sufficient for all estimated requirements of coaching and goods stock up to 1935.

*Eastern Bengal Railway.*

328. The estimated stock of broad gauge locomotives on the Eastern Bengal Railway in 1935, is 335, and to deal with this, pit capacity for 24 will be required. The remodelling of Kanchrapara loco. shops is making provision for this number so that all future requirements will be met with there.

329. From the drawings of the proposed remodelling shown to us, we are inclined to think that the new shops are needlessly large. For instance, the boiler shop will have an area of 1,400 square feet per erecting shop pit. This is excessive and should be cut down to 1,000 square feet. The length of the proposed shop is 480 feet so that if this were reduced to between 300 and 350 feet, ample accommodation would be provided. Also we fail to see the necessity for the frame park, which might, we think, be cut out.

330. The new steaming shop too, is considerably bigger than necessary. It has two tracks so that if the length were reduced from 140' to 70', it would still be capable of accommodating two engines at a time which is ample for a shop of this size.

331. Further, the fact must not be lost sight of that the electrification of the suburban lines round Calcutta may possibly be an accomplished fact in the space of a few years. Apart, therefore, from the points we mentioned above, careful consideration should be given to the question of laying out the new shops at Kanchrapara so that they could deal, if necessary, with electric locomotives and multiple unit stock.

332. As regards the metre gauge, the estimated stock of locomotives in 1935 is 231, and the new 15 pit shop proposed at Saidpur will be able to deal with all requirements of the metre gauge system.

*Carriage and Wagon Shops.*

333. The recommendations we have already made regarding the carriage and wagon shops on the Eastern Bengal Railway cover all requirements in the near future.

*Summary.*

334. It will be seen from the foregoing that we have recommended considerable 'cuts' in several of the proposed schemes for enlargement or extension of the mechanical workshops. The Chief Mechanical Engineers and Agents of the various Railways, responsible for the proposals we have criticised, have not been in the advantageous position we now occupy of examining the total requirements of all the State Railways

together. The large savings anticipated in capital outlay are rendered possible largely because the assumption of State Management of two large railway systems has made the pooling of repair and manufacturing facilities a practical proposition. We have not recommended any increase in either man-power or machinery, except to the extent that they form an integral part of the modified plans of remodelling or rebuilding we have accepted.

## CHAPTER VII.

**Term III.—The advisability of concentrating the manufacture of spare parts in one or more of the larger workshops and to relieve the repair shops of all such manufacturing processes.**

335. In investigating this subject we have interpreted our term of reference to refer only to such spare parts as can be manufactured in large quantities, and not to the everyday manufacturing requirements of the ordinary repair shop. It is patent that the latter could not be entirely depleted of facilities for a certain amount of manufacture and it would certainly not be economical, even if practicable, to make a repair shop dependent on a central source of supply for petty items of manufactured material required for say, some special purpose.

### *Two Classes of Spares.*

336. Again, those items which are required in large quantities fall under two distinct heads :—

(a) where the cost of material constitutes only a small fraction of the total cost of the article—as for instance, injector cones ;

(b) where the cost of material constitutes the biggest proportion of the total cost—for example, brake blocks and firebars,

and it does not follow that the circumstances best suited for the economical production of the one are similar to the other. The first would obviously be most economically manufactured in a locality where labour is cheap, whereas the second depends more on the proximity to (and therefore cheapness of) raw material.

337. These differences, however, while they affect such matters as the choice and number of sites required, are subsidiary to the main issue of the term of reference which is the *advisability* of concentrating the manufacture of spare parts. As regards this, our opinion is that it certainly is economical and desirable to do so, and we have been exercised more as to the site where such concentration should take place rather than in attempting to prove its obvious benefits.

338. Needless to say, the extraordinary advantages of Jamalpur as the site for a manufacturing shop make its selection an almost foregone conclusion ; and if we considered that concentration in one shop only would suffice to meet the requirements of all State Railways, we would recommend Jamalpur for this purpose. In our opinion, however, confining this work to one big shop to meet the requirements of all State Railways would be unwise and we are therefore recommending it being undertaken in two shops—Jamalpur and Jhansi.

339. In deciding on two shops we have followed the argument that it would be unwise to create an excessive concentration of labour in any one locality, and in fixing on the particular two shops mentioned above, we have been guided by considerations of geographical position for easy distribution of manufactured articles, cheapness of labour, fuel, etc., and the proximity to the sources of supply of raw material.

340. Our first choice—Jamalpur—certainly meets all these requirements in an almost phenomenal manner, as a glance at Tables XXVII and XXVIII on the next page, will show. Jhansi, although further from the coal and iron fields, is the next most favourable in these respects.



341. TABLE XXVII.—*Elements of Cost (Locomotive Shops).*

Workshop.	Labour.					Average labour turn-over percentage.
	Average monthly wage of subordinate supervising staff.	Average monthly wage of workmen.			Attendance.	
		Skilled.	Unskilled.	Skilled and unskilled.	Average daily absence percentage.	
	Rs.	Rs.	Rs.	Rs.		
<i>Eastern Bengal Railway—</i>						
Kanchrapara . . . . .	246	35.5	13.5	30.73	13	43
Saidpur . . . . .	273	31.1	13.6	27.58	8	12
Dacca . . . . .	330	29.5	12.9	23.9	7	14
<i>East Indian Railway—</i>						
Jamalpur . . . . .	156	20.6	13.6	18.93	8	8
<i>Oudh and Rohilkhand Railway—</i>						
Lucknow . . . . .	310	36.8	13.4	33.5	7	15
<i>Great Indian Peninsula Railway—</i>						
Parel . . . . .	223	53.6	28.4	44.62	15	39
Jhansi . . . . .	164	34.0	17.8	29.15	13	17
<i>North Western Railway—</i>						
Moghulpura . . . . .	156	50.4	18.8	41.99	9	9
Karachi . . . . .	158	57.7	23.9	47.42	4	11
Kalka . . . . .	131	44.5	22.6	36.48	..	..
Rawalpindi . . . . .	143	..	..	39.05	7	16
Sukkur . . . . .	118	47.8	20.0	37.58	8	21

342. TABLE XXVIII.—*Elements of Cost (Locomotive Shops)—contd.*

Workshop.	Location.		Freight on steam coal from pit's mouth per t.n.	Cost of unit of electric current.
	Distance from Tatanagar.	Distance from the nearest port of call.		
	Miles.	Miles.	Rs. A. P.	Anna.
<i>Eastern Bengal Ry.—</i>				
Kanchrapara . . . . .	191	28	3 1 0	0.83
Saidpur . . . . .	451	288	6 15 0	1.50
<i>East Indian Ry.—</i>				
Jamalpur . . . . .	275	298	1 2 0	0.32*
<i>Oudh and Rohilkhand Ry.—</i>				
Lucknow . . . . .	567	616	5 12 0	1.30
<i>Great Indian Peninsula Ry.—</i>				
Parel . . . . .	1,065	5	13 11 0	0.76
Jhansi . . . . .	746	702	8 8 0	1.07
<i>North-Western Ry.—</i>				
Moghulpura . . . . .	1,154	761	11 14 0	1.16
Karachi . . . . .	1,759	5	15 11 0	..
Kalka . . . . .	1,017	891	11 1 0	..
Rawalpindi . . . . .	1,331	900	13 5 0	..
Sukkur . . . . .	1,469	302	14 11 0	..

\*0.95 anna, inclusive of maintenance.

343. Another factor that has weighed considerably with us is that central manufactory of spare parts could most conveniently and with least cost be started at shops which require in any case to be remodelled or altered to some considerable extent, and in this connection we have found additional arguments in favour of our choice. Jamalpur and Jhansi are both about to undergo very extensive remodelling and in neither case have the proposals passed the stage where they could not be easily modified to include a scheme of the nature proposed.

*Distribution of Work not Territorial.*

344. In quoting geographical position as one of the advantages of these two places, we do not wish it to be inferred that we are recommending that the distribution of manufactured articles from each shop will be made on a strictly territorial basis. This, in our opinion, would be wrong, necessitating, as it would, each shop manufacturing precisely the same articles for distribution to its own particular area. Further, although we consider that two shops are desirable, it is obvious that there are many articles which it would be advantageous to manufacture in one shop only, leaving the other to concentrate on some other items for which it has special facilities.

*Drop-Stamps.*

345. For instance (although we do not consider it part of our Term of Reference to say what items should be manufactured in any particular shop) we feel, and most people will agree, that such work as drop-stamping should be concentrated in one shop, as it requires a highly specialised die-sinking department, which it will be uneconomical to duplicate. In this particular case, Jamalpur would obviously be the best place for such work, as the important factors affecting economy would be cheapness of raw material and fuel. In other cases, however, it might be equally advantageous to manufacture at Jhansi.

*Cylinders.*

346. The case of cylinders likewise deserves special mention. As with drop-stamping, this is a highly specialised job calling for special purpose plant and equipment which ought obviously to be confined to one shop only. Here again, however, we would repeat what we said at the outset—namely, that the ordinary repair shops of railways will not be entirely depleted of manufacturing facilities. It would obviously be far from economical for a central manufacturing shop to make all cylinders of a non-standard class. For this and similar work, therefore, repair shops will have to retain a certain amount of machinery for manufacturing purposes.

*Standardisation.*

347. All of the foregoing refers to metal details, both loco. and carriage, and before going on to discuss the possibilities of concentrating the manufacture of other than these, we would like to remark on the all-important question of standardisation. It is our decided opinion—and we cannot over-emphasise it—that if the fullest benefits of central manufacturing are to be obtained, a whole-hearted attempt must be made by all railways to adopt as many standard details as possible on their present stock. We realise that this will entail initial expense and, in many cases, call for fairly extensive modifications to existing rolling stock, before standard

parts can be fitted, but we nevertheless consider that in a very large number of cases it would be amply justified. It would indeed be a pity to start an undertaking, with such a big initial handicap as the present imperfect state of standardisation undoubtedly constitutes.

### *Building of Coaching Stock.*

348. In addition to the class of work referred to up to now, we have assumed our Term of Reference to include the manufacture of coaching vehicles and on this point we are of the opinion that as good a case can be made for the concentration of such work as can be made for metal details. There is the added advantage that, if adopted, our recommendations might be put into operation almost immediately—at least for standard vehicles and parts.

349. In the choice of location for this work, we have been guided principally by the cost of labour, the size of the existing shops, and their efficiency. Such matters as geographical position with regard to other railways, etc., are comparatively unimportant, but the question of proximity of sources of supply of material (timber, in this case) is of as much importance as in the case of metal details. In the following table are collected data of interest in this connection.

350. TABLE XXIX.—*Elements of Cost (Carriage and Wagon Shops).*

Workshops.	Labour.					
	Average monthly wage of subordinate supervising staff.	Average monthly wage of workmen.			Average daily absentee percentage.	Average labour turnover percentage.
		Skilled.	Unskilled.	Skilled and unskilled.		
<i>Eastern Bengal Ry.—</i>	Rs.	Rs.	Rs.	Rs.		
Kanchrapara . . . . .	250	29·7	10·6	25·28	8	39
Saidpur . . . . .	233	25·6	13·4	23·81	9	12
Dacca . . . . .	..	27·5	14·2	..	7	14
<i>East Indian Ry.—</i>						
Lillooah . . . . .	132	27·0	20·0	28·34	14	25
<i>Oudh &amp; Rohilkhand Ry.—</i>						
Lucknow . . . . .	128	37·0	15·9	26·93	7	24
<i>Great Indian Peninsula Ry.—</i>						
Jhansi . . . . .	145	22·7	16·3	26·95	14	27
Matunga . . . . .	168	51·0	28·7	46·11	11	53
<i>North-Western Ry.—</i>						
Moghulpura . . . . .	122	43·7	23·3	37·34	11	17
Karachi . . . . .	204	55·8	23·7	43·68	5	10
Kelka . . . . .	72	43·3	19·3	37·48	4	..
Rawalpindi . . . . .	160	..	..	45·51	7	12
Sukkur . . . . .	122	39·4	21·8	34·26	8	10

351. TABLE XXX.—*Elements of Cost (Carriage and Wagon Shops)—*  
*contd.*

Workshops.	Location.		Freight on steam coal per ton.	Cost of a unit of electric current.
	Distance from Tatana-gar.	Distance from the nearest port of call.		
	Miles.	Miles.	Rs. A. P.	Anna.
<i>Eastern Bengal Ry.—</i>				
Kanchrapara . . . . .	191	28	3 1 0	0·83
Saidpur . . . . .	451	288	..	1·50
<i>East Indian Ry.—</i>				
Lillooah . . . . .	158	3	2 1 0	0·59
<i>Oudh &amp; Rohilkhand Ry.—</i>				
Lucknow . . . . .	567	616	5 12 0	1·30
<i>Great Indian Peninsula Ry.—</i>				
Jhansi . . . . .	746	702	8 8 0	1·07
Matunga . . . . .	1,063	5	13 11 0	1·76
<i>North-Western Ry.—</i>				
Moghulpura . . . . .	1,154	761	11 14 0	1·16
Karachi . . . . .	1,759	5	15 11 0	..
Kalka . . . . .	1,017	891	11 1 0	..
Rawalpindi . . . . .	1,331	900	13 5 0	..
Sukkur . . . . .	1,469	3,021	14 11 0	..

352. In our opinion the two best sites for the concentration of coaching stock building are Lillooah and Kanchrapara. The latter, in our opinion, should confine itself to all four-wheeled miscellaneous vehicles, horse-boxes, motor vans, etc., of which it could manufacture the total requirements of all State Railways.

353. At Lillooah we recommend concentration of the building of as many of the lower class bogie vehicles for all railways as the shops there can possibly take. The building programme averages about 350 to 400 lower class bogies per annum, so that Lillooah could deal with all requirements of these for the Great Indian Peninsula Railway, Eastern Bengal Railway, East Indian Railway, together with all the North-Western Railway requirements, except about 100 bogies per annum.

354. We, therefore, recommend that all other carriage and wagon shops on State Railways (excepting Lahore, to a limited extent) be entirely relieved of lower class coach-building. They should, however, continue to build their own upper class vehicles. The figures of cost in the accompanying table will be found to bear out our recommendations.

355. TABLE XXXI.—Average Cost of Construction of Coaching Vehicles built during 1925-26.

Railways.	Labour.	English Stores.	Indian Stores.	Timber	General Charges.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Eastern Bengal Railway—</i>						
Upper Class Bogie—						
Broad Gauge . . . . .	4,846	32,176	4,422	9,098	1,844	52,386
Metre Gauge . . . . .	3,642	28,965	2,561	6,251	1,879	43,289
Third Class—						
Broad Gauge . . . . .	3,031	13,949	2,409	11,900	984	32,273
Metre Gauge . . . . .	2,500	12,431	992	6,330	854	23,107
Horse-box . . . . .	805	800*	2,389†	1,842	278	..
Motor Van . . . . .	..	..	..	..	..	6,460‡
<i>East Indian Railway—</i>						
Upper Class . . . . .	10,300	29,800	1,800	4,600	1,300	47,800
Third Class . . . . .	5,300	16,500	600	3,600	600	26,600
Motor Van . . . . .	3,500	5,300	300	1,500	400	11,000
<i>Oudh &amp; Rohilkhand Railway—</i>						
Motor Vans . . . . .	2,953	..	4,710§	6,277	1,181	15,121
<i>Great Indian Peninsula Railway—</i>						
I Class corridor						
Compos., etc. . . . .	15,649	20,870	5,841	11,405	11,998	65,763
I & II Class Bogie . . . . .	13,409	18,121	16,044	9,986	8,123	65,683
Third Class . . . . .	5,975	13,262	5,852	5,762	3,796	34,647
Motor Van . . . . .	3,065	1,240	4,170	1,975	1,749	12,199
Horse-box . . . . .	2,957	1,638	2,379	2,865	2,060	11,899
<i>N.-W. Railway—</i>						
Moghulpura—						
Bogie Upper . . . . .	5,356	45,690	2,402	13,009	595	67,052
Bogie Third . . . . .	2,396	19,638	1,770	8,577	266	32,647
Karachi—						
Horse box . . . . .	1,600	8,561	562	3,473	178	14,374
C. C. Truck . . . . .	1,438	6,048	551	2,966	160	11,163

\* Second-hand.

† Petty Stores.

‡ In 1921-22.

§ Total of English and Indian Stores.

*Standardization of Coaching Details.*

356. Here again, we would urge the necessity for standardization. Lower class vehicles could and ought to be made standard for all State Railways ; also horse-boxes, motor vans and other miscellaneous four-wheeled coaching stock. Upper class stock is somewhat different but with these also we recommend the standardization of as many details as possible, such as doors, door and intermediate pillars, windows, louvres, door shutters, etc.

*Carriage Underframes.*

357. In this connection, there is another important aspect of the case, which cannot be lost sight of. We have recommended concentration of the building of new coaching vehicles, but this refers to bodies only and not underframes. The present procedure is to obtain the majority of the latter from outside sources and his practice is often the cause of very

serious delays. In nearly every carriage shop visited, we were informed that the delivery of underframes by private concerns had been so erratic and unreliable that it had been extremely difficult, and in many cases impossible, to adhere to a regular building programme.

358. Carriage bodies cannot be stored waiting for underframes ; in fact, there is not a shop in India where they can even be lifted from one part of the building shop to another. It stands to reason, therefore, that unless underframes are ready to be run under the bodies as soon as they are built, a building shop can be very quickly brought to a standstill.

359. Delay in the delivery of underframes is a serious handicap at present, in spite of the fact that in the majority of cases there is accommodation in excess of requirements in the building shops, but in a central workshop manufacturing on mass production lines, such delay would be disastrous.

360. It appears to us that if the manufacture of coaching stock bodies is to be carried out in a central building shop, it would at the same time be advantageous for railways to undertake the building of the necessary underframes. This course in our opinion would be the most satisfactory method of insuring a central shop being able to adhere to a steady programme of work.

#### *Mass Production of Underframes.*

361. Apart from the question of convenience, we are convinced that with the favourable labour rates prevailing at Jamalpur, this work could be more economically carried out there than by purchasing from outside sources. As in the case of body building, underframes would be manufactured on mass production lines and all details would therefore be strictly interchangeable.

#### *Co-ordination of Work.*

362. In considering the co-ordination of the work of maintenance and repairs as carried out at the several workshops, we have recommended that such work as has to be done on the spot be conducted as hitherto. With the progress of standardization, increasing amounts of work can be undertaken at places advantageously located with respect to labour, proximity to raw materials and markets, etc., where the economies of mass production could be fully realised. In the foregoing paragraphs, we have consequently considered the most advantageous distribution of work, such as is inherently susceptible of distribution and we have recommended the concentration of certain kinds thereof at Jamalpur, Kanchnrapara and Lillooah. We have had these proposals in mind in making our detailed recommendations with respect to Terms I and II and to this extent, our recommendations are therefore interdependent.

#### *Costing of Repetition Work.*

363. We consider it of the greatest importance that, wherever the manufacture of spare parts and components of spare parts, or the construction of rolling stock, is carried out, the system of accounts should be so modified as to clearly bring out in fullest detail the expenditure that is being incurred per unit turned out. We have recommended elsewhere the need for revising the existing system of workshop accounts, and we wish to emphasise here the importance of being in a position to compare on

the one hand the actual cost of production of items that are being manufactured on a comparatively large scale with quotations that it may be possible to obtain from outside firms either in India or abroad and on the other hand, to keep a watch on the economies effected by the installation of expensive labour-saving machinery. The cost accounts that have to be maintained for repetition work are by nature comparatively simple and the difficulties experienced in accurate cost keeping for repair operations will not arise.

## CHAPTER VIII.

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**Term IV.**—The alternative of establishing an entirely independent work shop wherein manufacturing work could be standardised and, if necessary, such maintenance work performed as other workshops may be unable to undertake. Consideration to be given to the question of the site or locality most likely to lead to economic manufacturing costs and expeditious output.

**Term V.**—The question of increased utilisation of Indian products in railway workshops.

364. We have already declared ourselves in favour of concentrating the work of manufacture in existing workshops. The reasons for our preference are many and important.

365. Each railway workshop is already equipped for carrying out the manufacture of most of such spare parts as are needed by it. Concentration of manufacture can follow only on the heels of standardisation, and standardisation, however desirable, takes time to bring about. During this period of transition, and we hesitate to guess what this may be, the bulk of the work of manufacture will have to be done as heretofore.

366. Further, railway repair shops now have the advantage of being able to shift from 'repairs' to 'manufacture' and *vice versa* as fluctuations in the volume of work demand such manipulation. In a sense, the manufacture of spare parts is now a bye-product of the chief work of repairs and this is partly responsible for the favourable comparison which railway rates of manufacture (of other than articles of general commerce) ordinarily bear to those which engineering firms can quote. To centralise manufacture at a spot where repair work is not also carried out is therefore to forego the advantages that exist in being able to turn the same equipment to either work.

367. Granted that the volume of the work of manufacture of spare parts is sufficiently great to justify an entire workshop being devoted to it, it is not very clear what particular advantages are to be found in making it an entirely 'independent' workshop. Cost accounting on proper commercial lines, up-to-date methods of production and the observance of business principles in the matter of administrative control are not *ipso facto* divorced from a workshop which is not entirely 'independent'. We have no hesitation under the circumstances to consider it both wiser and more economical to have recourse to the progressively increasing concentration of manufacturing work in existing workshops than to bring into existence a new central manufacturing workshop with new buildings, plant, and equipment. The great distances in India also constitute an important objection to over-centralisation of supplies, which it will be difficult to overlook and we do not therefore favour the alternative suggested in this term of reference.

368. Should the increase in the number of items of rolling stock on which special purpose machines and equipment can advantageously be employed on mass production principles assume such proportions at the



places we have recommended as to justify the latter being run as 'entirely independent' workshops, the question could then be reconsidered. In the meantime the period of transition would be covered without an experiment bound to be initially very expensive having been undertaken, and no advantages that may *prima facie* be claimed for an entirely independent workshop would have been sacrificed.

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**TERM V.**—*The question of increased utilisation of Indian products in railway workshops.*

369. We find that the bulk of the raw materials used in mechanical workshops on Indian State Railways is being purchased locally according to the policy enunciated by the Government of India, Department of Industries and Labour, in their resolution No. S.-217, dated the 6th May 1924. This policy aims at the encouragement of the industries of the country without sacrificing economy, and the main feature of these rules consists in the assertion of a definite preference for stores produced and manufactured wholly or partly in India. We understand that the spirit of these rules is being loyally observed.

370. Most of the materials that are being imported are spare parts of rolling stock such as cannot be manufactured in India, *e.g.*, wheels, tyres, tubes, etc. We would point out that it would be possible to manufacture a larger portion of such of the requirements of State Railways in the direction of special steels and steel products as are not being manufactured by local firms, if the steel plants at Jamalpur and the Ordnance Factories in India were called upon to undertake this work. We recommend that the requirements of State Railways, both in the way of special steels and special steel sections be met from these sources, as it is difficult to obtain supplies of such articles from manufacturing firms, owing to the comparatively small orders that could be placed. We have advocated the building in India of all carriage underframes and this would also bring out greater utilisation than at present of Indian products and labour.

371. The establishment of the Indian Stores Department is the direct outcome of the revision of the Stores Purchase Rules and the desire of the Government of India to pursue a definite policy with respect to the encouragement of Indian industries. The Chief Controller of Stores is supplied with copies of purchases made by the State Railways either locally or abroad and watches the interests of the local manufacturers. We would suggest in addition, his being invited to bring to the notice of Railway Administrations from time to time all cases where the increased utilisation of Indian products, is rendered possible either by new sources of supply of raw products being tapped or by new industries being started in the country.

## CHAPTER IX.

**Term VI.—Whether the manufacture of spare parts is done at rates which shew favourable comparison with the rates at which they could be obtained from outside agencies.**

372. We consider this the most difficult amongst our terms of reference, as the issues involved are of such a nature as would affect State policy with regard to private engineering enterprise. We have consequently devoted our best care and attention towards a careful and impartial examination of the question.

### *“ Repairs ” and “ Manufacture ”.*

373. Every State Railway workshop is engaged to an extent, which we indicate below, paras. 376 and 377 on work of a ‘ manufacturing ’ nature as distinguished from purely repair work. This ‘ manufacture ’ is essentially that of locomotive component parts, spares of component parts and carriage and wagon fittings. Since these have yet to be fully standardised and the existing standards themselves have not been worked to fixed tolerances, under a proper gauging system, the ‘ manufacture ’ work above referred to has been largely dependent on the ‘ repair ’ work in hand. Very little of this manufacturing work can by the nature of things, (as they exist at present), be undertaken with convenience by outside engineering firms in India and in fact has never been so undertaken. The manufacture of ‘ spare parts ’ has, therefore, been generally conducted entirely in railway workshops, and few orders having been placed on outside agencies, it is found impossible to ascertain the rates which outside firms in India would charge for such work if placed with them.

### *Costs Not Directly Comparable.*

374. Except in the workshops at Parel and Jamalpur, no attempt has been made at costing individual items of manufacture. A bulk rate has all along been considered satisfactory and has alone been worked out. Consequently, even if the rates of outside engineering firms for specific items were available, it would be impossible to compare the railway rates with outside rates except with respect to such items as have been manufactured at Parel and Jamalpur. Nor are the Jamalpur and Parel rates directly comparable with outside rates, in as much as the expenditure on superior supervision, depreciation of workshop plant, buildings, etc., has not entered into railway costs.

### *Magnitude of Manufacture.*

375. Apart altogether from the question of comparative rates, the bulk of the manufacture that is being carried on in locomotive workshops, in so far as it appertains to the manufacture of component parts of locomotives and of spares of such component parts, is of such a nature that it has to be carried out by railways in their own workshops. An idea of the magnitude of the work that is being done in railway workshops can be obtained from the following figures which show that the value of the annual outturn of rough castings and forgings in the case of the locomotive shops and of planks and scantlings in addition, in the case of the carriage and wagon shops, aggregates to more than 2 crores and 27 lakhs.

376. TABLE XXXII.—*Annual Outturn of Manufacture. (Locomotive Shops).* (Locomotive Omitting 000.)

Railways.	Labour.	Stores.	Total.
	Rs.	Rs.	Rs.
Eastern Bengal —			
Kanchrapara . . . . .	187	755	942
Saidpur . . . . .	14	86	100
East Indian—			
Jamalpur . . . . .	724	5320	6044
Oudh and Rohilkhand—			
Lucknow . . . . .	123	387	510
Great Indian Peninsula—			
Parel . . . . .	637	2568	3205
Jhansi . . . . .	340	1361	1701
North-Western—			
Moghulpura . . . . .	361	1511	1872
Rawalpindi . . . . .	75	218	293
Sukkur . . . . .	98	199	297
Karachi . . . . .	74	162	236
Grand Total . . . . .	2633	12567	15200

377. TABLE XXXIII.—*Annual Outturn of Manufacture. (Carriage and Wagon Shops.)* (Omitting 000.)

Railways.	Labour.	Stores.	Total.
	Rs.	Rs.	Rs.
Eastern Bengal—			
Kanchrapara . . . . .	57	539	596
	7	72	79
East Indian—			
Lilloah . . . . .	325	1227	1552
Oudh and Rohilkhand—			
Lucknow . . . . .	39	226	265
Great Indian Peninsula—			
Jhansi . . . . .	14	401	415
Matunga . . . . .	359	2011	2370
North-Western—			
Moghulpura . . . . .	254	1774	2028
Rawalpindi . . . . .	1	55	56
Sukkur . . . . .	5	49	54
Karachi . . . . .	18	100	118
Grand Total . . . . .	1079	6454	7533

*Delays in Supplies by Outside Firms.*

378. It is our considered opinion that, even if private enterprise were capable of raising sufficient capital to accomplish the feat of supplying railway requirements, delays in supply would be inevitable and would militate against the expeditious repair of rolling stock, unless stocks out of all proportion to the work on hand, were maintained on each railway. Considering the immense disadvantages of the railways being dependent for such supplies on outside agencies—and the failure of firms to make deliveries to time has not been uncommon—we have little hesitation in recommending that the manufacture of spare parts be conducted by the State as heretofore, or concentrated in one or more of the larger workshops. In this we are supported by the general practice on other railways of the world, including those which are more favourably situated as regards proximity to a competitive market for such spares. In Annexure XX will be found lists of such articles as have been purchased from local firms by the State Railways; a cursory examination of these lists will suffice to show how few their number is and how (comparatively) trivial their importance. The corresponding lists of articles manufactured in the shops run into many thousands of items.

*Present Methods of Manufacture Uneconomical.*

379. Subject to the above general remarks, we wish to make the following observations. We are convinced that the methods of manufacture now prevailing in State Railway workshops (except Parel) are not sufficiently up-to-date, being improperly organised; and that they are susceptible of very considerable improvement which would be reflected in a lowering of costs and rates. The only workshop in which any attention has been paid to the planning of production work and to the organisation of a regular scheme of outturn is Parel, and we are pleased to record our satisfaction with the results achieved. Despite less efficient methods of production, the rates of articles manufactured at Jamalpur compare very favourably with those of Parel owing to the excellence of the location of the former both with respect to cheap labour and fuel. We feel confident that, in equally advantageously located modern workshops suitably equipped for the manufacture of components of rolling stock and the spares thereof and run on proper commercial lines with the aid of suitable costing systems, the rates will be so low as to defy all competition from any source whatsoever. We may quote two instances where we have been in a position to work out the correct costs of certain material manufactured in railway workshops and compare them with the quotations of outside firms.

*Costs of Points and Crossings.*

380. The first is with respect to permanent-way materials. The North-Western Railway recently invited tenders for certain quantities of points and crossings. The cheapest among the tenders received from local engineering firms was so much higher than the cost of manufacture of similar crossings made in the Jamalpur shops that the matter appeared to demand investigation; and investigation led to the work not being given to outside firms but being undertaken at Jamalpur. We have carefully examined the cost figures in this connection and find that after making an allowance for all items of oncost, the railway rates are cheaper than those quoted by the lowest tenderer by 11.8 to 34.2 per cent.

381. TABLE XXXIV.—Rates for Points and Crossings.

	Crossing 1 in 12, 90 lbs. F. F.	Points 12' 90 lbs. F. F.	Points 15' 90 lbs. F. F.	Crossings 1 in 8½ 75 F. F.	Points 12' 75 lbs. F. F.	Remarks.
	Rs.	Rs.	Rs.	Rs.	Rs.	
1. Tender I . . . . .	228	265	250	200	245	Rates f. o. r. Howrah per set.
2. Tender II . . . . .	294	284	248	240	260	Rates f. o. r. Calcutta per set.
3. Cost to the East Indian Railway, inclusive of all indirect charges except those of superior supervi- sion and interest on build- ings and plant.	187	190	177	137	178	Rates f. o. r. Jamalpur* per set.
4. Ditto includ- ing all indirect charges and 10 % profit.	224	231	218	164	220	F. o. r. Jamalpur per set.
5. Ditto includ- ing all indirect charges but excluding profit.	204	213	198	149	200	Ditto.
6. Percentage, lowest quota- tion by private firm is higher than comparable quotation by Railway workshop.	11·8%	24·4%	26·3%	31·2%	22·5%	

\* Jamalpur is about 300 miles nearer the place of destination.

382. We have not been asked to make any recommendations with respect to the manufacture of articles other than spare parts of rolling stock. We have been led to quote this instance and the next largely because, as we have mentioned before, there are few instances of importance where spare parts of rolling stock manufactured in railway workshops have at the same time been purchased from local firms. In the manufacture of points and crossings, from a ready supply of rails and plates, a railway workshop has no natural advantage over a private engineering workshop, and the instance quoted above is proof that railway rates should and would compare favourably with outside rates. Where the utilisation of scrap is an important factor in the elements of cost (as it is in the manufacture of spare parts of rolling stock) the railway workshop is obviously at an advantage for raw-material and is in a position to produce cheaper than other workshops.

#### *Cost of Rolled Steel.*

383. The manufacture of rolled steel sections at Jamalpur affords an example of this nature that also conveniently allows of comparison with outside costs. Jamalpur is unique in being the only railway workshop in India to carry out the manufacture of rolled steel sections. We had been told that the cost of manufacture of rolled steel at Jamalpur was very low and that the railway was saving substantial sums by largely manufacturing its own requirements and keeping down purchases from outside sources to a minimum. It appeared to us that this claim was far-fetched, as the average daily out-put of steel sections was less than sixteen tons and the whole equipment of furnaces, producers and rolling mills was found, on inspection, to be of a type far from modern. We consequently

instituted an examination of the cost figures over a period of six months and the results of this examination are given below.

#### *Rating of Scrap.*

384. Annexure XVI affords full details of the raw-materials used and the expenditure incurred in the manufacture of steels in the open hearth basic furnaces at Jamalpur. It will be noticed that a quantity of low-priced scrap is used in making up the charge and that the saving in 'pig' thus brought about is responsible for a reduction in costs that is not negligible. We found that the scrap was being valued at schedule rates which have remained practically unchanged during the last twenty years. A scrutiny of the rates which scrap has fetched in recent auction sales showed that the market value was higher than that charged to manufacture and we have adopted the higher rates in arriving at the cost of scrap to be debited to manufacture. Annexure XIX shows the schedule and auction rates for the more important items of scrap.

#### *Rating of Labour.*

385. Labourers employed in the shops contribute to the Railway Provident Fund Institution and are entitled to a bonus and retiring gratuity under certain conditions. The charges on account of the above ought to be included also in the prime cost of manufacture. Assuming that the railway pays the bonus, gratuity, etc., in every case, we have added 10 per cent. on the direct labour employed to the charges of smelting, thereby increasing the prime cost of manufacture of molten steel from Rs. 74-6-0 per ton to Rs. 83-0-8 per ton as shown below.

#### 386. TABLE XXXV.—*Prime Cost of Molten Steel.*

1. Output of molten steel in six months ( <i>vide</i> Annexure XVI) ..	3,494	tons.	
2. Prime cost of above ( <i>vide</i> Annexure XVI) ..	Rs.		2,59,882
3. <i>Add</i> undercharge for scrap—			
the steel mill being debited at lower rates for scrap than it should have been (as per Annexure XIX) and allowing for 126 tons of scrap credited to manufacture— ..	..	..	Rs. 24,860
4. <i>Add</i> 10% on direct labour to cover charges for provident fund bonus and gratuity, not included in prime cost .. .. .	..	..	Rs. 5,411
			2,90,153
5. Prime cost as it should be .. .. .	..	..	Rs. 2,90,153
6. Hence prime cost of molten steel .. .. .	..	..	Rs. 83—0—8 per ton.

387. Annexure XVII affords an analysis of the expenditure incurred in casting molten steel into ingots and takes account of the expenditure on crucibles and moulds and the handling of the molten metal and ingots. We have to allow for certain additional charges, whereby the prime cost of ingots is forced up from an average of Rs. 87-11-5 per ton to that of Rs. 95-8-8 per ton, as shown below.

388. TABLE XXXVI.—*Prime Cost of Ingot Steel.*

1. Output of ingot steel in six months ( <i>vide</i> Annexure XVII) .. ..	3,250 tons.		
2. Prime cost of above ( <i>vide</i> Annexure XVII) .. Rs.		2,81,231	
3. <i>Add</i> undercharge ( <i>vide</i> Annexure XVII) for molten metal :—charged for 3,250 tons, Rs. 2,41,222, should have been charged, at Rs. 83-0-8 per ton	Rs. 2,69,885	.. Rs.	28,663
4. <i>Add</i> 10% on total direct labour (of Rs. 6,124) to cover provident fund bonus and gratuity not included in prime cost .. ..	..	.. Rs.	613
5. Prime cost as it should be .. ..	..	.. Rs.	3,10,507
6. Hence prime cost of ingot .. ..	..	.. Rs.	<u>95—8—8 per ton.</u>

*Holiday Wages.*

389. The next operation is the rolling of ingots into sections and the expenditure incurred thereon is shown in Annexure XVIII. We wish to point out here that the scheduled rates of Rs. 95 and Rs. 90 per ton adopted in charging ingots to the Rolling Mill have prevented the addition of a greater undercharge to the prime cost of manufacture than would have otherwise been the case. Despite this, however, the average prime cost of steel bar has been forced up from Rs. 7-6-9 per cwt. to Rs. 7-10-1 per cwt., as will be seen below. During the period under review, the Steel Plant and Rolling Mill closed down for the Durga Puja holidays with consequent decrease in production and increase in labour costs (owing to the workmen being eligible for pay without work during these holidays). The prime cost of production of steel bar of Rs. 7-10-1 per cwt. thus errs, if at all, on the high side.

390. TABLE XXXVII.—*Prime Cost of Steel Sections.*

1. Output of steel sections in six months (Annexure XVIII) .. ..	2,458 tons.		
2. Prime cost (Annexure XVIII) .. ..	..	.. Rs.	3,61,135
3. <i>Add</i> undercharge for ingot steel (charged for 3,076 tons Rs. 2,82,802, should be at Rs. 95-8-8 per ton, Rs. 2,93,886) .. ..	..	.. Rs.	11,084
4. <i>Add</i> 10% on direct labour (Rs. 29,531) to cover provident fund bonus and retiring gratuity not included in prime cost .. ..	..	.. Rs.	2,953
5. Prime cost, as it should be .. ..	..	.. Rs.	3,75,172
6. Hence prime cost .. ..	..	.. Rs.	152—10—2 per ton, <i>i.e.</i> , Rs. 7—10—1 per cwt.

391. The *prime cost* of manufacture having thus been arrived at it is necessary to work out the total oncost to ascertain the actual cost of production. The charges on account of direct and indirect supervision, not included in costs, are as shown below.

392. TABLE XXXVIII.—*Supervision Oncost.*

1. Pay of Steel Plant and Rolling Mill Foremen for six months .. .. .	Rs.	8,400
Add 25% of above to cover leave, provident fund, passage, etc. .. .. .	Rs.	2,100
2. Share of superior, supervising, accounts and clerical establishment.		
[Average monthly cost over whole workshop at Jamalpur—Rs. 26,000.		
Add 25% to cover provident fund, gratuity, etc.—Rs. 6,500—total monthly cost Rs. 32,500		
Share allocatable monthly to the steel foundry and rolling mill on the basis of labour employed, <i>e.g.</i> (700 to 12,000)—Rs. 1,900]		
Hence for six months .. .. .	Rs.	11,400
Total supervision oncost .. .. .	Rs.	21,900

393. The other items of oncost are of interest and depreciation on buildings, plant and machinery. The present value of these assets is only a small fraction of the book-value. We have also charged interest at the rate of 5 per cent. although only 3½ per cent. is being actually paid on most of the capital at charge.

394. TABLE XXXIX.—*Interest and Depreciation on Buildings.*

Book-value of Steel Plant ..	Rs.	1,11,500
Book-value of rolling mill ..	Rs.	1,28,250
Total ..	Rs.	2,39,750
Interest at 5% and Depreciation at 2% on total cost for one year:—Rs. 16,783 <i>i.e.</i> , for six months .. .. .	Rs.	8,392

395. TABLE XL.—*Interest and Depreciation on Plant and Machinery.*

Book-value of Steel Plant ..	Rs.	5,52,583
Book-value of Rolling Mill ..	Rs.	2,51,736
Total ..	Rs.	8,04,319
Interest at 5% and Depreciation at 5% on total cost ..	Rs.	80,432
Ditto for six months .. .. .	Rs.	40,216

396. The total oncost on 2458 tons of steel sections is thus Rs. 70,508 or Rs. 1-7-0 per cwt. The *cost of production* is therefore Rs. 7-10-1 *plus* Re. 1-7-0 = **Rs. 9-1-1 per cwt.**

*The Cost of Production of Steel.*

397. The cost of production of steel sections to British Engineering Standards Association specification is thus about 25 per cent. higher than



the rate of Rs. 7 per cwt., which the Railway has been considering as its cost of production. The basic selling price for Tata's steel sections is Rs. 9 per cwt. and quotations for similar steel sections in the Calcutta market during December 1925, was also Rs. 9 per cwt., f. o. r. Calcutta. The cost f. o. r. Jamalpur will be higher by about Rs. 0-3-0 per cwt., *i.e.*, the average market quotation f. o. r. Jamalpur would be about Rs. 9-3-0 per cwt. or just a little more than the cost of production at Jamalpur. It is evident, therefore, that, *despite the very low and uneconomical output*, the manufacture of rolled steel sections is being conducted at Jamalpur within the margin of economic production.

#### *Oncost of Railway Workshops.*

398. One of the principal shortcomings of the existing system of cost accounts is that, as it is worked at present, any additional expenditure incurred in providing more economical plant and machinery and the cost of better supervision is not caught up automatically in costs and reflected in the rates of production. This has made it extremely difficult to compare costs readily even as between Railway Workshops. The addition of an arbitrary percentage of 'indirect charges' common for all railways, serves and is meant merely to serve as a safeguard against any loss accruing to the state, when work is done for private parties and outside firms and has to be paid for by them, but fails to allow of the rates of two different railway workshops being compared. These and other such problems must be tackled without delay, if cost figures are to be of real assistance in effecting comparisons, first as between railways themselves and next, as between them and outside firms. We are, however, of the conviction that the percentage of oncost, which railway workshops have to charge (were a complete commercial system of cost-keeping installed) would ordinarily be less than that which any private engineering firm will have to charge. This important point was raised not long ago, in connection with an English Railway and the late Lord Airedale, well-known as a pioneer of private industrial enterprise, submitted it to a close scrutiny on behalf of private manufacturers and admitted that the overhead charges of a private concern bore much more heavily on costs, than that of a railway workshop. One of the biggest engineering firms in India has to provide for a normal oncost of about 200 per cent. on labour, and this confirms what we have stated above, as this percentage is nearly double what in our experience, has normally to be allowed for, in any workshop on an English Railway. Figures for Indian Railways have been worked out and will be found at paras. 181 and 182.

#### *Other Elements of Cost.*

399. Further, having regard to the comparative security of tenure which labour enjoys in State Railway Workshops and the elimination of the middleman (Labour Contractor and Managing Agent) it is our opinion that the rates for labour and material private firms have to pay, should of necessity be higher than those a railway has to pay. Assuming equal efficiency of organisation and control on either side, all the elements of cost, such as labour, materials and oncost have necessarily a tendency to be lower in a Railway Workshop than in a private workshop. Private firms have ordinarily to provide a margin of 10 per cent. over and above their actual costs in the shape of profit, while it would be perfectly just if the State included interest alone as an element of cost. These are considerations which would obviously be taken into full account in determining the

policy of the State ; we only wish to emphasise here that, with respect to such components of locomotives and spare parts of carriages and wagons that have till now been manufactured almost entirely in railway workshops in India (and not locally purchased), and on the regular and expeditious supply of which depends the efficiency of railway transportation for which the Railway Board is responsible, the arguments advanced above, ought to carry more weight than when the manufacture of other articles is being considered.

*Conclusions.*

400. Briefly then, our opinion is :—

- (1) that the rates at which spare parts of rolling stock are being manufactured in railway workshops *do* bear favourable comparison with the rates which outside agencies could or would charge,
- (2) that nevertheless such manufacture is *not* being carried on as efficiently and economically as it could be, owing either to lack of organisation and co-ordination or lack of suitable plant, and
- (3) that with the concentration of the manufacturing work, in such existing shops as are advantageously situated with respect to cheap labour, fuel and suitable equipment, on the lines we have recommended, great economies could be achieved.

## CHAPTER X.

### Recommendations on Points of Importance germane to the Terms of Reference.

#### *Repairs at Running Sheds.*

401. As already noted, we took the opportunity while on tour, of inspecting four or five of the principal running sheds. Our time, however, was very limited, and the few running sheds visited were hardly sufficient to give us a very comprehensive idea of the work being done in them. We saw sufficient, however, to convince us that they are not confining themselves to running repairs only.

402. Running sheds are not intended for other than very light repairs, and although they may claim to be able to do fairly heavy work on an engine and turn it back into traffic sooner than if the engine had been sent to shops, it stands to reason that the work done in sheds must necessarily be more expensive than work done in properly equipped workshops.

403. In our opinion, the temptation to carry out fairly heavy shed repairs has been increased by the practice of allowing sheds to accumulate too much machinery with the result that many of them have developed into miniature workshops.

404. We, therefore, recommend that steps be taken to put strict limits on the work sheds are allowed to undertake, and in our opinion, the best way to ensure that these will be observed is to transfer away from sheds all machinery not absolutely necessary to carry out purely running repairs.

#### *Cranes.*

405. It was our opinion after going round State Railway shops, both loco. and carriage, that not enough foresight had been shown in the past in providing adequate crane capacity for anticipated increase in the size and weight of rolling stock. In many shops this has resulted in Railway Administrations now being faced with the necessity of expending very considerable sums of money on the strengthening of columns and girders in order to enable heavier cranes being installed. In all new buildings and remodelling, therefore, we recommend that the possibility of bigger cranes being required in the future should not be lost sight of.

406. A further point in this connection to which attention should be paid is the desirability of cranes spanning three tracks wherever possible. This of course is already the case in loco. shops where the erecting shop has longitudinal pits, but in the carriage and wagon repair shops we were struck by the fact that failure to allow a third clear road between the working tracks, for the purpose of bringing and taking away material, was one of the most fruitful causes of congestion. This was particularly noticeable in the wagon repair shops and it is for these that we specially recommend cranes spanning three tracks.

#### *Planning, Production and Metallurgical Departments.*

407. It will have been noticed that in nearly every loco. and carriage shop visited by us, we had occasion to refer to the introduction of Pro-

gress, Planning and Production Departments and we do not think we have left any doubt as to the urgency we attach to our recommendations on these points.

408. In again emphasising them, however, we would like to add our views regarding the equally important questions of inspection and gauging. With very few exceptions, these are not being given the attention they need, and we cannot too strongly urge the necessity for doing so without delay.

409. As regards inspection, this in our opinion should be extended to include inspection of materials as well as finished work. To undertake this calls for adequate testing plant, both physical and metallurgical. The Great Indian Peninsula Railway and the East Indian Railway already have Metallurgical Departments, but the other two railways are dependent on the Government Test House for work of this nature. In the case of the Eastern Bengal Railway, this is probably not inconvenient, and we do not recommend any change in the existing procedure there. On the North-Western Railway, however, matters are different. Lahore is too far away from any Government Test House to allow of such being used regularly or satisfactorily. In Moghulpura shops there is already the nucleus of a testing plant which could be extended and brought up to date, but in addition we recommend the introduction of a Metallurgical Department under the charge of a qualified Chemist and Metallurgist. If this is accepted, the Great Indian Peninsula Railway could, we believe, assist in its initiation as they already have two qualified chemists working at Parel.

#### *Economic life of Locomotive Boilers.*

410. We have previously referred to the question of repairs being carried out on boilers that had in our opinion greatly exceeded their useful life. There is no doubt that the life of a boiler can be prolonged more or less indefinitely but there is no less doubt that to do so is contrary to all interests of economy or efficiency. The question therefore resolves itself into one of fixing what is the economic life of a boiler, or in other words, after what time it ceases to be worth repairing.

411. To do this, the boiler cannot be treated entirely on its own merits but must be considered in relation to the whole locomotive. A locomotive can also be repaired almost indefinitely, but it differs from a boiler in that it reaches a state of obsolescence of type after a more or less definite number of years. Experience has shown that altering conditions of traffic, permanent-way, loading, etc., almost invariably render a locomotive obsolete after 30 to 35 years.

412. If a boiler could be run for a like period without requiring excessive repairs, it would obviously be convenient to scrap both boiler and locomotive simultaneously, but this is not a practical proposition and need not be considered.

413. No reliable figures seem to be available on Indian Railways of comparative cost of upkeep of a boiler during, say, the first ten years as compared with subsequent years, but the general experience in India certainly confirms the results of experiments conducted in Europe and America which all go to show that cost of repairs to a boiler during the second ten years of its life rapidly rises to a figure which is out of all proportion to the original cost of the boiler.

414. All other things being equal, therefore, it would obviously be convenient to fix the economic life of a boiler at a figure that would allow

of a locomotive outliving two boilers—in other words to accept a figure of approximately 16 to 18 years, and that this figure is a fair estimate of the economic life of a boiler has been proved by experiments on many railways both at Home and abroad.

415. We therefore recommend that the accepted life of a locomotive boiler be reduced from 25 to 17 years.

#### *Piece-work and Bonus Systems.*

416. Piece-work is being carried out on three of the State Railways, the Eastern Bengal, the East Indian and the North-Western.

417. On the *Eastern Bengal Railway* there is both a straight piece-work system and a Rowan bonus system. A very large number of operations and processes have been carefully timed, the daily wages rate for each arrived at on the basis of ideal outturn, a percentage (usually 33 p. c.) allowed in the shape of a bonus or profit and the piece-work rate in money worked out. The daily wages of workmen are assured and the profits that accrue on the basis of the piece-work rates are paid the month following that in which the work has been done. Losses are deducted from the profits of succeeding months.

418. The Rowan bonus system has come into operation on the Eastern Bengal Railway only very recently. Careful attention has been paid to the accurate timing of each individual process. The rates for each operation are fixed on the basis of time and the bonus made by the individual, which depends on the time saved, is distributed between him and the railway in proportion that the time saved bears to the time allowed. An extension of this system is in contemplation.

419. On the *East Indian Railway* a large amount of work is done on the straight piece-work system, the men being paid on the basis of outturn. The rates are money rates and have been carefully fixed. These are being continually checked and reviewed as new machinery is installed. There is a good system of inspection and the check on outturn is satisfactory, most of the materials passing directly into stores. We consider that the piece-work system on the East Indian Railway has been successful in cutting down labour costs.

420. On the *North-Western Railway*, the shops at Moghulpura work to a large extent on a bonus system which has for its feature the payment of a bonus on outturn *in excess of a fixed minimum*. Nearly three-fifths of the locomotive shops are on this bonus system, which, however, does not obtain in the carriage and wagon shops at the same place.

421. We understand that with the institution of the bonus system, the outturn has doubled and that the cost per unit of outturn has greatly decreased. We find, however, that these savings are not reflected in the total cost of maintenance and repairs of locomotives on the North-Western Railway. The reason for this appears to be that the shops, by increasing their capacity have been enabled to receive engines for repair in far greater numbers than previously, leading both to an accumulation of repaired engines for which the Transportation Department has no immediate use and to a tendency on the part of that department to offer engines for repairs before completion of a reasonable mileage.

*North-Western Railway System Unsound.*

422. The weakness of the system appears to consist primarily in the fact that the time rates for the minima of outturn that are in force have not been obtained as the result of any systematic or scientific method of time-fixing. Other short-comings consist in the supervising staff having a share in the bonus, and in the case of engine repairs, the outturn being measured in terms of ' heavy repairs ' for which there is no precise definition. We are of the opinion that no bonus system can function satisfactorily that is not based on the accurate timing of individual operations, carefully carried out by a highly skilled rate-fixer with considerable experience. There must also be adequate supervision to watch that work is not scamped, and the complaints of the Transportation Department on the North-Western Railway would lead to the suspicion that the work that is being done at present is not of a high order. The cost of maintenance and repairs to locomotives on the North-Western Railway is the highest among the State Railways whether taken on the basis of cost per 1,000 engine miles or per locomotive. We would, in the circumstances, strongly recommend the immediate substitution of the present bonus system by one more scientific. This is a measure of reform on which both the Accounts and the Administration appear to be very keen as is instanced by the steps taken to obtain information as to the latest practice in England.

*The Mechanical Department and Stores Organisation.*

*(a) Stores in Running Sheds.*

423. We feel it necessary to place on record the difficulties we experienced in our investigations owing to the general practice that has obtained on all the Indian State Railways, of keeping a fairly considerable stock of stores in running sheds and other places, which had been " charged off " and debited to running expenses. This procedure of charging off imprest stores not only upsets greatly the accuracy of the progressive figures of revenue expenditure, being responsible for the great fluctuations in the monthly repairs bill, but is conducive to waste and leakage of material. We have personally noticed in one of the larger running sheds these " charged off " stores lying about the place in disorderly heaps, no arrangement having been in existence to bring to bear the ordinary checks and procedure of store-keeping. We have been told that this is a result of the campaign of reducing " stores balances " but we cannot accept this explanation. No book-keeping method of reducing stores balances could go to the root of the evil, which it is obviously sought to eradicate and it is our conviction that necessary economies in expenditure cannot be enforced without a proper system of store-keeping and store-accounting being observed at all places where stores accumulate. Distinct minima and maxima of stock should therefore be prescribed for all important running sheds and carriage and wagon sub-stores and these should be watched as in the case of other stores by the Stores and Audit Departments. Whatever may be the detailed arrangements that may be adopted as a result of this recommendation—and these need immediate attention—there should in our opinion exist a continuous and concurrent check on these stores, and the stores themselves should not be charged off to final heads of revenue account until actually required for use.

*(b) Stores in Workshops.*

424. The above remarks apply with even greater force to workshops, as these latter are usually situated in close proximity to the Central Stores Depôt on each railway. The accumulation of raw and finished material in Mechanical Workshops complicates accounting and makes it extremely difficult for the requisite check to be exercised on the allocation of expenditure as between work orders. We have noticed in more than one place the existence in workshops of large quantities of "charged off" material awaiting distribution. In some cases these materials have been received on Capital Account, charged off to the work for which they have been received long before the commencement of any building or erecting operations and kept lying about the shops, without any apparent check whatever. We are told that this is a recent practice adopted in order to bring about the reduction of stores balances we have already made mention of. It is obviously ineffectual to resort to such practice, where the resulting reduction in stores balances is merely artificial and fictitious and we recommend that it be made a strict rule that no stores should be issued to workshops unless actually required for immediate use. We would also recommend that ordinarily no manufactured articles, spares, component parts, etc., should pass out of the workshop except through the Stores Department. Further, where stocks of manufactured material are held, whether they are in a finished or a semi-finished state, these stocks must be under the control of the Stores Department. We noticed at Jamalpur and Lillooah large stocks of material within the workshops worth several lakhs of rupees and under the charge of the Chief Mechanical Engineer. Though under the Mechanical Department, the cost of these stores is shown in accounts as part of Stores Suspense (Capital); and in order to do this, the *accounts* are maintained as they would be if the stores were held by the Controller of Stores and not by the Chief Mechanical Engineer. We are of opinion that, as a matter of principle, these stores should be put under the full control of the Stores Department. The location of the stores and the service rendered will be precisely the same as before; but there will be outside control and regular store-keeping, which we consider essential elements in a properly organised stores service.

*(c) Stores Distribution.*

425. We have noticed many instances of stores for outstations having been requisitioned direct from Mechanical Workshops, the deliveries being made almost without the knowledge or intervention of the Stores Department. It has happened very often that demands for the same items of stores have been placed simultaneously on the Controller of Stores. On the North-Western Railway, the Carriage and Wagon Shops at Moghulpura have more or less completely usurped the functions of the Stores Department in having made themselves definitely responsible for the distribution of carriage and wagon stores to outstations. We are of the opinion that no requisition for stores should be sent into the workshops from outstations except through the Stores Department and that all stores should be under the direct supervision of the Controller of Stores or his officers. The question of the supply of stores is of the first importance and careful consideration must be given by the Chief Mechanical Engineer, in consultation with the Chief Controller of Stores, to the time required for such supply so that

the maintenance and repairs of rolling stock on the line can be carried on without delay. The illusion appears to exist in the minds of certain officers of the Mechanical Department we have met, that supplies of stores to outstations could be speeded up if the Mechanical Workshops undertook the responsibility therefor; it should be recognised that the proper function of the Mechanical Department is *production* and *not distribution*. The Stores Department should be organised so as to carry out the proper storage and expeditious distribution of stores and in this respect must bear its full share of responsibility. It appears to us essential to have officers with a mechanical training in charge of workshop stores, or at any rate someone fully conversant with material specifications and mechanical details.

(d) *The Root of the Evil.*

426. We learn that the above is rather the exception than the rule on the State Railways and this explains to a large extent the lack of co-ordination between the Stores and Workshops which has led to stores being drawn by the workshops in bulk and store-keeping (and even stores distribution) being duplicated with results that are far from economical. We strongly recommend that early steps be taken to remove this defect and to ensure that the work of the two departments is carried out in closer co-operation. It ought to be clearly recognised that it is as important for the Stores Department to adapt itself to cater to the special requirements of the workshops as it is for the Mechanical Department to observe strictly the rules of procedure laid down for the requisitioning, receipt, issue and return of stores. The Stores Department should be organised in such a way as to be in a position to render the workshops effectual assistance not only with respect to the new and second-hand materials that are being regularly dealt with, but also with respect to the many items of surplus, scrap half-finished and repaired stores, that pass in, or out of, or are dealt with, in workshops. It is the neglect of duties such as these that is primarily responsible for waste in repairs and manufacture and this could be avoided were a more elastic and responsible system of store-keeping in force *in and through* the workshops and not merely in close proximity to the workshops.

(e) *The Remedy.*

427. In short, the casual store-keeping that is now being done *in* almost every sub-shop of each Mechanical Workshop by men of the Mechanical Department is really duplication of work that is being done *outside* the workshop by the Stores Department. Owing to its being improperly organised, it is extremely difficult to exercise a due measure of control on material passing through the workshops and there is a great amount of wastage in material that can be avoided. This, in our opinion, is an important factor that is responsible for the repairs and maintenance of rolling stock generally being carried out uneconomically and inefficiently. The situation can be met only by introducing strict and careful store-keeping *within* the workshops, of all material, new, second-hand, surplus, or scrap—whether on the stores books or no—under the control, *not* of officers of the Mechanical Department, but of suitably trained and qualified officers of the Stores Department, whose work will be subject to the checks of stock-verification and audit in the usual approved manner. Costing of repair and manufacture work would be possible only under these conditions. Accounts do not now represent facts as large quantities of material worth several lakhs of rupees are recorded as having been consumed in work,



when they have merely left the shelves of the Stores Department to rest in those of the workshops. With a good system of store-keeping within the shops, the accounts would be more in harmony with facts and efficiency of control over materials would come within the region of practical achievement. We feel it our duty, under the circumstances, to commend the urgent need for the examination of the present system of store-keeping and the institution of reforms on the general lines we have suggested above.

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## CHAPTER XI.

### Summary of Report.

#### I.—INTRODUCTORY.

428. Between the 4th January and the 2nd of March, the Committee visited all the principal workshops on the State Railways and some of the more important running sheds, in addition to the works of certain private firms. The capital outlay on the plant and equipment of these railway workshops is shown as well as the strength, annual cost of maintenance and capital value of the rolling stock that is repaired in them.

#### II.—GENERAL REMARKS ON WORKSHOPS.

##### *North-Western Railway.*

429. The main workshops of the North-Western Railway at Moghul-pura, Lahore, are modern, well laid out and excellently equipped. Paucity of supervision, absence of all planning and progress, inadequate inspection of finished work and a faulty bonus system greatly offset these advantages. The subsidiary shops at Rawalpindi, Sukkur and Karachi leave much to be desired in their layout and equipment as well.

##### *East Indian Railway.*

430. The locomotive workshops of the East Indian Railway at Jamal-pur, which include a steel plant, a rolling mill and a large manufactory of points and crossings enjoy a good location, but are old, badly planned and greatly congested. There is a chemical and metallurgical laboratory that is doing useful work, but neither a Planning nor a Progress department. The Carriage and Wagon shops of the East Indian Railway at Lillooah are more modern and better laid out. The mass production of standard body sections deserves creditable mention; but repair work has been relegated to a secondary place and the system of stores control is defective.

431. The locomotive shops of the old Oudh and Rohilkhand Railway at Lucknow are well equipped. Their layout is also satisfactory which cannot be said of the carriage and wagon shops at the same place. These latter suffer also from the bad 'balance' between the repair and paint shops.

##### *Great Indian Peninsula Railway.*

432. The only shops to have an organisation for planning, progress and production are those of the Great Indian Peninsula Railway at Parel, Bombay. A proper schedule of locomotive repairs is being worked to, accurate gauging of work is a commendable feature, the stores organisation is excellent and there exists a metallurgical laboratory. The labour force is however both expensive and unstable, and in this respect, the Jhansi Locomotive shops have the advantage. Despite many disabilities of layout and equipment the latter are carrying out repairs in a manner deserving of special mention. The carriage and wagon shops at Matunga, Bombay, are of more recent date, but the equipment is poor, the organisation leaves much to be desired and the labour rates are prohibitive.

*Eastern Bengal Railway.*

433. The locomotive shops of the Eastern Bengal Railway both at Kanchrapara and Saidpur, are old and out of date. The former which are the better equipped are being remodelled. The stores organisation is good. The carriage and wagon shops at Kanchrapara are comparatively new, of large size and include the best equipped saw-mill on the State Railways. But the outturn of work is small, owing to the great lack of balance between the several shops.

## III.—COST OF MAINTENANCE AND REPAIRS.

434. The existing framework of cost accounts is good, but costs are not worked out in sufficient detail, and there is lack of uniformity in the manner of their compilation. Nor is the best use made even of such figures as are obtained. The principal obsession is the progress of expenditure against the grant for the year. All this requires radical alteration.

435. Certain elements of oncost are for the purpose of convenience, deliberately left out of account in arriving at the costs of production. This has led in many cases to repairs being carried out at a stage when it would have been more economical to scrap and renew, and renders the comparison of costs with those of the railways outside India and of private firms a matter of some difficulty.

436. Figures are given showing the costs of unit repairs of rolling stock for each workshop. These will be found to be instructive.

437. The annual costs of maintenance and repairs per unit of rolling stock have been worked out for the bigger State railways and compared with similar figures for the South African, Australian, and English Railways.

## IV &amp; V.—FIRST TERM OF REFERENCE.

(“ The capacity or otherwise of the existing workshops of State Railways to deal economically and expeditiously with the maintenance of rolling stock at the present time.”)

438. The existing workshops of State railways have been able to maintain the rolling stock in a safe running condition but, with one or two exceptions, have not been doing so either economically or expeditiously.

439. Among the many contributory causes are paucity of supervision, inadequate equipment, bad layout, but by far the most fruitful cause of inefficiency has been the absence of proper internal organisation for systematic working.

440. The State railway workshops are generally singularly deficient in such matters as scheduling of repairs, planning and progressing of work, inspection, and gauging. The immediate introduction of the necessary facilities for rectifying this has been recommended. As regards the remodelling or extension of the existing shops, the following recommendations are made :—

*Locomotive shops.*441. *North-Western Railway.*

(a) Existing shops at Karachi and Rawalpindi should be closed down.

- (b) The existing shop at Sukkur should be entirely rebuilt on up-to-date lines with forty pit accommodation capable of extension to eighty.

442. *East Indian Railway.*

The remodelling now in hand at Lucknow should meet all present requirements, but Jamalpur will have to be remodelled.

443. *Great Indian Peninsula Railway.*

Farel and Jhansi shops are at present meeting all requirements.

444. *Eastern Bengal Railway.*

The shops at Kanchrapara should be remodelled as soon as possible as the existing facilities are quite inadequate to deal with the work expeditiously.

The shops at Saidpur are very badly laid out and should be rebuilt entirely.

*Carriage and Wagon Shops.*

445. *North-Western Railway.*

(a) Karachi and Rawalpindi should be closed down as carriage repair shops.

(b) An up-to-date carriage repair shop should be laid down at Sukkur capable of dealing with all coaching stock previously repaired in the subsidiary shops.

(c) Well-equipped wagon repair shops should be provided at the following places in addition to existing shop at Moghulpura.

(i) Rawalpindi	..	..	..	for 50 wagons.
(ii) Sukkur	..	..	..	„ 50 „
(iii) Karachi	..	..	..	„ 100 „

446. *East Indian Railway.*

(a) Carriage repair work at Lillooah should be reduced as far as possible and this shop should concentrate on the building of new vehicles.

(b) Wagon repair accommodation at Lillooah should be increased by 50 per cent.

(c) Wagon repair capacity of Lucknow and Ondal should be increased to give accommodation for an additional 300 units.

447. *Great Indian Peninsula Railway.*

(a) Carriage repair shop accommodation at Matunga should be increased by utilising part of the adjoining steel erecting shop.

(b) Carriage repair accommodation at Jhansi should be increased, but the proposals submitted are excessive and should be considerably curtailed.

(c) Wagon repair accommodation at Matunga should be increased from 72 to 105 units.

- (d) Additional wagon repair accommodation should be provided at Jhansi and Bhusawal to give a total of 200 units.

448. *Eastern Bengal Railway.*

- (a) The carriage repair accommodation at Kanchrapara is badly out of balance and this should be rectified by increasing the capacity of the wheel and machine shops.
- (b) The wagon repair shop at Kanchrapara should be doubled in size.
- (c) Saidpur shops being old and badly laid out, should be entirely rebuilt.

VI.—SECOND TERM OF REFERENCE.

- (“ The necessity or otherwise of enlarging the existing workshops, man-power, and machinery with a view to the maintenance of an increased quantity of rolling stock.”)

449. The proposals for extensions and remodelling of shops submitted by the various railway administrations have been examined and criticised in the light of probable requirements during the next ten years.

*Locomotive Shops.*

450. *North-Western Railway.*

Recommendations made under the first term of reference cover all requirements for the next ten years.

451. *East Indian Railway.*

- (a) The proposals for the remodelling of Jamalpur should be reconsidered. Complete rebuilding of all shops is advocated by the East Indian Railway but this does not appear to be necessary. The number of pits suggested (96) should be reduced to 70, and the rebuilding confined in the first instance to the large block of old buildings situated in the centre of the existing shops.
- (b) Auxiliary shops provided for in the Lucknow remodelling now in hand are excessive but the work has already proceeded too far to permit of any material curtailment. Manufacturing work should be transferred as far as possible to Jamalpur.

452. *Great Indian Peninsula Railway.*

- (a) Little change will be necessary at Parel except that the number of steam engine pits should be reduced as the stock of electric locomotives increases.
- (b) Remodelling at Jhansi will be necessary in the near future. The proposals submitted by the Great Indian Peninsula Railway have been cut down as they were considered to be in excess of requirements.

453. *Eastern Bengal Railway.*

- (a) Some of the auxiliary shops in the remodelling proposals of Kanchrapara were considered to be too large and have been consequently reduced.
- (b) Recommendations already made under the first term of reference for Saidpur should meet future requirements.

*Carriage and Wagon Shops.*454. *North-Western Railway.*

- (a) Any further increase in carriage repair accommodation should be provided at Sukkur.
- (b) Increased wagon repair facilities should be provided at Rawalpindi, Karachi and Sukkur as and when required.

455. *East Indian Railway.*

- (a) Additional carriage repair accommodation should be provided at Lucknow.
- (b) Any further extensions to wagon repair shops should be made at Lillooah, Lucknow or Ondal.

456. *Great Indian Peninsula and Eastern Bengal Railways.*

Recommendations made under the first term of reference are considered sufficient to meet all requirements for the next ten years.

## VII.—THIRD TERM OF REFERENCE.

(“ The advisability of concentrating the manufacture of spare parts in one or more of the larger workshops and to relieve the repair shops of all such manufacturing processes.”)

457. The concentration at two sites—Jamalpur and Jhansi—of the manufacture of spare parts has been recommended subject to the repair shops being provided with sufficient machinery for the manufacture of small orders of urgently required or non-standard articles.

458. The building of all lower class coaching vehicles should be concentrated at Lillooah, (Lahore to assist if the requirements exceed the capacity of Lillooah) ; and all miscellaneous four-wheeler coaching stock should be built at Kanchnrapara.

459. The manufacture of bogie underframes in railway workshops has been recommended, in the interests of economy and to avoid dislocation of building programmes through late delivery of underframes from outside sources.

## VIII.—FOURTH AND FIFTH TERMS OF REFERENCE.

(“ The alternative of establishing an entirely independent workshop wherein manufacturing work could be standardised and, if necessary, such maintenance work performed as other workshops may be unable to undertake. Consideration to be given to the question of the site or locality most likely to lead to economic manufacturing costs and expeditious output.”)

460. An entirely independent manufacturing workshop has no *prima facie* advantages, and standardization of rolling stock details is a necessary preliminary to concentration of work. The great distances in India also constitute a problem of no small difficulty. This alternative is, under the circumstances, not favoured.

(“ The question of increased utilisation of Indian products in railway workshops.”)

461. The bulk of the articles imported for utilisation in workshops is made up of such as cannot be, or are not, manufactured in India—e.g., wheels, tyres, tubes and rubber goods. All other products are

obtained locally and the spirit of the new Stores Purchase Rules of 1924 that lay down the policy of the Government of India in this connection is being observed. The manufacture locally of special steels, steel products and carriage underframes is advocated and the importance of the Indian Stores Department bringing to the notice of the Railways all indigenous sources of supply of either raw or finished products, is emphasised.

#### IX.—LAST TERM OF REFERENCE.

(“ Whether the manufacture of spare parts is done at rates which show favourable comparison with those at which they could be obtained from outside agencies.”)

462. State Railways manufacture in their workshops all their requirements of spare parts of rolling stock. They purchase from outside sources only when they are unable to manufacture the spares themselves, owing either to the articles being of a proprietary nature, or to lack of suitable equipment and facilities, or to arrears of repair work having to be overtaken. ‘ Repairs ’ and ‘ Manufacture ’ are so much intertwined and delays in supplies by outside firms are so disastrous to economical working that this is the correct course to follow. Further, railway workshops are in a position to command cheaper labour and lower rates for raw material at the expenditure of smaller overhead charges and can defy competition from private firms.

463. Railway costs are not directly comparable with the costs quoted by outside firms ; but it is not impossible to render them so. Illustrations are given which prove that manufacture is carried out at rates which compare favourably with those quoted by outside agencies.

#### X.—RECOMMENDATIONS ON POINTS OF IMPORTANCE GERMANE TO THE TERMS OF REFERENCE.

464. The following points outside of, but germane to, the terms of reference demand attention.

- (1) *Running sheds* ought to carry out running repairs only and should not attempt to undertake repairs that are better carried out in the workshops.
- (2) Provision should be made in all new shops for *cranes* of greater capacity being subsequently installed to meet increases in the size and weight of rolling stock.
- (3) A *metallurgical laboratory* is a necessary adjunct to a mechanical workshop.
- (4) It is more economical to renew locomotive *boilers* after 16 to 18 years service rather than to prolong their life to 25 years.
- (5) *Piece-work* and *bonus* systems of payment of labour, that are not based on careful timing of individual operations are uneconomical. An alteration of the system on the North Western Railway is called for.
- (6) The methods of *store-keeping* employed at present need drastic revision before economy in the use of materials can be assured.

VINCENT L. RAVEN, *Chairman*,  
J. M. D. WRENCH, *Member*.

DELHI,  
The 6th April 1926.

## **ANNEXURES.**

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**L1SRWC**



## ANNEXURE I.

### *Schedule of information called for.—Locomotive Workshops.*

1. The authorised stock and the average tractive effort of locomotives on the system on 1st April 1925.
2. The estimated stock and average tractive effort of locomotives on the system on 1st April 1935.
3. The capital outlay on 1st April 1925 on existing,
  - (a) Workshop Buildings,
  - (b) Workshop Plant and Equipment,

separately for each mechanical workshop on the line, showing both book-value and estimated present day value (depreciated).

(These values may be assessed on the best available data if not readily ascertainable and a note may be appended stating how the depreciated values of the different items of plant and equipment have been calculated and also what is included under plant and equipment.)

4. The additions to capital outlay on,
  - (a) Workshop Buildings,
  - (b) Workshop Plant and equipment.

provided for in any remodelling schemes or considered necessary in the course of the next ten years, (a note may be appended showing what is included under plant and equipment).

5. The capital outlay on 1st April 1925 on existing machine tools in each mechanical Workshop on the system, showing both original cost and present cost as depreciated. (A list of the machine tools may be prepared and the original and present costs assessed on the best available data).

6. The additions to capital outlay on machine tools provided for in any remodelling schemes or the purchase of which is either contemplated or considered necessary in the course of the next ten years.

7. Average period (days) and mileage run by locomotives from heavy repair to heavy repair in mechanical workshops.

8. Average monthly outturn of heavy repairs to locomotives from each of the shops which carry out such repairs and the average tractive effort of the locomotives repaired.

9. The average time taken to complete a heavy repair to an engine, *i.e.*, from the date received in mechanical workshops to date of despatch.

10. The average time all engines are out of service, for all classes of repairs in Mechanical Workshops.

11. The number of engine repair pits in each of the existing mechanical workshops ; also number provided for in any remodelling schemes.

12. The number of spare locomotive boilers on the system expressed as percentage of the authorised locomotive stock.

13. Average cost of a heavy repair to a locomotive in the various shops (labour and stores to be shown separately).

14. Average strength and wages of staff employed during the last six months in the various shops which carry out heavy repairs to locomotives ;

- (a) Erecting shop,
  - (b) Boiler shop,
  - (c) Fitting shop,
  - (d) Machine shop,
  - (e) Smithy,
  - (f) Foundry,
  - (g) Other shops,
- Total.

*Note.*—The information should be in tabulated form and should show shop by shop, the strength and monthly wages bill of—

- (a) Supervising staff charged to General Administration,
- (b) Supervising staff charged to Workshop Suspense,
- (c) Skilled labour, trade by trade, and
- (d) Unskilled labour.

15. Average daily absentee percentage.

16. Average annual labour turnover expressed as a percentage of the total staff.

17. The total monthly outturn for the last six months of each Standing Work Order for manufacture showing the quantities (weight, etc.) outturned either by classes of work or by individual items, the cost of such outturn under labour and stores and the rate of outturn.

18. Average weight and cost of spare parts—

- (a) Manufactured monthly,
- (b) Supplied to the Transportation Department or Running Districts monthly, under the following heads :—
  - (a) Cast Iron (Rough),
  - (b) Cast Iron (Finished),
  - (c) Wrought Iron (Rough),
  - (d) Wrought Iron (Finished),
  - (e) Brass (Rough),
  - (d) Brass (Finished),
  - (g) Any other main heads.

19. The average period taken to comply with requisitions received from the Transportation Department or Running Districts, for spare parts which are in constant demand.

20. The total outturn of work monthly for the last six months for each mechanical workshop separately if possible by Labour and Stores

*Note.*—This should be in tabular form showing :—

- (1) The cost of capital work done in the construction of rolling stock and in providing additional workshop equipment,
- (2) The cost of work, chargeable to Capital, done for the Stores Department,
- (3) The total outturn chargeable to Capital,
- (4) The outturn chargeable to Abstracts B. and C., separately for Ordinary Repairs and for Renewals and Replacements, and
- (5) The total outturn chargeable to Revenue.

21. Average men-days per heavy repair in each Workshop.

*Note.*—A heavy repair means a standard first class or unit repair as per last part of para. 9 of instructions sent with the Railway Board's letter No. 1100-St., dated the 15th December 1925.

22. The cost of ordinary maintenance and repairs in mechanical workshops of locomotives per 1,000 engine miles during the period 1st October 1924 to 30th September 1925.

23. The cost of ordinary maintenance and repairs in Transportation Workshops and Running Sheds of Locomotives per 1,000 engine miles during the period 1st October 1924 to 30th September 1925.

24. (a) Areas of the following shops in each of the mechanical workshops :—

1. Erecting shop,
2. Boiler shop,
3. Fitting shop,
4. Machine shop,
5. Smithy,
6. Foundry,
7. Tool Room,
- Total.

(b) Any increase or decrease in the above as the result of any proposed remodelling.

25. The percentage of wastage on all manufacturing operations, with a note as to the manner in which the wastage is calculated.

- (d) Wrought Iron (finished),
- (e) Brass (rough),
- (f) Brass (finished),
- (g) Any other main heads.

19. The average period taken to comply with requisitions received from the Transportation Department or Running Districts, for spare parts which are in constant demand.

20. The total outturn of work monthly for the last six months for each mechanical workshop by Labour and Stores separately, if possible

*Note.*—This should be in tabular form showing :—

- (1) The cost of capital work done in the construction of rolling stock and in providing additional workshop equipment.
  - (2) The cost of work chargeable to Capital for the Stores Department.
  - (3) The total outturn chargeable to Capital,
  - (4) The outturn chargeable to Abstracts B. and C., separately, for Ordinary Repairs and for Renewals and Replacements, and
  - (5) The total outturn chargeable to Revenue.
21. Average men-days per heavy repair in each workshop.

- (a) Coaching vehicles,
- (b) Goods vehicles,

*Note.*—The percentage of upper class stock and lower class stock repaired may be stated.

22. The cost of ordinary maintenance and repairs in Mechanical workshops of vehicles during the period 1st October 1924 to 30th September 1925.

- (a) Coaching vehicle per 1,000 Passenger and mixed train miles.
- (b) Goods vehicle per 1,000 goods train miles.

23. The cost of ordinary maintenance and repairs in Transportation workshops and Running Sheds of vehicles during the period 1st October 1924 to 30th September 1925.

- (a) Coaching vehicle per 1,000 Passenger and mixed train miles.
- (b) Goods vehicle per 1,000 goods train miles.

24. (a) Areas of the following shops in each of your Mechanical Workshops :—

- 1. Saw-Mill and Wood Machine Shop,
- 2. Body Building Shop,
- 3. Underframe and Bogie shop,
- 4. Carriage Repair shop,
- 5. Paint shop,
- 6. Wagon Repairs shop,
- 7. Total on ' wood ' side,

8. Total on ' iron ' side,

9. Grand total.

(b) Any increase or decrease in the above as the result of any proposed remodelling.

25. The average cost of construction of coaching vehicles built or erected during the last 12 months in each Mechanical Workshop separately, for

*a.* Upper bogie vehicles, ●

*b.* III Class bogie vehicles,

*c.* Horse-boxes,

*d.* Motor vans.

The cost should be analysed at least to the following extent :—

1. Labour,

2. English stores including underframes, wheels and axles, electric fittings, etc.,

3. Indian Stores (excluding timber),

4. Timber,

5. General charges,

6. Total.

26. The percentage of wastage on all manufacturing operations, with a note as to the manner in which the wastage is calculated.

### ANNEXURE III.

#### *Questionnaire I.—General.*

1. What is the practice on your railway with regard to the manufacture of spare parts in the Mechanical Workshops? Are they manufactured in large quantities and placed in Stores to be drawn on as required, or made in small numbers to meet outstanding requisitions?

A brief description of your system of manufacture and distribution may kindly be supplied together with any remarks you may have to offer on its advantages or disadvantages.

2. Are detailed parts machined to fixed tolerances in order to ensure interchangeability. If so, please state what gauging system has been adopted?

3. Is there any provision in your workshop organisation for the inspection of manufactured articles prior to being despatched or placed in Stores?

4. Does your workshop organisation include a planning department for dealing with progress and production? If so, please give a brief description of the work undertaken and the staff employed.

5. What safeguards are in force to ensure all material and its subsequent heat treatment if necessary, being in accordance with the B. E. S. A., or I. S. R., specification.

6. What is the percentage of skilled workmen in the Tool Room to the number in Mechanical Shop?

7. Are the requirements of your Railway sufficient to justify the introduction of full automatic machines for the manufacture of such details as piston valve liners, piston and valve rings, side-rod bushes, crosshead gudgeon pins, etc., etc., or could these be more economically manufactured in large quantities to meet the requirements of *all* State Railways?

8. Have you any piece-work system in force in your shops? If so, please give a brief description.

9. Do you consider that you have sufficient supervision in your shops? If not, what is the real inadequacy—lack of sanctioned posts or inability to fill them with the proper type of men? This refers to both superior and subordinate posts, but these may please be given separately. Your definite recommendations on this question are not at this stage required, but your reply should give sufficient detail to make your position perfectly clear.

## ANNEXURE IV.

### *Questionnaire II.—Transportation.*

1. The number of Running Sheds on the system and the number of engines stabled in each.

1 (a) The number of carriage and wagon examination depôts and the number of light repairs carried out at each.

If possible a small map of the system showing the above might be supplied.

2 (a) The nature and extent of repairs carried out in running sheds.

(b) The nature and extent of the repairs carried out in sick lines.

3. On whose orders are (a) Engines, (b) Carriages and Wagons sent into workshops for heavy repairs ?

4. What principle is adopted to decide whether or not heavy repairs are required to (a) Engines, (b) Carriages and Wagons ?

5. Are you satisfied with the condition of (a) Engines, (b) Carriages and Wagons received out of shops after heavy repairs ?

6. Are the engines coming into shops for heavy repairs in such a condition as to be unable to work a load ?

7. Are you satisfied with the deliveries and quality of spare parts supplied by mechanical shops (Loco. and Carriage and Wagon material separately), or have you any difficulty in obtaining these without unnecessary delay to rolling stock ?

8. If the Mechanical Department were to hold complete stocks of all mechanical parts, would you be able to reduce imprests held by you in view of the fact that you would be able to obtain supplies from the Mechanical Branch at very short notice.

## ANNEXURE V.

*Costs of Maintenance and Repairs of Locomotives (Exclusive of Renewals).*

Railway.	Year.	Wages.	Overtime.	Materials.	Total.	Per Engine Mile.	
						Annas to two places of decimals.	
						B. G.	M. G.
		Rs.	Rs.	Rs.	Rs.		
1. Eastern Bengal Railway.	1920-21	9,54,235	56,246	6,01,763	16,12,244	2.76	1.44
	1921-22	9,42,756	90,468	9,01,782	19,35,006	3.16	2.10
	1922-23	12,00,579	61,928	10,77,968	23,40,475	3.72	2.45
	1923-24	11,00,039	56,509	11,05,192	22,61,740	3.62	2.41
	1924-25	..	..	..	21,82,140	2.93	2.47
2. East Indian Railway.	1920-21	21,45,028	1,19,452	32,99,165	55,63,645	2.32	..
	1921-22	20,47,543	1,39,617	30,97,343	52,84,503	2.43	..
	1922-23	24,60,333	1,92,209	36,97,834	63,50,376	2.72	..
	1923-24	23,44,458	1,65,831	31,97,226	57,07,515	2.53	..
	1924-25	18,19,643		35,78,204	53,97,847	2.35	..
3. Oudh and Rohilkhand Railway.	1920-21	1,87,946	18,577	11,16,536	13,23,059	3.39	..
	1921-22	2,28,740	26,810	12,31,007	14,86,557	3.73	..
	1922-23	2,40,668	24,687	14,94,802	17,60,157	4.18	..
	1923-24	2,47,031	22,258	14,29,374	16,98,663	4.17	..
	1924-25	1,66,513		13,06,990	14,73,503	3.52	..
4. Great Indian Peninsula Railway.	1920-21	48,69,444	6,43,099	32,80,196	87,92,739	5.05	..
	1921-22	45,81,202	4,80,135	39,89,442	90,50,779	5.42	..
	1922-23	43,49,964	2,28,538	41,86,247	87,64,749	5.44	..
	1923-24	40,92,500	1,16,000	38,51,080	80,59,580	5.21	..
	1924-25	41,72,737	2,23,198	37,70,029	81,65,964	4.92	..
5. North-Western Railway.	1920-21	43,58,388	..	72,44,123	1,16,02,511	6.93	..
	1921-22	66,22,259	..	56,10,215	1,22,32,474	7.31	..
	1922-23	59,45,317	..	45,11,082	1,04,56,399	6.30	..
	1923-24	61,72,653	..	50,30,850	1,12,03,503	6.45	..
	1924-25	..	..	..	1,13,68,801	6.19	..



## ANNEXURE VI.

*Costs of Maintenance and Repairs of Locomotive Plant and Machinery (Exclusive of renewals.)*

Railway.	Year.	Wages.	Overtime.	Materials.	Total.	Per Engine Mile. Annas to two places of decimals.	
						B. G.	M. G.
		Rs.	Rs.	Rs.	Rs.		
Eastern Bengal Railway.	1920-21	1,56,227	800	1,96,284	3,53,311	·57	·36
	1921-22	1,69,106	1,178	1,90,789	3,61,073	·61	·37
	1922-23	2,07,139	819	1,96,835	4,04,793	·66	·41
	1923-24	1,94,653	303	1,57,042	3,51,998	·58	·35
	1924-25	..	..	..	3,61,049	·61	·33
East Indian Rail- way	1920-21	2,91,895	..	2,48,065	5,39,960	·23	..
	1921-22	2,63,935	..	2,26,635	4,90,570	·23	..
	1922-23	3,08,273	..	3,58,873	6,67,146	·29	..
	1923-24	2,94,545	..	2,97,745	5,92,290	·26	..
	1924-25	..	..	..	4,27,136	·19	..
Oudh and Rohil- khand Railway.	1920-21	..	..	..	2,21,055	·57	..
	1921-22	..	..	..	2,70,855	·68	..
	1922-23	..	..	..	3,39,291	·81	..
	1923-24	..	..	..	2,46,214	·60	..
	1924-25	..	..	..	3,02,945	·72	..
Great Indian Peninsula Rail- way.	1920-21	2,70,418	14,772	6,42,496	9,27,686	·53	..
	1921-22	2,59,220	11,914	5,04,680	7,75,814	·46	..
	1922-23	3,14,412	4,793	3,46,524	6,65,729	·41	..
	1923-24	2,00,178	1,876	2,65,919	4,67,973	·30	..
	1924-25	2,88,447	12,020	2,91,509	5,91,976	·36	..
North-Western Railway Rail- way.	1920-21	5,15,475	..	7,24,833	12,40,308	·74	..
	1921-22	5,28,480	..	8,50,892	13,79,372	·82	..
	1922-23	3,99,121	..	5,17,037	9,16,158	·55	..
	1923-24	4,15,170	..	3,43,854	7,59,024	·44	..
	1924-25	..	..	..	7,41,692	·40	..

## ANNEXURE VII.

*Costs of Maintenance and Repairs of Coaching Vehicles (Exclusive of Renewals).*

Railway.	Year.	Wages.	Overtime.	Materials.	Total.	Per 1,000 coaching vehicle miles run by home line vehicles.	
						B. G.	M. G.
		Rs.	Rs.	Rs.	Rs.		
Eastern Bengal Railway.	1920-21	5,71,927	730	7,45,231	13,17,888	17·56	11·44
	1921-22	5,87,352	925	7,66,166	13,54,443	15·87	12·88
	1922-23	5,64,048	738	7,74,606	13,39,392	16·19	10·36
	1923-24	5,54,627	484	7,82,216	13,37,327	16·62	8·15
	1924-25	..	..	..	13,76,153	11·75	7·71
East Indian Railway.	1920-21	8,41,923	48,661	10,88,091	19,78,675	12·63	--
	1921-22	10,77,675	1,18,975	14,59,259	26,55,909	16·83	--
	1922-23	12,20,706	56,317	14,74,153	27,51,176	16·81	--
	1923-24	14,40,996	66,042	17,45,003	32,52,041	18·71	--
	1924-25	6,85,145		27,95,777	34,80,922	18·13	--
Oudh and Rohilkhand Railway.	1920-21	28,890	1,784	6,88,461	7,19,135	16·87	--
	1921-22	37,151	1,919	9,44,209	9,83,279	23·84	--
	1922-23	46,095	2,217	9,51,375	9,99,687	22·26	--
	1923-24	50,386	2,013	8,89,465	9,41,864	15·78	..
	1924-25	2,37,881		9,95,509	12,32,590	22·19	..
Great Indian Peninsula Railway.	1920-21	21,47,609	1,07,404	26,32,190	48,87,203	29·17	..
	1921-22	20,12,957	1,09,678	29,35,464	50,58,099	28·90	..
	1922-23	19,55,792	81,901	30,94,538	51,32,231	29·99	..
	1923-24	20,98,732	45,287	24,49,493	45,93,512	26·71	..
	1924-25	17,39,264	79,139	24,31,393	42,49,796	25·64	..
North-Western Railway.	1920-21	19,92,667	..	16,69,518	36,62,185	19·88	..
	1921-22	21,57,628	..	24,17,244	45,74,872	22·52	..
	1922-23	20,51,359	..	28,21,117	48,72,476	22·37	..
	1923-24	21,30,435	..	23,10,859	44,41,294	20·11	..
	1924-25	..	..	..	45,51,403	19·79	..

## ANNEXURE VIII.

*Costs of Maintenance and Repairs of Goods Vehicles (Exclusive of Renewals).*

Railway.	Year.	Wages.	Overtime.	Materials.	Total.	Per 1000 vehicle miles (goods) run by home line vehicles. Rs. to two places of decimals.	
		Rs.	Rs.	Rs.	Rs.		
Eastern Bengal Railway.	1920-21	4,12,175	891	6,07,024	10,20,090	..	8.33
	1921-22	4,28,406	1,895	5,59,962	9,90,263	5.42	9.50
	1922-23	4,51,723	872	14,13,579	18,66,174	15.83	7.87
	1923-24	4,80,171	544	9,06,402	13,87,117	13.54	7.23
	1924-25	..	..	..	13,32,033	12.47	6.81
East Indian Railway.	1920-21	9,05,339	82,654	25,41,741	35,29,734	5.65	..
	1921-22	13,08,381	1,27,763	33,46,432	47,82,576	9.46	..
	1922-23	15,11,321	63,041	46,83,198	62,57,560	12.06	..
	1923-24	22,39,379	1,02,816	84,15,275	1,07,57,470	17.29	..
	1924-25	20,58,624		35,60,583	56,19,207	9.62	..
Oudh and Rohilkhand Railway.	1920-21	22,592	1,563	6,29,322	6,53,477	6.56	..
	1921-22	28,848	1,675	3,24,375	3,54,898	4.50	..
	1922-23	64,297	1,727	7,18,428	6,52,404	7.37	..
	1923-24	38,588	1,845	8,12,942	8,53,375	12.07	..
	1924-25	5,91,650		6,70,428	12,62,078	13.04	..
Great Indian Peninsula Railway.	1920-21	13,37,317	63,506	34,64,051	48,64,874	19.91	..
	1921-22	12,82,520	66,607	43,94,240	57,43,367	27.08	..
	1922-23	13,42,341	51,571	26,59,007	40,52,919	17.76	..
	1923-24	11,40,461	27,978	32,70,857	44,39,296	15.64	..
	1924-25	9,41,344	46,201	21,89,452	31,76,997	10.06	..
North-Western Railway.	1920-21	12,89,064	..	22,33,205	35,22,269	11.51	..
	1921-22	14,48,982	..	37,44,452	51,93,434	15.80	..
	1922-23	12,90,393	..	32,74,009	45,64,402	15.02	..
	1923-24	13,06,316	..	24,74,813	37,81,129	10.77	..
	1924-25	..	..	..	45,56,786	10.81	..

## ANNEXURE IX.

*Costs of Maintenance and Repairs of Carriage and Wagon Plant and Machinery  
(Exclusive of Renewals).*

Railway.	Year.	Wages.	Overtime.	Materials.	Total.	Per 1000 coaching and goods vehicle miles.	
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Eastern Bengal Railway.	1920-21	67,060	253	1,04,222	1,71,535	·93	·26
	1921-22	56,100	89	89,274	1,25,463	·81	·11
	1922-23	66,391	102	90,999	1,57,492	1·04	·12
	1923-24	63,424	40	57,932	1,21,396	·97	·03
	1924-25	..	..	..	1,27,598	·90	·12
East Indian Railway.	1920-21	1,37,329		1,11,111	2,48,440	·31	..
	1921-22	1,66,293		1,11,256	2,77,549	·42	..
	1922-23	1,70,579		1,86,687	3,57,266	·52	..
	1923-24	1,86,823		1,37,143	3,23,966	·41	..
	1924-25		..	..	3,25,391	·39	..
Oudh and Rohilkhand Railway.	1920-21	..	..	..	76,107	·54	..
	1921-22	..	..	..	90,614	·75	..
	1922-23	870	..	87,839	88,709	·66	..
	1923-24	155	..	94,321	94,476	·72	..
	1924-25	..	..	..	1,08,802	·71	..
Great Indian Peninsula Railway.	1920-21	1,69,816	8,026	2,10,245	3,88,087	·94	..
	1921-22	1,35,774	7,665	2,26,601	3,70,040	·96	..
	1922-23	74,833	3,285	1,55,711	2,33,829	·59	..
	1923-24	62,031	1,586	1,10,127	1,73,744	·38	..
	1924-25	1,17,525	5,719	1,23,737	2,46,991	·51	..
North-Western Railway.	1920-21	1,19,155	..	2,03,945	3,23,100	·66	..
	1921-22	2,19,871	..	3,68,553	5,88,424	1·11	..
	1922-23	1,68,083	..	3,28,721	4,96,804	·95	..
	1923-24	1,94,980	..	3,78,508	5,73,488	1·00	..
	1924-25	..	..	..	6,27,834	·96	..

*Cost of repairs per unit of rolling stock.—(Exclusive of renewals but inclusive of machinery has been divided equally*

Railway.	Year.	Total cost of repairs (including repairs to machinery but excluding programme revenue). (Omitting 000.)		
		Locomotives.	Coaching Vehicles.	Goods Vehicles.
		Rs.	Rs.	Rs.
Eastern Bengal—Broad Gauge.—	1915-16	6.24	3.73	3.38
	1916-17	6.87	3.53	2.67
	1917-18	7.86	3.09	3.74
	1918-19	10.81	4.85	4.31
	1919-20	11.48	7.04	6.50
	1920-21	13.89	9.05	7.01
	1921-22	15.41	7.98	5.72
	1922-23	18.65	8.86	14.95
Eastern Bengal—Metro Gauge.—	1915-16	4.38	2.77	1.97
	1916-17	4.86	2.66	2.06
	1917-18	4.53	2.73	1.93
	1918-19	5.66	3.61	2.13
	1919-20	6.78	3.75	3.29
	1920-21	5.73	4.98	4.05
	1921-22	7.58	6.18	4.80
	1922-23	8.84	5.32	4.50
East Indian . . . . .	1915-16	34.52	16.11	17.47
	1916-17	33.60	12.09	24.61
	1917-18	33.44	11.22	20.36
	1918-19	44.12	12.23	24.29
	1919-20	50.31	19.05	50.94
	1920-21	61.04	22.49	36.54
	1921-22	57.75	27.95	49.21
	1922-23	70.18	29.30	64.36
Oudh and Rohilkhand . . . . .	1915-16	7.07	5.07	4.10
	1916-17	6.91	6.50	4.53
	1917-18	7.72	6.10	4.28
	1918-19	9.69	6.95	7.02
	1919-20	13.10	8.85	13.48
	1920-21	15.44	7.57	6.92
	1921-22	17.57	10.29	4.00
	1922-23	20.99	10.44	6.08
Great Indian Peninsula . . . . .	1915-16	19.45	9.89	9.08
	1916-17	17.76	12.87	13.16
	1917-18	47.65	12.88	13.78
	1918-19	49.81	13.19	13.91
	1919-20	49.27	18.73	14.22
	1920-21	67.69	28.04	23.88
	1921-22	83.06	41.63	42.15
	1922-23	97.20	50.81	50.59
North-Western . . . . .	1915-16	98.27	52.43	59.28
	1916-17	94.30	52.49	41.70
	1917-18	85.28	46.80	45.26
	1918-19	87.58	43.73	33.00
	1919-20	37.33	13.74	7.84
	1920-21	32.93	11.54	9.10
	1921-22	48.51	15.74	14.68
	1922-23	68.10	22.81	25.38
North-Western . . . . .	1915-16	94.72	26.39	30.06
	1916-17	1.29.10	38.42	36.97
	1917-18	1.36.12	48.69	54.88
	1918-19	1.13.73	51.21	48.13
	1919-20	1.19.63	47.28	40.68
	1920-21	1.21.10	48.65	48.71
	1921-22			
	1922-23			

**XURE—X.**

*repairs to plant and machinery. Cost of repairs to carriage and wagon between coaching and goods vehicles.)*

Authorised stock.				Maintenance cost per (excluding Pro. revenue).			
Locomotives.	Total tractive effort. Omitting 000.	Coaching Vehicles in four-wheelers.	Goods vehicles in four-wheelers.	Locomotive.	Maintenance cost per 1,000 lbs. tractive effort.	Coaching vehicle four-wheeler.	Goods vehicle four-wheeler.
No.	Lbs.	No.	No.	Rs.	Rs.	Rs.	Rs.
322	61,32	1,256	7,459	1,937	102	297	45
326	61,32	1,285	7,466	2,197	112	275	36
331	60,87	1,323	7,580	2,376	129	234	49
314	60,00	1,282	7,633	3,442	180	379	56
298	59,59	1,263	8,022	3,854	193	557	81
305	56,29	1,211	9,063	4,553	247	744	77
305	59,49	1,213	9,059	5,053	259	658	63
308	58,85	1,218	9,079	6,055	317	727	164
308	58,85	1,211	9,126	5,707	299	779	111
293	61,89	1,272	8,784	5,073	240	705	105
262	36,46	1,446	7,655	1,671	120	192	26
257	36,46	1,447	7,542	1,889	133	184	27
258	35,16	1,538	7,566	1,756	129	178	26
243	33,55	1,485	7,567	2,330	160	243	28
252	33,60	1,463	7,668	2,690	201	257	43
269	38,28	1,522	7,573	2,132	150	328	53
269	37,75	1,534	7,754	2,817	201	403	62
258	36,00	1,534	7,781	3,427	246	347	58
258	36,06	1,513	7,791	3,318	237	300	56
252	37,06	1,418	6,811	3,560	247	284	69
1,259	..	3,326	36,198	2,742	..	484	48
1,259	..	3,373	36,048	2,669	..	358	68
1,259	..	3,375	36,163	2,656	..	332	56
1,259	..	3,421	36,195	3,504	..	256	67
1,269	..	3,528	38,176	3,964	..	540	133
1,299	..	3,518	40,676	4,699	..	639	90
1,328	..	3,520	40,781	4,349	..	794	121
1,328	23,828	3,558	42,722	5,284	295	823	151
1,350	25,725	3,702	44,450	4,667	245	922	246
1,352	26,130	3,918	47,133	4,308	223	930	123
286	..	1,440	8,186	2,691	Nil	352	50
286	..	1,441	8,198	2,415	..	451	55
286	..	1,440	8,189	2,699	..	424	52
286	..	1,471	8,207	3,387	..	473	86
290	..	1,508	8,513	4,516	..	587	158
304	..	1,496	8,665	5,079	..	506	80
304	..	1,462	8,579	5,781	..	704	47
304	21,24	1,496	8,684	6,906	..	698	—70
316	56,88	1,501	8,627	6,155	342	659	105
316	57,46	1,619	8,619	5,622	309	795	153
1,192	2,46,41	2,859	18,971	3,997	193	450	73
1,195	2,47,02	3,001	19,039	4,168	202	439	73
1,195	2,47,02	3,036	19,089	4,123	199	617	74
1,195	2,46,97	3,033	19,111	5,664	274	924	125
1,195	2,46,97	3,050	19,098	6,951	336	1,365	221
1,216	2,62,86	3,146	19,147	7,994	370	1,615	264
1,239	2,76,72	3,146	19,718	7,931	355	1,667	301
1,239	2,77,04	3,134	19,843	7,611	340	1,675	210
1,282	2,90,75	3,381	20,863	6,652	293	1,384	217
1,281	2,92,34	3,439	21,659	6,837	300	1,272	152
1,498	2,93,93	4,892	31,318	2,492	127	281	25
1,498	2,94,78	5,059	31,350	2,198	112	228	29
1,499	2,94,91	5,049	31,499	3,236	165	312	47
1,494	2,93,90	5,359	33,000	4,558	232	426	77
1,618	3,21,23	4,940	33,040	5,854	295	533	91
1,630	3,23,71	5,353	32,319	7,920	399	718	114
1,635	3,24,65	5,342	32,330	8,325	419	912	170
1,655	3,30,08	5,523	33,086	6,872	345	927	145
1,657	3,31,27	5,703	33,145	7,219	361	829	123
1,653	3,32,99	6,279	33,100	7,326	364	775	147

## ANNEXURE XI.

[Progressive capital outlay on rolling stock, plant and machine tools.]

Omitting 000.

Railway.	Year.	Outlay on	Outlay on	Outlay on Loco-	Outlay on Car-
		Locomo- tives.	Carriages and Wagons.	motive Work- shop Plant, including Machine Tools.	riage and Wagon Work- shop Plant, in- cluding Machine Tools.
		Rs.	Rs.	Rs.	Rs.
Eastern Bengal Broad Gauge	1915-16	15,44	29,76	1,81	2,57
	1916-17	7,40	10,04	74	10
	1917-18	..	8,03	..	..
	1918-19	..-30	3,79	1,19	26
	1919-20	30	43,60	1,08	25
	1920-21	..-15,54	61,86	1,73	12
	1921-22	9,64	18,75	..	58
	1922-23	3,70	48,16	1,26	39
	1923-24	4,26	5,35	3,87	54
	1924-25	6,13	12,62	1,45	34
Eastern Bengal Metre Gauge	1915-16	8,98	14,83	29	22
	1916-17	..-2,32	6,36	15	8
	1917-18	4	2,43	..	..
	1918-19	..-8,67	..-7,66	5	1
	1919-20	2,95	..-8,93	3	..-84
	1920-21	6,39	10,59	37	31
	1921-22	..-99	15,16	..	10
	1922-23	1,72	17,37	18	18
	1923-24	4,59	3,87	77	73
	1924-25	44	1,59	17	24
East Indian	1915-16	17,00	43,93	25	..-2
	1916-17	..-1,29	14,22	39	18
	1917-18	26	8,42	26	11
	1918-19	..	4,47	..-46	15
	1919-20	8	62,47	2,33	63
	1920-21	56,27	58,48	5,89	37
	1921-22	31,16	1,13,83	4,41	1,44
	1922-23	26,31	2,53,06	4,20	3,89
	1923-24	47,89	2,17,24	8,24	3,66
	1924-25	..	..	3,14	1,57
Oudh and Rohilkhand	1915-16	4,41	12,53	..	..
	1916-17	..	3,21	..	..
	1917-18	..	50	..	..
	1918-19	..	1,30	..	..
	1919-20	..	25,80	..	..
	1920-21	7,60	26,94	..	..
	1921-22	5,16	31,27	..	..
	1922-23	23,96	14,75	..	..
	1923-24	14,24	23,64	..	..
	1924-25	1	16,56	..	..
Great Indian Peninsula	1915-16	42,59	44,88	3,15	1,38
	1916-17	2,38	12,32	1,44	2,73
	1917-18	..	4,25	1,93	67
	1918-19	..	2,52	49	31
	1919-20	..	3,62	54	24
	1920-21	57,46	67,66	15,51	3,61
	1921-22	39,68	30,94	6,41	1,04
	1922-23	1,67	81,93	3,14	88
	1923-24	47,00	75,76	8,68	1,25
	1924-25	63	65,00	4,61	3,88
North-Western Broad Gauge	1915-16	8,69	35,31	1,57	46
	1916-17	2,63	10,37	45	90
	1917-18	22,98	38,40	11	21
	1918-19	5,66	63,02	1,43	8
	1919-20	28,87	89,81	4,35	10
	1920-21	1,06,31	18,75	61	98
	1921-22	16,27	20,87	11,76	3,84
	1922-23	37,11	72,95	47	3,17
	1923-24	26,69	77,99	1,55	4,16
	1924-25	3,80	54,23	2,28	1,28
North-Western Narrow Gauge	1915-16	1,29	2,70	4	..
	1916-17	1,51	40	..	..
	1917-18	95	2,18	..	..
	1918-19	5,39	5,18	..	..
	1919-20	1,59	5,42	..	..
	1920-21	73	1,09	..	..
	1921-22	13,78	82	..	..
	1922-23	99	46	..	..
	1923-24	3	3,99	..	..
	1924-25	5,62	2,66	..	..

Old records not available.

## ANNEXURE XII.

## Locomotive Shops—Percentage of Supervision to Labour.

Railways and Shop.	Foremen and Assistant Foremen (charged to General Administration).			Subordinate supervision charged to workshops.			Skilled Labour.			Unskilled Labour.			Percentage of supervision.	
	No.	Monthly wages.	Rate.	No.	Monthly wages.	Rate.	No.	Monthly wages.	Rate.	No.	Monthly wages.	Rate.	On Numbers.	On Monthly wages (skilled and unskilled).
<i>Eastern Bengal Railway.</i>		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		
(1) Kanchrapura . . . . .	12	6,175	502	23	5,649	246	1,886	66,061	35·5	523	7,061	13·5	1·45%	15·97%
(2) Saidpur . . . . .	4	1,895	474	9	2,460	273	874	27,185	31·1	220	2,991	13·6	1·19%	14·43%
(3) Dacca . . . . .	1	550	550	1	330	330	183	5,396	29·5	93	1,201	12·9	·72%	13·34%
<i>East Indian Railway—</i>														
(4) Jamalpur . . . . .	37	20,195	546	281	43,782	156	6,405	1,32,253	20·6	3,261	50,745	15·6	3·29%	34·96%
<i>Oudh and Rohilkhand Railway—</i>														
(5) Lucknow . . . . .	11	5,302	482	75·5	23,387	310	1,060	72,169	36·8	323	4,316	13·4	3·77%	37·51%
<i>Great Indian Peninsula Railway—</i>														
(6) Parcel . . . . .	17	10,833	637	133	20,687	223	3,059	1,64,090	53·6	1,700	48,258	28·4	3·15%	19·08%
(7) Jhansi . . . . .	10	5,285	529	80	13,108	164	2,197	74,830	34	947	16,825	17·8	2·86%	20·07%
<i>North-Western Railway—</i>														
(8) Moghulpura . . . . .	23	11,512	501	152	23,765	156	3,762	1,89,434	50·4	1,357	25,559	18·8	3·42%	16·41%
(9) Karachi . . . . .	5	2,800	560	47	7,431	158	783	45,195	57·7	344	8,251	23·9	4·61%	19·14%
(10) Kalka . . . . .	1	600	600	15	1,971	131	127	5,656	44·5	74	1,676	22·6	7·96%	35·07%
(11) Rawalpindi . . . . .	5	2,800	560	25	3,563	143	608	..	..	201	31,599*	..	3·71%	20·11%
(12) Sukkur . . . . .	6	3,375	562	35	4,114	118	668	31,943	47·8	390	7,816	20	3·88%	18·84%

\* This figure is the total cost of skilled and unskilled labour.



### ANNEXURE XIII.

#### Carriage and Wagon Shops—Percentage of Supervision to Labour.

Railway and Shops.	Superior supervision charged to General Administration.			Subordinate supervision charged to Workshops.			Skilled labour.			Unskilled Labour.			Percentage of supervision.	
	No.	Monthly wages.	Rate.	No.	Monthly wages.	Rate.	No.	Monthly wages.	Rate.	No.	Monthly wages.	Rate.	On Numbers.	On monthly wages (skilled and unskilled).
<i>Eastern Bengal Railway—</i>		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		
* (1) Kanchrapara . . . . .	7	3,825	546	13	3,250	250	1,964	57,771	29·4	686	7,133	10·3	·75%	10·80%
(2) Saidpur . . . . .	3	1,500	500	3	710	233	1,007	25,785	25·6	173	2,316	13·4	·50%	7·86%
(3) Dacca . . . . .	..	..	..	..	..	..	161	4,356	27·5	20	285	14·2	..	..
<i>East Indian Railway—</i>														
(4) Lillooah . . . . .	28	15,200	543	185	24,500	132	11,500	3,41,900	27	1,800	36,100	20	1·60%	10·52%
(5) Ondal . . . . .	2	900	450	2	200	100	270	6,800	36·3	110	1,100	10	1·05%	13·92%
<i>Oudh and Rohilkhand Railway—</i>														
(6) Lucknow . . . . .	10	5,100	510	89	11,402	128	1,584	58,629	37	1,449	23,071	15·9	3·26%	20·19%
<i>Great Indian Peninsula Railway—</i>														
(7) Matunga . . . . .	16	10,703	669	119	20,092	168	3,197	1,63,163	51	906	26,080	28·7	3·29%	16·27%
(8) Jhansi . . . . .	4	1,867	467	36	5,239	145	1,214	40,655	22·7	672	10,975	16·3	2·08%	13·76%
<i>North-Western Railway—</i>														
(9) Moghulpura . . . . .	27	14,167	524	178	21,841	122	3,795	1,65,882	43·7	1,801	43,120	23·3	3·66%	17·22%
(10) Karachi . . . . .	1	600	600	26	5,317	204	797	44,497	55·8	536	12,734	23·7	1·02%	10·33%
(11) Kalka . . . . .	..	..	..	5	364	72	81	3,509	43·3	26	502	19·3	4·66%	9·07%
(12) Rawalpindi . . . . .	1	600	600	12	1,925	160	372	..	..	79	20,527†	..	2·88%	12·30%
(13) Sukkur . . . . .	1	600	600	25	3,070	122	619	24,410	39·4	257	5,611	21·8	2·96%	12·22%

\*Dose not include carriage construction shop.  
This figure is the total cost of skilled and unskilled labour.

**ANNEXURE XIV—(i).**

**and Wages of Staff employed in Erecting Shop.**

Railways and shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.
Kanchrapara*	3	1,421	9	2,436	471	17,958	113	1,667
Saidpur	1	440	4	1,050	199	6,100	71	797
(Paint)	1	475	..	..	312	7,532	55	671
Dacca	1	550	1	330	27	771	10	169
(Paint)	..	..	..	..	63	1,614	..	..
<i>East Indian Railway—</i>								
Jamalpur	5	2,725	65	8,409	1,156	24,645	193	3,778
(Paint)	1	500	2	121	123	2,402	38	437
<i>O. &amp; R. Railway—</i>								
Lucknow	2·3	931	15	3,048	354	14,974	79	1,075
(Paint)	..	..	..	..	30	800	18	226
<i>Great Indian Peninsula Railway—</i>								
Parcel	3	1,856	36	11,088	863	54,049	243	7,073
(Paint)	..	..	2	232	41	2,297	48	1,254
Jhansi	2	1,188	21	4,927	379	14,647	123	2,056
(Paint)	..	..	1	71	36	1,103	20	323
<i>North-Western Railway—</i>								
Moghalpura	6	2,695·3	40	7,063	825	46,002·15	209	4,256·12
Karachi	1	525	13	1,564	177	10,453	76	1,929
Kalka	1†	600†	2	230	24	1,056	6	139
Rawalpindi	1	550	5	921	102	..	65	6,226·5
Sukkur	1	550	13	1,611	126	5,902	48	870

\* Erecting and Fitting Shops are a single charge.

† For all shops at Kalka.

**ANNEXURE XIV—(ii).**

*Strength and Wages of Staff employed—Fitting Shop.*

Railways and shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.		
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number	Monthly Wages.	
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.	
Kanchrapara . . . . .	}	See erecting shops same figures apply to fitting and erecting.							
Saidpur . . . . .		..	..	..	..	22	622	12	143
Dacca . . . . .		..	..	..	..	80	1,499	1	23
<i>East Indian Railway—</i>									
Jamalpur . . . . .	4	1,950	18	2,397	538	10,845	54	794	
<i>Oudh and Rohilkhand Railway—</i>									
Lucknow . . . . .	1	540-8	9	1,374	264	10,958	31	427	
<i>Great Indian Peninsula Railway—</i>									
Parel . . . . .	1	900	13	2,038	217	10,035	50	1,304	
Jhansi . . . . .	1	525	8	1,068	165	5,748	55	848	
<i>North-Western Railway—</i>									
Moghalpura . . . . .	1	575	15	2,658	269	15,528	76	1,255	
Karachi . . . . .	..	..	5	738	75	4,199	25	598	
Kalka . . . . .	..	..	..	..	..	..	..	..	
Rawalpindi . . . . .	..	..	6	480	53	..	22	3,292	
Sukkur . . . . .	..	..	1	69	60	2,784	18	364	

**ANNEXURE XIV—(iii).**  
*Strength and Wages of Staff employed—Boiler Shop.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour..	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
		Rs.		Rs.		Rs.		Rs.
<i>Eastern Bengal Railway—</i>								
Kanchrapara . . . . .	2	983	3	802	442	13,688	69	1,137
Saidpur . . . . .	1	550	2	470	192	6,107	45	642
Dacca . . . . .	..	..	..	..	36	1,036	5	85
<i>East Indian Railway—</i>								
Jamalpur . . . . .	2	1,150	14	2,982	539	9,491	72	733
(Constn.) . . . . .					77	1,638	4	125
Repairs . . . . .	3	1,650	35	6,363	1,058	19,479	231	3,211
Tinsmith . . . . .	1	600	1	85	64	154	8	99
Coppersmith . . . . .	..	..	2	620	135	2,884	7	76
Tube-shop . . . . .	..	..	..	..	33	643	27	355
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	2	872	18.5	3,252	414	14,049	28	373
Tin and Copper . . . . .	..	..	2	275	94	3,527	14	190
<i>Great Indian Peninsula Railway—</i>								
Parcel . . . . .	2	1,360	9	2,059	505	20,115	164	3,956
Coppersmith . . . . .	1	455	7	1,260	117	6,283	59	1,734
Jhansi . . . . .	1	475	11	1,479	375	11,315	121	1,823
Copper and Tin . . . . .	1	475	2	286	132	4,414	44	702
<i>North-Western Railway—</i>								
Moghalpura . . . . .	5	2,157	32	4,515	1,145	50,601	176	3,441
Karachi . . . . .	1	500	11	1,454	260	15,046	56	1,353
Coppersmith . . . . .	..	..	1	210	18	1,019	1	26
Kalka . . . . .	1*	600*	2	602	24	996	8	188
Rawalpindi . . . . .	1	500	5	6,879	224	..	42	11,013
Sukkur . . . . .	1	550	9	1,070	196	10,159	62	1,214

\* Figures represent the Supervision Staff charged to General Administration for all shops at Kalka.

**ANNEXURE XIV—(iv).**

*Strength and Wages of Staff employed—Millwright and other shops.*

Railways and shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<b>Eastern Bengal Railway—</b>		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	1	510	4	949	150·9	6,882	76·7	1,167·3
Saidpur . . . . .	..	..	1	380	121	4,241	31	489
Dacca . . . . .	..	..	..	..	32	1,121	40	507
<b>East Indian Railway—</b>								
Jamalpur . . . . .	6	3,400	32	7,820	689	15,088	1,369	21,833
<b>Oudh and Rohilkhand Ry.—</b>								
Lucknow . . . . .	1·7	881	9	2,080	..	..	..	..
<b>G. I. P. Railway—</b>								
Parel . . . . .	4	2,505	20	3,783	246	16,561	532	16,249
Jhansi . . . . .	2	1,120	16	2,408	347	12,307	341	7,106
<b>North-Western Railway—</b>								
Moghalpura . . . . .	3	1,520	15	2,346	299	15,562	260	4,710
Karachi . . . . .	1	700	..	..	..	..	..	..
Kalka . . . . .	..	..	8	886	27	1,479	40	942
Rawalpindi . . . . .	1	700	2	506	14	..	4	1,249
Sukkur . . . . .	1	475	..	..	..	..	..	..
	1	475	5	464	40	2,298	36	862

**ANNEXURE XIV—(v).**

*Strength and Wages of Staff employed—Loco. Foundry Shop.*

Railways and shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
Eastern Bengal Railway—		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	2	605	1	317	198·7	7,343·4	86·8	1,221·3
Saidpur . . . . .	..	..	..	..	..	..	..	..
Dacca (Brass Foundry) . . . . .	..	..	..	..	5	175	2	28
East Indian Railway—								
Jamalpur (Iron) . . . . .	2	1,250	18	2,432	353	7,978	221	3,232
Jamalpur (Brass) . . . . .	2	1,045	4	656	1	77	45	1,021
Pattern Shop . . . . .	1	550	14	1,077	164	2,768	213	3,509
Oudh and Rohilkhand Railway—								
Lucknow . . . . .	1	575	3	457	163	3,727	45	530
Great Indian Peninsula Railway—								
Parl . . . . .	1	632	13	2,533	202	4,294	80	1,157
Jhansi . . . . .	..	..	..	..	291	17,999	337	9,792
North-Western Railway—								
Moghalpura . . . . .	2	1,200	12	1,501	..	..	..	..
Karachi (Iron) . . . . .	..	..	2	480	301	13,674	201	3,484
Karachi (Brass) . . . . .	..	..	1	287	27	1,352	16	383
Karachi (Pattern) . . . . .	..	..	1	287	9	508	7	160
Kalka . . . . .	..	..	2	322	11	673	1	24
Rawalpindi . . . . .	1*	600*	1	93	13	549	5	85
Sukkur . . . . .	..	..	1	352	..	..	..	..
	..	..	1	163	43	2,139	42	700

\* Figures represent the Supervision Staff charged to General Administration for all shops at Kalka.

**ANNEXURE XIV—(vi).**

*Strength and Wages of Staff employed—Loco. Smithy Shop.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	2	1,583	1	219	326	8,556.1	12	310
Saidpur . . . . .	1	425	..	..	176	4,623	7	117
Dacca . . . . .	..	..	..	..	29	770	15	120
<i>East Indian Railway—</i>								
Jamalpur . . . . .	3	1,750	27	3,450	210	6,073	383	5,628
Jamalpur (Forge shop) . . . . .	1	650	8	685	28	872	111	1,913
Jamalpur (Bolt & nut shop) . . . . .	..	..	3	685	89	2,308	70	1,115
Jamalpur (Spring shop) . . . . .	..	..	2	186	26	520	33	474
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	1	524	6.8	1,078	203	5,633	14	177
<i>Great Indian Peninsula Railway—</i>								
Parel . . . . .	1	1,002	5	804	250	8,977	60	1,481
Jhansi . . . . .	1	491	6	655	321	8,413	58	796
		77						
<i>North-Western Railway—</i>								
Moghalpura . . . . .	3	1,596	8	825	282	13,533	247	4,816
Karachi . . . . .	1	525	3	444	45	2,768	104	2,380
Kalka . . . . .	1*	600*	1	85	13	563	10	219
Rawalpindi . . . . .	1	550	1	95	8	..	27	1,081
Sukkur . . . . .	1	550	1	81	44	1,660	77	1,843

\* Figures represent the Supervising Staff charged to General Administration for all shops at Kalka.

†The figures are for skilled and unskilled labour combined.

**ANNEXURE XIV—(vii).**

*Strength and Wages of Staff employed—Loco. Machine Shop.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	2	1,073	5	926	297·3	12533·5	95·6	1,368
Kanchrapara (Wheel & Brass) . . . . .	..	..	..	..	45	1,497	24	359
Saidpur . . . . .	1	480	2	560	141	4,617	42	587
Dacca . . . . .	..	..	..	..	32	901	9	149
<i>East Indian Railway—</i>								
Jamalpur . . . . .	4	1,850	16	2,300	376	8,625	49	769
					25	633	1	17
Jamalpur (Wheel shop) . . . . .	1	600	6	784	184	3,809	61	734
Jamalpur (Brass Finishing shop) . . . . .	1	525	14	2,726	294	6,094	25	341
<i>Oudh &amp; Rohilkhand Railway—</i>								
Lucknow . . . . .	2	979	12	11,590	336	15,395	36	380
Lucknow (Wheel) . . . . .	..	..	1	234	63	2,539	23	301
<i>Great Indian Peninsula Railway—</i>								
Parcel . . . . .	3	1,548	24	5,045	450	24,283	135	3,596
Wheel shop . . . . .	1	575	4	846	79	3,491	71	1,819
Jhansi . . . . .	1	554	10	1,354	349	13,961	103	1,831
Wheel tender . . . . .	1	457	5	860	92	2,922	82	1,310
<i>North-Western Railway—</i>								
Moghalpura . . . . .	3	1,769	30	4,856	641	34,533	188	3,595
Karachi . . . . .	1	550	9	1,932	161	9,177	58	1,398
Kalka . . . . .	1*	600*	1	76	24	1,012	5	133
Rawalpindi . . . . .	1	500	5	541	207	..	41	8,737
Sukkur . . . . .	1	550	5	656	147	6,438	94	1,706

\*Figures include cost of supervision for all shops.



**ANNEXURE XV—(i).**

*Strength and Wages of Staff employed—Saw-mill.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	1	550	1	170	87	2,753	118	1,422
Saidpur . . . . .	..	..	..	..	232	8,332	22	334
Dacca .. . . .	..	..	..	..	2	40	..	..
<i>East Indian Railway—</i>								
Lillooh . . . . .	2	1,300	3	900	200	6,000	200	2,600
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	1	550	5	769	150	5,381	124	1,890
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	1	628	8	1,272	94	5,952	110	3,284
Jhansi . . . . .	..	..	3	465	55	1,873	69	1,201
<i>North-Western Railway—</i>								
Moghalpura . . . . .	3	1,539	13	1,470	218	9,474	159	3,684
Karachi . . . . .	..	..	2	159	25	1,932	53	1,104
Kalka . . . . .	..	..	..	..	..	..	..	..
Rawalpindi . . . . .	..	..	1	125	19	Included in column 9	13	1,001
Sukkur . . . . .	..	..	1	85	7	319	31	575

**ANNEXURE XV—(ii).**

*Strength and Wages of Staff employed—Body Building Shop.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	..	..	..	..	329	11,796	46	615
<i>East Indian Railway—</i>								
Lillooah . . . . .	2	1,200	23	2,100	1,970	68,700	90	1,600
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	1	917	16	2,170	214	17,766	39	1,089
Jhansi . . . . .	1	620	7	1,014	263	9,343	37	706
<i>North-Western Railway—</i>								
Moghalpura . . . . .	3	1,422	18	923	387	19,184	36	633

**ANNEXURE XV—(iii).**

*Strength and Wages of Staff employed—Underframe and Bogie Shop.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
		Rs.		Rs.		Rs.		Rs.
<i>Eastern Bengal Railway—</i>								
Kanchrapara . . . . .	..	..	1	260	107	2,934	49	606
<i>East Indian Railway—</i>								
Lilloah . . . . .	2	1,000	11	1,500	1,190	35,400	30	600
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	1	550	5	503	32	1,436	39	1,054
Jhansi . . . . .	..	..	..	..	..	..	..	..
<i>North-Western Railway—</i>								
Moghalpura . . . . .	2	1,096	23	2,676	612	25,427	138	2,565

**ANNEXURE XV—(iv)**

*Strength and Wages of Staff employed in Paint Shop.*

Railways and Shops.	Superior Supervision Charged to General Administration.		Subordinate Super- vision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
		Rs.		Rs.		Rs.		Rs.
<i>Eastern Bengal Railway—</i>								
Kanchrapara . . . . .	1	550	2	560	321	8,679	205	1,470
Saidpur . . . . .	1	475	..	..	312	7,522	55	671
Dacca . . . . .	..	..	..	..	63	1,614	..	..
<i>Eastern Bengal Railway—</i>								
Lillooah . . . . .	2	1,000	6	1,700	1,100	27,400	10	200
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	1	550	7	1,325	133	5,096	351	5,966
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	1	818	9	1,416	373	16,982	24	648
Jhansi . . . . .	1	320	4	548	248	7,104	58	797
<i>North-Western Railway—</i>								
Moghalpura . . . . .	3	1,503	12	1,257	416	16,851	36	697
Karachi . . . . .	..	..	1	137	126	6,178	10	195
Kalka . . . . .	..	..	2	172	29	1,254	1	20
Rawalpindi . . . . .	..	..	1	140	68	..	11	3,503*
Sukkur . . . . .	..	..	3	428	80	3,288	30	718

\* Represents the cost of skilled and unskilled labour.

**ANNEXURE XV—(v.)**

*Strength and Wages of Staff employed—Wagon Repair Shop.*

Railways and Shops.	Superior Supervision Charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
		Rs.		Rs.		Rs.		Rs.
<i>Eastern Bengal Railway—</i>								
Kanchrapara . . . . .	1	550	5	1,400	554	13,551	131	1,414
Saidpur . . . . .	1	475	2	580	310	6,337	56	595
Dacca . . . . .	..	..	..	..	..	..	..	..
<i>East Indian Railway—</i>								
Lilloah . . . . .	2	1,200	25	4,000	2,780	82,900	100	1,700
Ondal . . . . .	2	900	2	200	270	6,800	110	1,100
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	2	950	19	2,498	250	8,398	267	3,897
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	1	575	20	4,125	347	14,601	116	3,232
Jhansi . . . . .	1	402	10	1,672	189	5,773	343	5,604
<i>North-Western Railway—</i>								
Moghalpura . . . . .	2	991	18	1,755	579	20,844	211	4,679
Karachi . . . . .	..	..	2	631	123	6,527	37	879
Kalka . . . . .	..	..	..	..	10	405	..	..
Rawalpindi . . . . .	..	..	7	1,430	203	..	47	10 990*
Sukkur . . . . .	..	..	5	535	135	5,132	47	1,081

\*Includes wages of skilled and unskilled labour.

**ANNEXURE XV—(vi).**

*Strength and Wages of Staff employed—Carriage Repair Shop.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
		Rs.		Rs.		Rs.		Rs.
<i>Eastern Bengal Railway—</i>								
Kanchrapara . . . . .	1	625	..	..	281	11,291	43	547
Saidpur . . . . .	1	550	1	130	153	3,584	40	716
Dacca* . . . . .	..	..	..	..	96	2,702	20	285
<i>East Indian Railway—</i>								
Lillooah . . . . .	3	1,400	16	1,800	1,540	46,500	70	1,200
Ondal . . . . .	..	..	..	..	..	..	..	..
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	2	1,000	26	3,278	519	21,222	169	2,655
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	2	1,395	15	1,865	600	38,384	46	1,250
Jhansi . . . . .	..	..	6	684	170	5,139	27	511
<i>North-Western Railway—</i>								
Moghalpura . . . . .	4	2,104	20	2,559	549	25,119	142	3,108
Karachi . . . . .	..	..	2	282	93	4,205	7	140
Kalka . . . . .	..	..	1	40	21	877	3	59
Rawalpindi . . . . .	..	..	3	230	82	..	8	5,033†
Sukkur . . . . .	..	..	5	531	149	5,947	5	185

\* Includes wagon shops also.

† Represents the cost of skilled and unskilled labour.

**ANNEXURE XV—(vii).**

*Strength and Wages of Staff employed—Other Carriage and Wagon Shops.*

Railways and Shops.	Superior Supervision charged to General Administration.		Subordinate Supervision charged to Workshops.		Skilled Labour.		Unskilled Labour.	
	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.	Number.	Monthly Wages.
<i>Eastern Bengal Railway—</i>		Rs.		Rs.		Rs.		Rs.
Kanchrapara . . . . .	3	1,550	4	860	614	18,563	140	1,674
<i>East Indian Railway—</i>								
Lillooah . . . . .	15	8,100	101	12,500	2,720	75,000	1,300	28,200
<i>Oudh and Rohilkhand Railway—</i>								
Lucknow . . . . .	4	2,050	32	3,532	532	18,532	538	8,663
<i>Great Indian Peninsula Railway—</i>								
Matunga . . . . .	9	5,820	46	8,741	1,437	78,042	532	15,523
Jhansi . . . . .	1	525	6	856	315	11,433	138	2,156
<i>North-Western Railway—</i>								
Moghulpura . . . . .	10	5,512	74	11,201	1,034	48,983	1,079	27,754
Karachi . . . . .	..	..	19	4,108	430	24,655	429	10,416
Kalka . . . . .	..	..	2	152	21	973	22	423
Sukkur . . . . .	..	..	11	1,491	248	9,724	144	3,052

**ANNEXURE XVI.**

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**MISRWC**



## ANNEXURE

## Cost of Molten Metal

Description.	Metal.						Freight on Metal.	
	Weight.			Rate.				Amount.
	Ton	ewt.	qr. lb.	Rs.	A. P.	ton		Rs. A. P.
<i>June 1925.</i>								
Iron, Pig, Basic "Tata" . . . . .	164	17	3 0	66	2 10	ton	10,911 12 6	..
Iron, Pig, Basic "Burn" . . . . .	102	10	2 0	53	0 0	..	5,433 13 3	..
Scrap, W. I. and M. S., Cl. 4 . . . . .	42	3	3 0	25	0 0	..	1,054 11 0	..
Scrap, W. I. and M. S., Cl. 7A . . . . .	279	11	2 26	15	0 0	..	4,193 13 0	..
Scrap, Cast, Steel, Cl. 10 . . . . .	15	19	0 9½	35	0 0	..	558 6 5	..
Scrap, Steel, Tyres . . . . .	22	19	2 0	20	0 0	..	459 8 0	..
Ferro Manganese . . . . .	4	6	1 18	400	0 0	..	1,728 3 5	..
Ferro Silicon . . . . .	0	16	0 1	12	8 4	ewt.	201 8 4	..
Aluminium . . . . .	0	0	2 23½	77	7 6	..	91 13 2	..
Iron, Pig, Hæmatite . . . . .	0	0	3 3	161	12 10	ton	6 2 5	..
Scrap Rails, Cl. 7A . . . . .	9	12	1 0	15	0 0	..	144 6 0	..
Cr. Value of shop accumulation . . . . .	31	0	0 0	15	0 0	..	465 0 0	..
	611	18	3 7	..	..	..	24,319 1 6	978 15 0
<i>July 1925.</i>								
Iron, Pig, Basic "Burn" . . . . .	320	13	0 0	53	0 0	ton	16,994 7 1	..
Ferro Manganese . . . . .	4	15	2 14	400	0 0	..	1,912 8 0	..
Ferro Silicon . . . . .	0	16	0 0	10	4 9	ewt.	164 12 5	..
Aluminium . . . . .	0	0	3 5½	77	7 6	..	61 11 9	..
Scrap, W. I. and M. S., Cl. 4 . . . . .	57	10	0 0	25	0 0	ton	1,437 8 0	..
Scrap, Rails, Cl. 7A . . . . .	45	10	0 0	15	0 0	..	682 8 0	..
Scrap, W. I. and M. S., Cl. 7A . . . . .	297	0	0 0	15	0 0	..	4,455 0 0	..
Scrap, Cast Steel, Cl. 10 . . . . .	21	12	0 0	35	0 0	..	756 0 0	..
Scrap, Steel, Tyres . . . . .	9	18	0 0	20	0 0	..	198 0 0	..
Cr. Value of Shop accumulation . . . . .	36	0	0 0	15	0 0	..	540 0 0	..
	721	15	1 19½	..	..	..	26,122 7 3	766 13 0



## ANNEXURE

Description.	Metal.			Freight on Metal.
	Weight.	Rate.	Amount.	
	Ton Cwt. qr. lb.	Rs. A. P.	Rs. A. P.	
<i>August 1924.</i>				
Iron, Pig, Basic "Burn" . . . . .	309 15 0 0	53 0 0 ton	16,416 11 5	..
Iron, Pig, Hæmatite . . . . .	0 8 0 0	161 12 10 ..	64 11 6	..
Ferro Manganese . . . . .	4 8 1 14	29 15 2 cwt.	2,646 8 4	..
Aluminium . . . . .	0 0 3 $\frac{1}{2}$	77 7 8 ..	58 9 10	..
Scrap, W. I. and M. S., Cl. 7A . . . . .	281 18 0 0	15 0 0 ton	4,228 8 0	..
Scrap, Rails, Cl. 7A . . . . .	23 17 0 0	..	357 12 0	..
Scrap, Cast Steel, Cl. 10 . . . . .	23 9 0 0	35 0 0 ton	820 12 0	..
Ferro Silicon . . . . .	0 16 0 0	10 4 9 cwt.	164 12 6	..
Scrap, Steel, Tyres . . . . .	25 1 0 0	20 0 0 ton	501 0 0	..
Scrap, W. I. and M. S., Cl. 4 . . . . .	26 15 0 0	25 0 0 ..	668 12 0	..
Scrap, flat-footed, rails . . . . .	2 10 0 0	..	62 8 0	..
Cr. Value of shop accumulation . . . . .	29 0 0 0	..	435 0 0	..
	669 18 4 14 $\frac{1}{2}$	..	25,555 9 7	671 5 0
<i>September 1925.</i>				
Iron, Pig, Basic "Burn" . . . . .	179 5 0 0	53 0 0 ton	9,500 4 0	..
Iron, Pig, Hæmatite . . . . .	4 11 0 0	4 7 0 cwt.	403 13 0	..
Ferro Manganese . . . . .	2 12 3 0	29 15 2 ..	1,579 10 11	..
Ferro Silicon . . . . .	0 9 1 16	10 4 9 ..	96 11 9	..
Aluminium . . . . .	0 0 1 23	77 7 6 ..	35 4 6	..
Scrap, flat-footed, rails . . . . .	1 5 0 0	25 0 0 ton	31 4 0	..
Scrap, W. I. and M. S., Cl. 4 . . . . .	4 0 0 0	25 0 0 ..	100 0 0	..
Scrap, W. I. and M. S., Cl. 7A . . . . .	157 10 0 0	15 0 0 ..	2,362 8 0	..
Scrap, Cast Steel, Cl. 10 . . . . .	44 17 0 0	35 0 0 ..	1,569 12 0	..
Scrap, Steel, Tyres . . . . .	16 8 0 0	20 0 0 ..	328 0 0	..
Cr. Value of shop accumulation . . . . .	10 0 0 0	15 0 0 ..	150 0 0	..
	400 18 2 11	..	15,857 4 2	418 6 0



## ANNEXURE

Description.	Metal.			Freight on Metal.	
	Weight.		Rate.		Amount.
	Ton	Cwt. qr. lb.	Rs. A. P.		Rs. A. P.
<i>October 1925.</i>					
Iron, Pig, Basic " Burn "	285	6 0 0	53 0 0 ton	15,120 14 1 ..	
Iron, Pig, Basic Hæmatite	5	13 0 0	4 13 9 cwt.	549 2 6 ..	
Ferro Manganese	4	3 2 14	49 6 10 "	4,133 2 4 ..	
Aluminium	0	0 2 20½	77 7 6 "	52 14 7 ..	
Ferro Silicon	0	7 0 12	10 4 9 "	73 3 1 ..	
Scrap, W. I. and M. S., Class 7A	227	6 0 0	15 0 0 ton	3,409 8 1 ..	
Scrap, Rails, Class 7A	14	13 0 0	15 0 0 "	219 12 0 ..	
Scrap, Cast Steel, Class 10.	91	5 0 0	35 0 0 "	3,193 12 0 ..	
Scrap, Steel, Tyres	4	8 0 0	20 0 0 "	88 0 0 ..	
Scrap, W. I. and M. S., Class 4	8	15 0 0	25 0 0 "	218 12 0 ..	
Scrap, flat-footed, rails	18	3 0 0	25 0 0 "	453 12 0 ..	
Cr. Value of shop accumulation	10	0 0 0	15 0 0 "	150 0 0 ..	
	650	0 1 18½	..	27,362 12 8 738 0 0	
<i>November 1925.</i>					
Iron, Pig, Basic " Burn "	276	0 0 0	53 0 0 ton	14,628 0 0 ..	
Iron, Pig, Hæmatite	6	15 0 0	4 13 9 cwt.	656 1 2 ..	
Ferro Manganese	4	9 2 0	42 11 6 "	3,823 8 7 ..	
Ferro Silicon	0	9 0 16	10 13 4 "	93 5 5 ..	
Aluminium	0	0 2 25½	77 7 6 "	56 8 9 ..	
Scrap, Steel Tyres	9	19 0 0	20 0 0 ton	199 0 0 ..	
Scrap, W. I. and M. S., Class 4	16	0 0 0	25 0 0 "	400 0 0 ..	
Scrap, Wheel, Centre	26	0 0 0	16 0 0 "	416 0 0 ..	
Scrap, Rails, Class 7A	56	3 0 0	15 0 0 "	842 4 0 ..	
Scrap, W. I. and M. S., Class 7A½	254	10 2 0	..	3,817 14 0 ..	
Scrap, Cast Steel, Class 10	51	17 2 0	35 0 0 "	1,815 10 0 ..	
Cr. Value of shop accumulation	10	0 0 0	15 0 0 "	150 0 0 ..	
	692	4 1 13½	..	25,598 3 11 786 2 0	

XVI—contd.

Miscellaneous Stores and Transfer, etc.	Fuel with freight.	Stationery engine Ex :	Daily labour.	Grand Total.	Outturn.	Cost per ton.
Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Ton Cwt. qr. lb.	Rs. A. P.
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
8,391 0 7	2,751 4 9	..	7,415 2 9	46,658 4 9	639 6 3 10	73 14 9
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
4,441 11 1	3,301 4 6	..	8,325 11 5	43,453 0 11	661 19 0 22	65 10 4

## ANNEXURE XVII.

### *Cost of Ingot Steel in Steel Plant.*

Period.	Description.	Molten metal weight.				Rate per ton.		Amount.		Miscellaneous stores and Transfers.		Stationery Engines, etc.		Daily labour.		Grand Total.		Outturn.				Cost per ton.	
		Ton.	cwt.	qr.	lb.	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Ton.	cwt.	qr.	lb.	Rs.	A. P.
1925.																							
June . . .	Molten metal .	490	4	0	0	83	8 4	40,942	0 10	8,129	6 2	627	12 2	999	11 7	50,598	14 9	490	4	0	0	103	3 6
July . . .	Molten metal .	610	16	0	0	71	15 4	43,951	8 3	53	15 3	648	5 8	1,285	6 9	45,939	3 11	610	16	0	0	75	3 4
August . . .	Molten metal .	574	17	2	0	70	13 4	40,721	1 6	6,300	13 7	635	9 0	1,149	6 0	48,806	14 1	574	17	2	0	84	14 5
September . . .	Molten metal .	334	0	0	0	87	6 11	29,202	9 8	876	5 4	643	6 4	697	4 8	31,419	10 0	334	0	0	0	94	1 2
October . . .	Molten metal .	605	5	0	0	73	14 9	44,730	0 2	9,861	7 9	540	0 9	1,024	1 6	56,155	10 2	605	5	0	0	92	12 6
November . . .	Molten metal .	634	17	2	0	65	10 4	41,675	1 10	4,826	4 3	840	14 5	968	3 8	48,310	8 2	634	17	2	0	76	1 7
	Grand Total)	3,250	0	0	0	..		2,41,222	6 3	..		..		6,124	2 0	2,81,230	13 1	3,250	0	0	0	..	

**ANNEXURE XVIII.**

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**MISRWC**



## ANNEXURE

## Cost of Steel Sections in

Description.	Metal.			Freight on Metal.	Miscellaneous Stores and Transfer.
	Weight.	Rate.	Amount.		
<i>June 1925.</i>	T. C. qr. lb.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Steel ingot, J. M. P.	378 2 0 0	95 0 0 ton.	35,919 8 0	..	..
Steel Axles, "Scrap"	0 1 2 0	30 0 0 ,,	2 4 0	..	..
Cr. Value of scrap, accumulation.	30 6 0 0	15 0 0 ,,	454 8 0	..	..
	347 17 2 0	..	35,467 4 0	0 3 0	10,658 1 7
<i>July 1925.</i>					
Steel ingot, J. M. P.	483 0 0 0	95 0 0 ton	45,885 0 0	..	..
Cr. Value of scrap accumulation.	3 0 0 0	15 0 0 ,,	45 0 0	..	..
Total	480 0 0 0	..	45,840 0 0	..	4,719 4 0
<i>August 1925.</i>					
Steel ingot, J. M. P.	468 8 0 0	99 8 0 ton	46,607 1 10	..	8,254 12 10
<i>September 1925.</i>					
Steel ingot, J. M. P.	474 7 0 0	84 0 11 ton	39,872 2 8	..	..
Scrap Steel Axles	5 19 2 0	30 0 0 ,,	179 4 0	..	..
Cr. Value of Scrap accumulation.	58 6 0 0	35 0 0	2,040 8 0	..	..
	422 0 2 0	..	38,010 14 8	14 12 0	3,007 15 0
<i>October 1925.</i>					
Steel ingot, J. M. P.	575 2 1 0	90 0 0 ton	51,760 2 0	..	..
Cr. Value of Scrap accumulation.	45 0 0 0	35 0 0 ,,	1,575 0 0	..	..
	530 2 1 0	..	50,185 2 0	..	5,474 12 3
<i>November 1925.</i>					
Steel ingot, J. M. P.	697 6 1 0	90 0 0 ton	62,758 0 0	..	..
Scrap, Steel, Axles	0 8 0 7	30 0 0 ,,	12 1 6	..	..
Cr. Value of Scrap accumulation.	12 15 0 0	35 0 0 ,,	446 4 0	..	..
	684 19 1 7	..	62,323 15 6	1 0 0	5,317 12 0
Average cost per month	488 0 0 0	..	46,407 0 0	..	6,239 0 0
Grand Total Steel Ingot	3,076 5 0 0	..	2,82,802 0 0	..	..

## XVIII.

## Rolling Mill.

Fuel with freight.	Stationery engine, etc.	Sundry labour.	Piece-work labour.	Grand Total.	Outturn.	Cost per Cwt.
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	T. C. qr. lb.	
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
1,164 13 5	564 8 9	508 3 5	3,384 2 11	51,747 5 1	315 2 3 27	8 3 4
..	..	..	..	..	..	..
..	..	..	..	..	..	..
1,966 15 0	524 0 4	772 13 8	4,100 4 7	57,923 5 7	409 7 2 25	7 1 2
..	..	..	..	..	..	..
..	..	..	..	..	..	..
1,854 8 5	534 5 11	448 9 1	4,009 14 4	61,709 4 5	369 11 2 0	8 5 7
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
1,781 8 7	877 6 4	838 14 3	3,790 13 11	48,322 4 9	351 6 3 20	6 14 1
..	..	..	..	..	..	..
..	..	..	..	..	..	..
2,191 11 9	555 11 2	651 0 4	4,517 15 0	63,576 4 6	442 0 0 14	7 3 2
..	..	..	..	..	....	..
..	..	..	..	..	....	..
..	..	..	..	..	....	..
2,811 0 4	893 10 9	777 14 2	5,730 12 7	77,856 1 4	570 16 0 18	6 13 2
1,962 0 0	658 0 0	666 0 0	4,256 0 0	60,188 0 0	409 0 0 0	7 6 9
..	..	3,997 6 0	25,534 0 0	..	2,458 2 0 0	.

## ANNEXURE XIX.

*Rates for Scrap on the East Indian Railway.*

Item No.	Class No.	Description.	Schedule rate.	Auction rate.
			Rs. a. p.	Rs. a. p.
			Per ton.	Per ton.
1	1	Scrap rails, over 11 feet long, unserviceable, steel or wrought iron of any description excepting flat-footed rails and tongue rails	35 0 0	..
2	2	Ditto flat-footed	25 0 0	..
3	3	Scrap Lowmoor, or best Yorkshire iron	30 0 0	..
4	4	Scrap, W. I., and M. S., miscellaneous, selected, fit for use in rolling mills consisting of tie bars, fish plates, flat girder plates, engine frame plates, foot-plates, tender plates, flat bars, rods, joists cuttings, angles and tee irons	25 0 0	..
5	5	Wrought iron wheel centres, broken into pieces not exceeding 2 cwts. in weight each	20 0 0	..
6	6	Ditto ditto whole	16 0 0	..
7	7	Unsuitable—Scrap, W. I. and M. S., miscellaneous, consisting of spikes, boiler plates, whole or in large pieces, lagging plate, smoke-box plates, splashers, broken corrugated iron sheets bent and burnt rails, twisted rails, tongue rails, rails between 4 and 11 feet in length all small scrap and rejected bars from the rolling mills and all old broken W. I. tools	15 0 0	27 0 0
8	7-A.	Suitable—Scrap, W. I., and M. S. miscellaneous, consisting of punchings shearings, rivets and bolt heads, cotters, strips of plates, rails four feet and under in length, top plates and buckles of laminated springs and cut-ends of fishplates	15 0 0	27 8 0
9	8	Scrap, cast iron, not requiring to be broken up	35 0 0	61 0 0
10	9	Ditto requiring to be broken up for the foundry	30 0 0	..
11	10	Scrap, stripped, laminated, locomotive springs, etc., without top plates and buckles, cast steel and old tools, consisting of files chisels of sorts, twist drills, riveters' snaps, taps and dies, steel crow bars, hammers of sorts, machine cutters and tools, punches, plane irons, rimers, drifts, brace-bits and file cutters	35 0 0	55 0 0
12	11	Scrap steel and cast iron axle boxes, mixed consignments of	20 0 0	..
13	21	Scrap axles, steel	30 0 0	..
14	22	Scrap tyres, steel	20 0 0	23 2 0
15	23	Scrap, mixed cast and wrought iron	20 0 0	85 0 0

## ANNEXURE XX—(i).

*List of spare parts purchased locally.—Eastern Bengal Railway.*

Description.	Quantity.	Rate.		
		Rs.	a.	p.
Coupling, screw, high tensile steel, C. & W., B. G., with shackles and pins . . . . .	500 No.	29	8	0 each.
I. R. pistons rings, complete with wave and compression spring . . . . .	3 Sets	} 416	0	0 Nett.
Springs for piston rod, gland packing . . . . .	72 No.			
Springs for piston valve rod, gland packing . . . . .	72 "			
Coupling, screw, shackles, high tensile steel to fit 1-3/8" pin . . . . .	150 "	4	4	0 each.
Coupling, screw, shackles, high tensile steel, to fit 1-1/2" pin . . . . .	200 "	4	4	0 "
Plugs for the "Petter" oil engine No. . . . .	2 "	4	0	0 "
Longitudinal girders for metre gauge bogie wagons	175 Pairs.	38	0	0 "
Drawbars, I. R. C. A., type . . . . .	20 No.	22	8	0 "
Coupling screw, high tensile steel, C. & W. B. G. with shackle and pins . . . . .	500 "	33	0	0 "
Drawbar sockets, large . . . . .	50 "	29	0	0 "
Drawbar sockets, small . . . . .	50 "	25	0	0 "
Piston rod for vac: cylinder I. R. C. A. standard brass-coated . . . . .	300 "	12	8	0 "
Cast steel, headstock brackets, 8 1/4" . . . . .	500 "	38	0	0 cwt.
Cast steel, cruciform, special ramp block to wooden pattern . . . . .	8 "	45	0	0 "
Cast steel, check blocks, 73 lbs.: 1-3/4" to brass pattern . . . . .	48 "	0	8	0 lb.
Cast steel head stock brackets, 9-1/4" and 10" . . . . .	500 "	38	0	0 cwt.
Brackets, cast steel, for bogie centre . . . . .	100 "	45	0	0 "
Axles, D. & J. class Engine, Bogie . . . . .	4 "	190	0	0 each.
Axles D. & G. class Engine, Tender . . . . .	12 "	215	0	0 "
Axle boxes, cast steel, machined, but without brasses 10" x 4-1/2" x 7-1/2" with 1" groove . . . . .	50 "	32	0	0 box.
Cast steel, axle boxes, 7" x 3-1/2" journal . . . . .	100 "	25	0	0 "
C. S. casting for escapement crank . . . . .	8 "	0	8	0 lb.
C. S. casting for escapement crank: half crank for above . . . . .	8 "	0	8	0 "
Cast steel bogie centre pivots, unmaclined, for "K" class engine . . . . .	6 "	42	0	0 cwt.
Brackets, cast steel, for bogie centre . . . . .	100 "	45	0	0 "
Crank escapement, cast steel, rough . . . . .	36 "	0	8	0 lb.
Half crank, cast steel, rough . . . . .	36 "	0	8	0 "
Cast steel, horn stays . . . . .	6 "	42	0	0 cwt.
Cast steel, crucification ramp block, 87°—20 to pattern . . . . .	8 "	45	0	0 cwt.

Description.	Quantity.	Rate.
		Rs. a. p.
Brake block, push rod, B. G., to sample . . . . .	100 No.	180 0 0 Lot. (Approximate.)
Cotters, split, for drawbar hook, $4-1/2" \times 1/2" \times 3/8"$ as per sample . . . . .	1,000 ,,	0 3 6 each.
Cotters, split, for drawbar hook, $4-1/2" \times 1-1/4" \times 1/4"$ as per sample . . . . .	1,000 ,,	0 3 0 ,,
Cotters, split, for hand brake lever $3-3/4" \times 1" \times 1/4"$ to sample . . . . .	200 ,,	0 2 6 ,,
Cotters, split, for hand brake lever, $3-3/4" \times 1-1/4" \times$ $5/16"$ as per sample . . . . .	200 ,,	0 2 6 ,,
Cotters, split, for drawbar shackle pin, $3" \times 3/4" \times 3/16"$ as per sample . . . . .	500 ,,	0 2 0 ,,
Cotters, split, for draw spring spindle, I. R. C. A. $4-3/8" \times 3/4" \times 3/8"$ to sample . . . . .	2,000 ,,	0 2 0 ,,
Cotters, split, for drawbar screwing pins, I. R. C. A. $3-7/8" \times 7/8" \times 1/4"$ as per sample . . . . .	200 ,,	0 2 0 ,,
Cotters split, for A class buffers, $3-5/8" \times 1" \times 1/4"$ to sample . . . . .	2,000 ,,	0 1 9 ,,
Cotters, split, for A class buffers, $3-1/4" \times 3/4" \times 5/32"$ as per sample . . . . .	2,000 ,,	0 1 9 ,,
Cotters, split, for bearing spring shackle pin, $2-1/2" \times$ $9/16" \times 1/8"$ as per sample . . . . .	1,000 ,,	0 1 3 ,,
Cotters, split, for bearing spring shackle pin, $2" \times$ $1/2" \times 1/8"$ to sample . . . . .	2,000 ,,	0 1 0 ,,
Cotters, split, fig: American wagon, $2-5/8" \times 11/16"$ $\times 3/16"$ to sample . . . . .	2,000 ,,	0 1 6 ,,
Cotters, split, fig: $2-1/2" \times 9/16" \times 3/16"$ to sample.	2,000 ,,	0 1 3 ,,

## ANNEXURE XX—(ii).

List of Spare Parts purchased locally.—East Indian Railway.

Description.	Quantity.	Rate.		
		Rs.	A.	P.
Chains and cotters, W. I., flat, for I. C. G. wagon . . . . .	29,565	1	7	0 each.
Chains and cotters, W. I., flat, for I. O. S. wagon . . . . .	2,088	1	8	0 "
Chains and pins, half round, for I. C. G. wagon . . . . .	7,907	1	5	0 "
Bridles, W. T., for axle guard, 6-5/8" . . . . .	8,400	0	12	0 "
Bridles, W. T., for axle guard, 7½" . . . . .	1,800	0	13	0 "
Case hardened cotters . . . . .	16,600	2	0	0 "
Catches, C. I., for door . . . . .	450	0	4	9 "
Sash pad . . . . .	72	2	0	0 doz.
Screw coupling . . . . .	20,000	24	4	0 each.
Locks, door, single action, with C. I handle, Defrees' patent, R. hand . . . . .	90	10	0	0 "
Locks, door, double action, with C. I handle, Defrees' patent, R. hand . . . . .	210	14	8	0 "
Spring wedges, steel, tempered in oil . . . . .	45,000	1	0	0 "
Spring wedge locks . . . . .	6,000	1	4	0 "
Ellis keys . . . . .	200	25	0	0 "
Dust shield . . . . .	365	5	4	0 "
Ellis key frame . . . . .	4	7	8	0 "
Locks, door, private, large . . . . .	15	0	14	0 "
Door handle, single action, R. & L. . . . .	66	2	2	0 "
Door handle, double action, R. & L. . . . .	10	2	8	0 "
Lids, W. I, for commode, round 18" × 1/8" . . . . .	93	0	14	0 "
Handles, door, W. I, for carriage Durbar pattern . . . . .	54	2	4	0 "
Fasteners or window catches, automatic, large, box pattern . . . . .	7,790	18	0	0 doz.
Friction, iron, type "A", for draw bars of 24 tons wagon . . . . .	21	32	8	0 each.
Auxiliary bearing spring box, cast steel, for I. R. C. A. truck . . . . .	200	6	0	0 "
Ventilators, roof, inside . . . . .	86	7	8	0 "
Lower class lavatory doors to E. I. R. pattern . . . . .	350	9	14	0 "
Expanded metal frame for 3rd class carriages . . . . .	2,400	2	2	0 "
Locks, door, malleable iron, single action . . . . .	192	2	2	0 "
Locks, door, malleable iron, double action . . . . .	484	2	4	0 "
Cotters, iron, with chains, type "C" for low-sided trucks . . . . .	1,300	1	7	0 "
Cotters, iron, with chains, for low-sided trucks . . . . .	900	1	7	0 "
Cotters, iron, with chains, for flap doors . . . . .	500	1	7	0 "
Pins, iron, half round, with chain for side doors of wagon . . . . .	400	1	5	0 "
Cotter pins, 2" × ¼" × 3/16" for bearing spring shackle pins . . . . .	5,500	0	2	0 "

## East Indian Railway—contd.

Description	Quantity.	Rate.		
		Rs.	A.	P.
Pins iron, with chains, for side door of wagons . . . . .	500	0	15	0 each.
Cotters, iron, 3" × 1" × 3/16" for buffers . . . . .	1,000	0	2	6 "
Brackets, net rod, large . . . . .	84	12	8	0 "
Brackets, net rod, small . . . . .	27	7	0	0 "
Cotters, flat iron, 6/8", with chain for wagon door . . . . .	300	1	7	0 "
Cushions, I. R., for window rest . . . . .	9,450	1	11	0 doz.
Bending bar . . . . .	50	1	2	0 each.
Shock absorber for bearing spring eye bolt . . . . .	48 sets	67	0	0 set.
Bridles, iron type, for "E" type axle guard of "S" type wagons . . . . .	60	0	12	6 each
Plates, horn, M. S., for axle guard "E" type . . . . .	120	2	8	0 "
Vacuum cylinder "E" type 24" . . . . .	11	229	8	0 "
Vacuum cylinder "F" type 24" . . . . .	18	266	10	0 "
Cylinder joint rings, 18" . . . . .	15,323	0	2	9 "
Gland packing box . . . . .	76	2	5	9 "
Hose pipe, I. R., 3/4" × 18" . . . . .	2,348	2	2	0 "
Hose pipe I. R., 2" × 27" with clips and couplings . . . . .	25,661	6	4	0 "
Hose pipe, I. R., 2" × 27" without clips and couplings . . . . .	54,100	4	3	6 "
Gauges, vacuum, single . . . . .	64	25	0	0 "
Screw for piston cap . . . . .	722	0	1	6 "
Hose clips, 3/4" . . . . .	66,163	0	1	11 "
Hose clips, 2" . . . . .	172,051	0	3	2 "
Vacuum Cylinder, "E" type, 21" . . . . .	26	168	12	0 "
Vacuum Cylinder, "F" type, 21" . . . . .	4	217	5	6 "
Hose Couplings . . . . .	21,000	2	0	0 "
Ball Valve, "E" type . . . . .	3,225	8	0	0 "
I. R. Rolling Rings, 18" . . . . .	8,400	1	14	0 "
Hose Pipe, I. R., 3/4" × 36" . . . . .	3,085	3	12	0 "
Hose Pipe, I. R., 3/4" × 24" . . . . .	15,490	2	3	6 "
Hose Pipe, I. R., 3/4" × 30" . . . . .	692	2	15	0 "
Hose Pipe, I. R., 1/2" × 3/4" × 15" . . . . .	332	1	9	0 "
Hose Pipe, I. R., 1" × 18" . . . . .	492	2	6	0 "
Hose Pipe, I. R., 2" × 18" . . . . .	368	3	4	6 "
Rolling Rings, I. R., 21" . . . . .	1,384	2	6	0 "
Rolling Rings, I. R., 24" . . . . .	774	2	1	3 "
I. R. Rings for Piston Rod Packings . . . . .	3,700	7	11	0 doz.
"Diaphragm" Valve Van . . . . .	387	0	8	0 each.
Valve Van . . . . .	88	43	0	0 "
Stuffing Box . . . . .	230	2	5	9 "
I. R. Joint Rings, 21" . . . . .	306	2	4	0 "
I. R. Joint Rings, 24" . . . . .	803	0	5	6 "
Hose Pipe, 3'-3" × 2 1/2" . . . . .	8	11	8	0 "
Ball Valve, "C" type . . . . .	11,147	8	0	0 "
Washers, I. R., for Hose Pipe, 2" . . . . .	7,500	1	0	0 doz.
Brass Bushes, 1 1/2" . . . . .	672	1	12	0 each.
Pins with cotters, cross head, for piston rod . . . . .	101	1	5	0 "
C. I. Syphon . . . . .	111	4	12	9 "

## East Indian Railway—contd.

Description.	Quantity.	Rate.
		Rs. A. P.
I. R. Rolling Rings, 22" . . . . .	3	2 1 0 each.
Piston Rod . . . . .	1,054	12 0 0 "
Vacuum Cylinder "E" type 18" . . . . .	87	168 12 0 "
Vacuum testing sets . . . . .	2 sets	3,750 0 0 "
Hair springs as per sample . . . . .	50	1 9 0 "
Pointers as per sample . . . . .	50	0 8 0 "
Quadrants as per sample . . . . .	25	4 9 0 "
Spindles as per sample . . . . .	25	2 6 0 "
Nipples, W. I., for C. I. syphon . . . . .	226	0 10 0 "
Packing or gland box with brass rings for "E" type 21" cylinder . . . . .	20	4 13 0 "
Washers, I. R., for ball couplings . . . . .	254	0 1 3 "
Vacuum cylinder piston rod for 24" "F" type cylinder . . . . .	2	16 10 6 "
Vacuum cylinder piston rod for 18" "F" type cylinder . . . . .	2	19 4 0 "
Brass necking for piston rod, packing . . . . .	206	0 8 6 "
Rings, brass, for stuffing box . . . . .	150	0 8 6 "
Lever for release valve . . . . .	140	0 8 0 "
Rubber washer for van valve seating . . . . .	154	0 2 0 "
Ball valve diaphragm . . . . .	3,000	0 2 1 "
Ball valve joint washers . . . . .	20,000	0 8 6 "
Rubbers, stuffing box joint . . . . .	12,000	0 1 3 "
Piston rod, gland . . . . .	6,000	0 4 6 "
Washer, coupling, I. R. . . . .	519	1 12 0 doz.
Washer, I. R., for syphon . . . . .	500	0 4 0 each.
Rings, joint, I. R., for ball valve cover. . . . .	180	0 0 6 "
Vacuum piston head joint rings . . . . .	60	0 1 6 "
Cylinder for vacuum testing machine . . . . .	1	18 0 0 "
Vacuum cylinder "F" type, 18" . . . . .	6	195 12 0 "
<i>Buffers.</i>		
Cases and plungers, only cast steel, I. R. C. A. standard, 2'-1" over all . . . . .	200	34 0 0 each.
Sockets, W. I., for 25" cylindrical buffer type . . . . .	90	22 0 0 "
<i>Springs.</i>		
Springs for bolster 3-1/8 × 2-1/2 . . . . .	100	3 6 0 each.
Springs, bearing, check, 4-1/2 × 1/2 × 1-1/4 . . . . .	934	1 4 0 "
Springs, I. R. 6-1/2 dia., 3/4 hole × 1/2 thick. . . . .	100	2 8 0 "
Springs, Volute steel, "J" type for drawbar . . . . .	20	12 8 0 "
Springs, spiral steel, for drawbar . . . . .	150	12 15 0 "
Springs, Helical, for "A" buffer. . . . .	266	13 8 0 "
		<i>plus 10 per cent.</i>



## ANNEXURE XX (iii).

List of spare parts purchased locally. Great Indian Peninsula Railway.

Description.	Quantity purchased in one year.				Rate. Rs. A. P.	Per
	No.	T.	Qr.	Lbs.		
<i>For Locomotives.</i>						
Cocks, blow off, Everitt patent . . . . .	150	0	0	0	50 0 0	each.
Hornblocks, driving, cast steel for J./1 type engines. . . . .	17 pair	5	6	0 18	40 0 0	cwt.
Brackets for rocking grate for D./5 type engines. . . . .	10	0	0	2 9	38 0 0	„
Taper plug, seating, B. R. 10—16 . . . . .	98	0	11	2 0	38 0 0	„
Tee links, cast steel . . . . .	234	2	7	2 20	38 0 0	„
Valves heads for piston valves, Cast steel	51	0	14	2 8½	38 0 0	„
Male nipples for 1/2" gas Dart unions . . . . .	48	0	0	0 0	0 12 0	each
Male nipples for 1" gas Dart unions . . . . .	24	0	0	0 0	1 4 0	„
Female nipples for 1/2" gas Dart unions . . . . .	72	0	0	0 0	0 12 0	„
Female nipples for 3/4" gas Dart unions . . . . .	24	0	0	0 0	0 15 0	„
Female nipples for 1" gas Dart unions . . . . .	156	0	0	0 0	1 4 0	„
Nuts for 1/2" gas dart unions . . . . .	172	0	0	0 0	9 0 0	doz.
Nuts for 3/4" gas Dart unions . . . . .	124	0	0	0 0	0 15 0	each.
Nuts for 1" gas Dart unions . . . . .	156	0	0	0 0	1 4 0	„
Pipes, exhaust, W. 1. black, 2-1/4" × 2- 1/2" × 16'-0" . . . . .	3,570'-6"	0	0	0 0	0 10 0	foot
Valves, globe, G. M., 5/8" with screwed female ends, 300 lbs. pressure, per sq. inch tested to 600 lbs. per sq. . . . .	167	0	0	0 0	7 0 0	each.
Valves, globe, G. M. 3/4" with screwed female ends, 300 lbs. pressure per sq. inch tested to 600 lbs. per sq. . . . .	102	0	0	0 0	7 10 0	„
Valves, globe, G. M., 1" with screwed female ends, 300 lbs. pressure per sq. inch tested to 600 lbs. per sq. . . . .	100	0	0	0 0	12 8 0	„
Clips, flexible, iron, 1-3/8" dia. . . . .	1184	0	0	0 0	20 0 0	0/0
Clips, flexible, iron, 2-7/8" dia. . . . .	550	0	0	0 0	0 5 10	each.
Clips, flexible, iron, 3-1/16" dia. . . . .	528	0	0	0 0	36 8 0	0/0
Tubes, copper, hard, solid drawn, 1-3/4" O/S. dia., No. 11, S.W.G. . . . .	..	4	7	3 0	84 0 0	cwt
Tubes, copper, hard, solid drawn, 2" O/S. dia., No. 11, S.W.G. . . . .	..	4	19	0 1	84 0 0	„
Tubes, copper hard, solid drawn, 2-1/4" O/S. dia., No. 9, S.W.G. . . . .	..	7	19	3 11	87 8 0	„

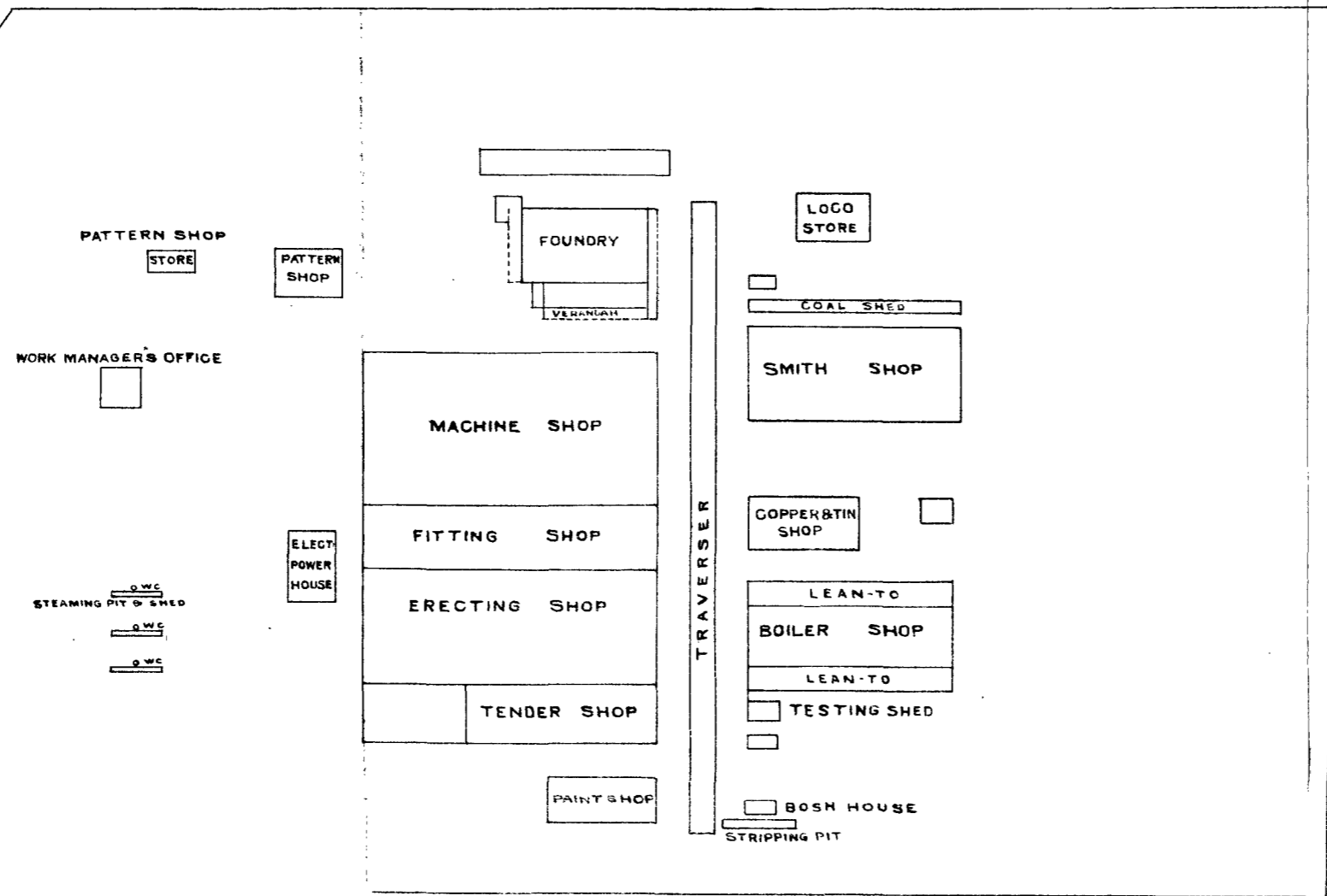
## Great Indian Peninsula Railway—contd.

Description.	Annual require- ments.	Rate.
<i>For Carriages and Wagons.</i>		Rs. A. P.
Axle boxes, Shepherd's, 10" × 5" journals, I. R. C. A. standard	194	39 8 0 each.
Buffers, Turton Platt, Noweld, I. R. C.A. standard, complete with I. R. springs	1,000	79 8 0
Buffers, Wota, I. R. C. A. standard pattern, with rubber springs, 13" face	500	83 0 0
Brackets, cast steel, outside body end	300	36 0 0
Brackets, head stock strengthening of 40 tons wagons	368	35 0 0 cwt.
Horn cheeks, cast steel	3,000	38 0 0 cwt
Metallic Fittings for Automatic Vacuum Brake:—		
Ball, gunmetal, 1/2" dia. for ball valves	26,000	1 4 0 doz.
Ball and release valves, C. I., complete for 18" cylinders.	4,800	5 15 0 each
Bushes, brass, for piston rod, 1-7/8" outside dia. of flange 2-1/2" by 1-8" thick, length 3"	6,000	0 13 0
Chain, iron, galvanized, for alarm signal	8,000 ft.	0 0 10 1/2 foot
Clips, flexible, iron, 1-5/8" dia., for syphon pipes	71,000	15 13 0 %
Clips, flexible, iron, 2-7/8" dia., for hose pipes	1,82,000	25 10 0 %
Couplings, Universal, stamped steel, for I. R. train pipe 2" inside dia.	48,000	2 15 0 pair.
		pairs
Dummy plugs, stamped steel, with horns	1,600	2 2 0 each
Internal ball valves for E cylinders	453	4 6 3 "
Piston rods, complete for 18" cylinders.	4,600	8 12 0 "
	10,000	4 15 0 "
Rings, brass, for gland packing boxes, 2-1/8" inside dia., by 13/16" deep for 18" and 21" cylinders	8,000	0 6 4 "
Studs, iron, for stuffing boxes, 1-3/4" × 3/8"	46,000	3 12 0 %
Studs for cylinders, 2-1/2" × 5/8"	24,000	6 12 0 %
Studs for ball valves, 1-1/2" × 3/8"	22,000	3 12 0 %
Valves, release, C. I., complete, for 18" cylinders	14,000	6 4 0 each.

# N. W. R. LOCO SHOPS MOGHALPURA.

*Scale—1 Inch to 600 Feet.*

Plan 1.  
N. W. R.  
Loco. Shops, Moghalpura.



SHOPS	AREA IN SQ. FT.
BOILER SHOP & VERANDAH	78039
MACHINE SHOP	88655
BLACKSMITH'S SHOP	49207
" " VERANDAH 2 BAYS	5400
" " " "	15380
FITTING SHOP	29551
PAINT "	17200
TENDER "	58028
ERECTING "	112833
WHEEL "	29552
MILLWRIGHT "	16582
TOOL "	1860
BRASS FINISHING	29551
IRON FOUNDRY	29412
BRASS "	7747
PATTERN	10256
" STORES	7298
COPPER SMITH	17200
STEAMING PIT	2700
STRIPPING PIT S	1800
BOSH HOUSE	1530
BOILER TESTING SHED	2280
NEW AIR COMPRESSOR POWER HOUSE	1200
ELECTRIC POWER HOUSE LOCO SUBST.	2790
TOTAL -----	616051

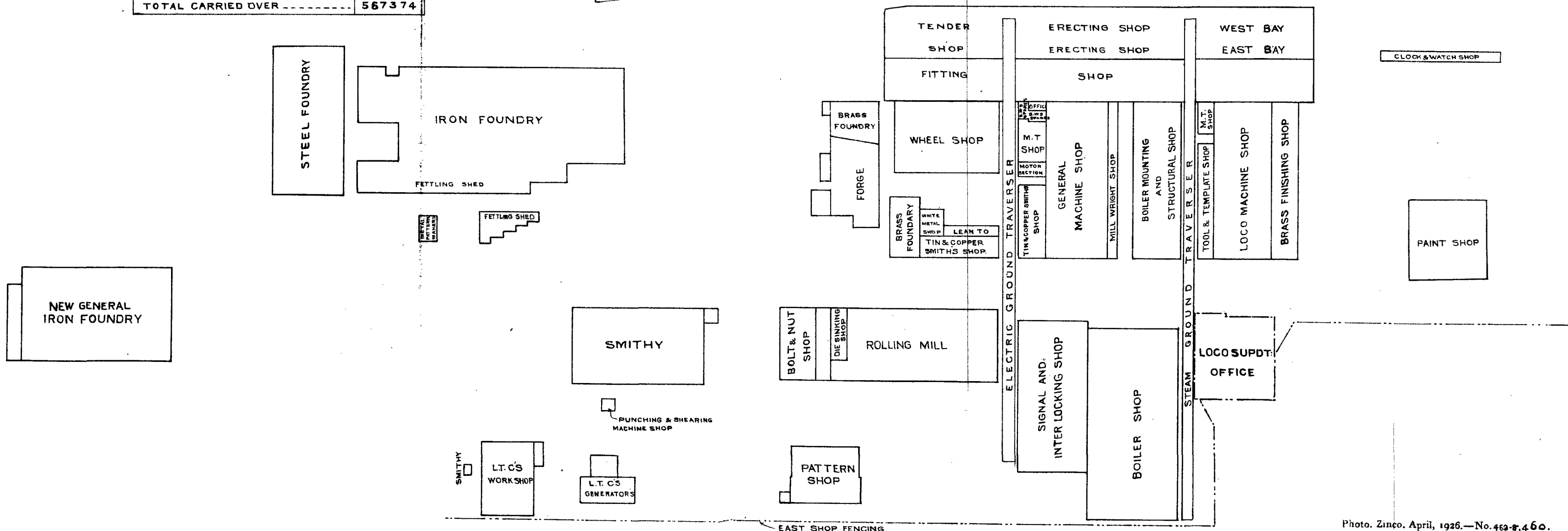
SHOPS	AREA IN SQ. FT.
BOILER SHOP	76000
SIGNAL & INTERLOCKING SHOP	48000
IRON FOUNDRY	134170
NEW GENERAL IRON FOUNDRY	69120
METAL PATTERN MAKERS	2200
FETTLING SHED	5600
SMITHY	45700
STEEL FOUNDRY	47250
L. T. CS WORK SHOP	17500
L. T. CS GENERATORS	9600
PUNCHING & SHEARING MACHINE SHOP	900
PATTERN SHOP	17884
BOLT & NUT SHOP	16500
DIE SINKING SHOP	3850
ROLLING MILL	48650
FORGE	16000
BRASS FOUNDRY	8450
" "	8000
TOTAL CARRIED OVER	567374

# E. I. R. LOCO SHOPS, JAMALPUR.

Scale—1 Inch to 400 Feet.



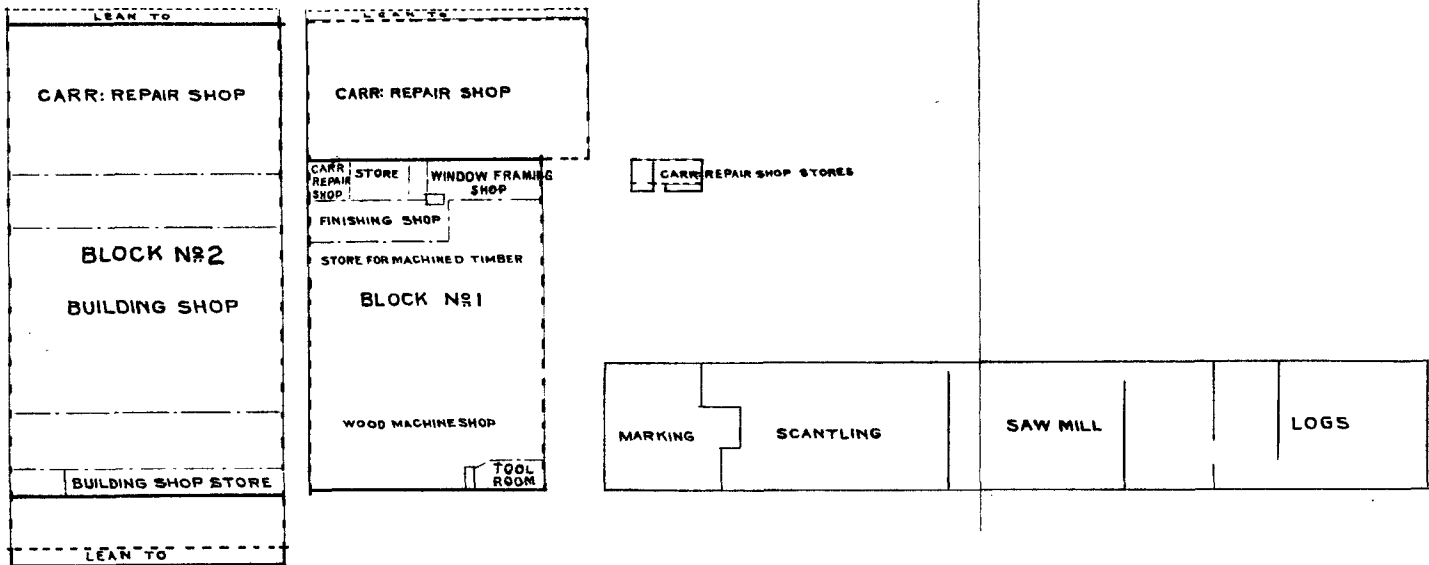
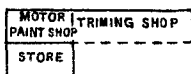
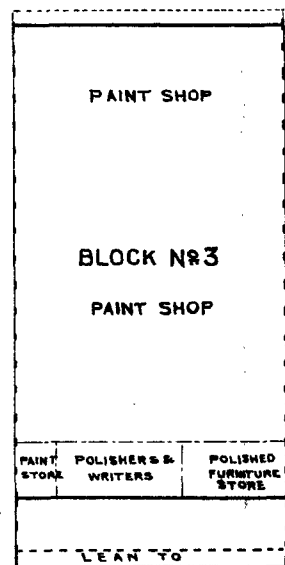
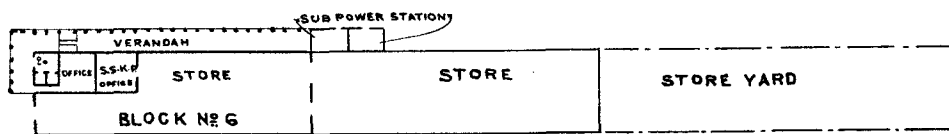
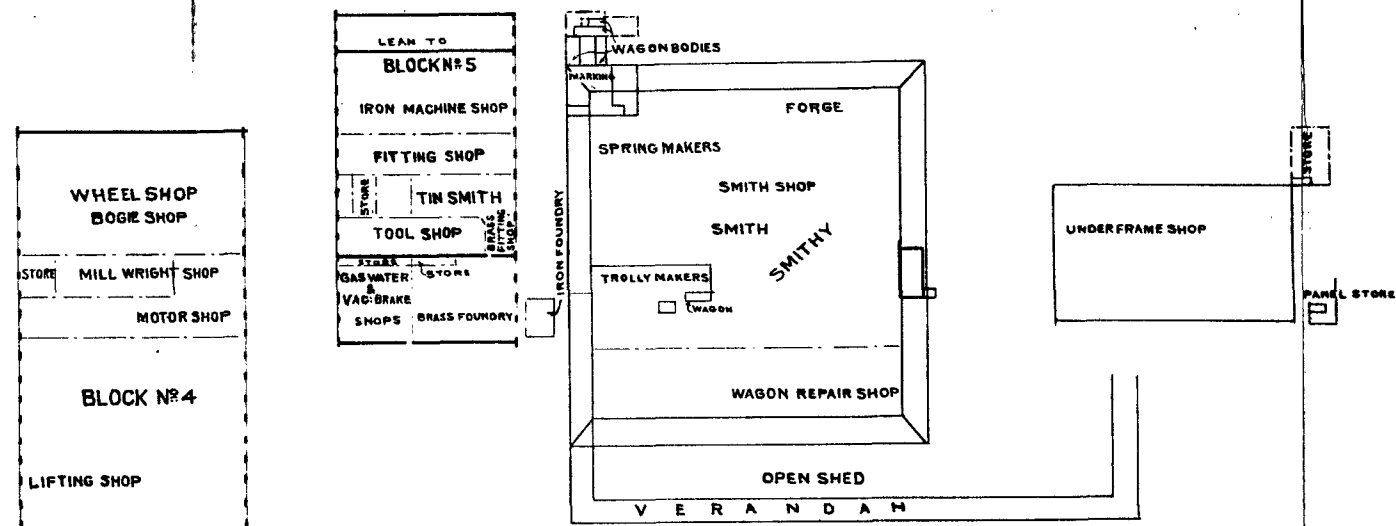
SHOPS	AREA IN SQ. FT.
TOTAL BROUGHT OVER	567374
PAINT SHOP	28900
WHITE METAL SHOP	3000
TIN & COPPER SMITHS SHOP	11360
WHEEL SHOP	33000
FITTING SHOP	54900
TENDER SHOP	27500
ERECTING SHOPS	39600
TIN & COPPER SMITHS SHOP	9600
MOTOR SECTION	1800
M.T. SHOP	5000
OFFICE	800
GENERAL MACHINE SHOP	42900
MILL WRIGHT SHOP	6600
BOILER MOUNTING & STRUCTURAL SHOP	33000
TOOL & TEMPLATE SHOP	8820
M.T. SHOP	2520
LOCO MACHINE SHOP	39600
BRASS FINISHING SHOP	18150
TOTAL	934424



# CARRIAGE & WAGON SHOPS MUGHALPURA

SCALE 200 FT 1 INCH

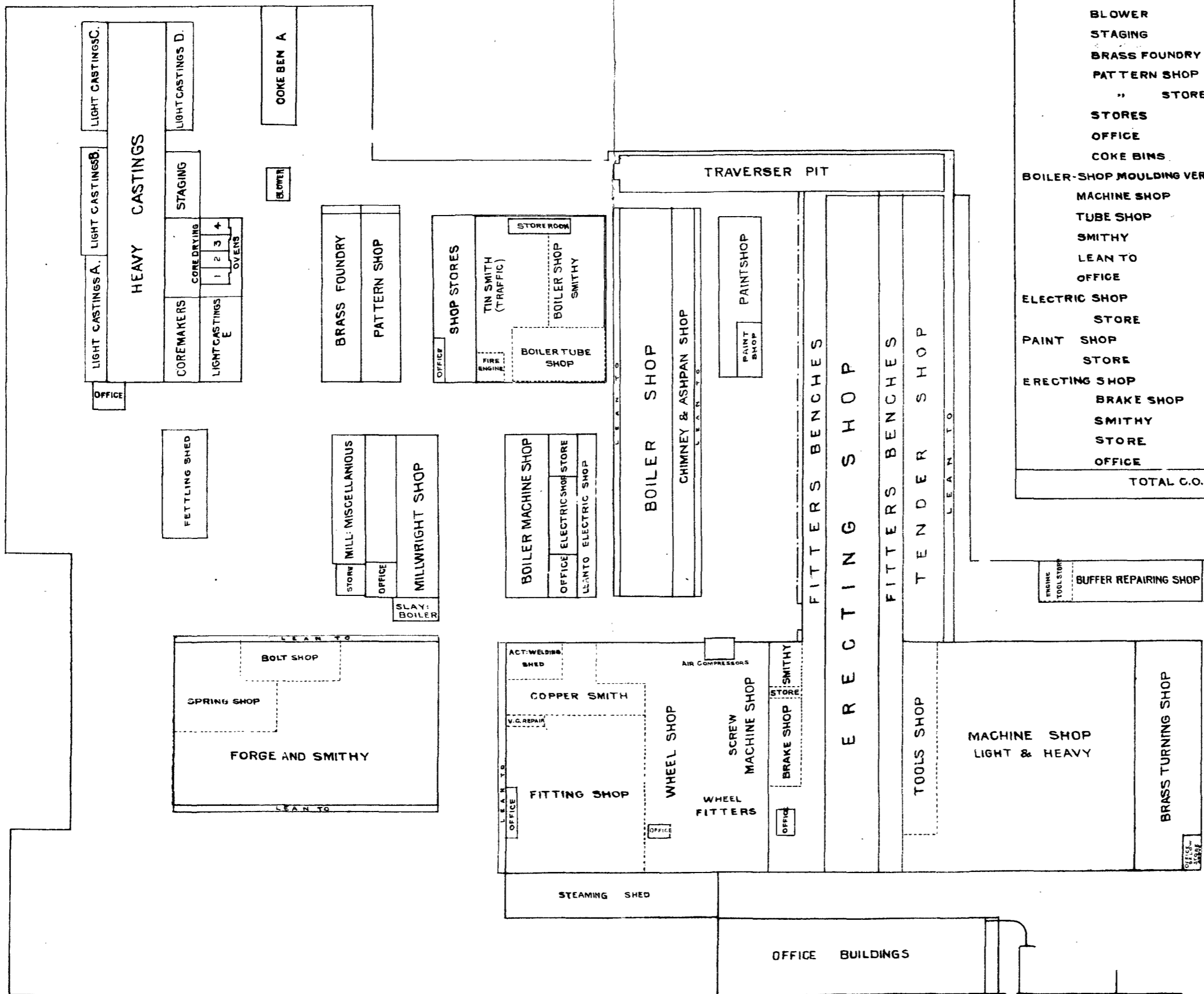
N. W. R.



SHOPS	AREA IN SQ FT
SAW MILL.	42560
SCANTLING.	26659
MARKING.	15996
WOOD MACHINE SHOP.	44651
MACHINE TIMBER STORE	26756
CARRIAGE REPAIR SHOP.	
STORE & WINDOW FRAMING SHOP.	110760
CARRIAGE BODY BUILDING SHOP.	124328
CABINET SHOP.	17060
PAINT SHOP INCLUDING MOTOR PAINTING & PAINT STORE.	176929
TRIMMING SHOP & STORE.	11550
ELECTRIC SHOPS	32194
LIFTING SHOP & STORE.	89836
MILL WRIGHT & MORTOR SHOP	21070
WHEEL SHOP.	20763
BOGIE REPAIR SHOP.	10535
IRON MACHINE SHOP.	24853
FITTING SHOP.	8127
TOOL SHOP.	10040
GAS WATER & VACCUM BRAKE SHOP.	7067
TINKERS BRASS FOUNDRY & BRASS FINISHING SHOP.	15636
SMITHY	101957
UNDER FRAME SHOP	11257
WAGON REPAIR SHOP.	103815
W. M.'S OFFICE & STORE.	60479
PANEL STORE SHED.	3519
<b>TOTAL</b>	<b>1118397</b>

# E. I. R. LOCO SHOPS CHARBAGH.

Scale—1 Inch to 200 Feet.



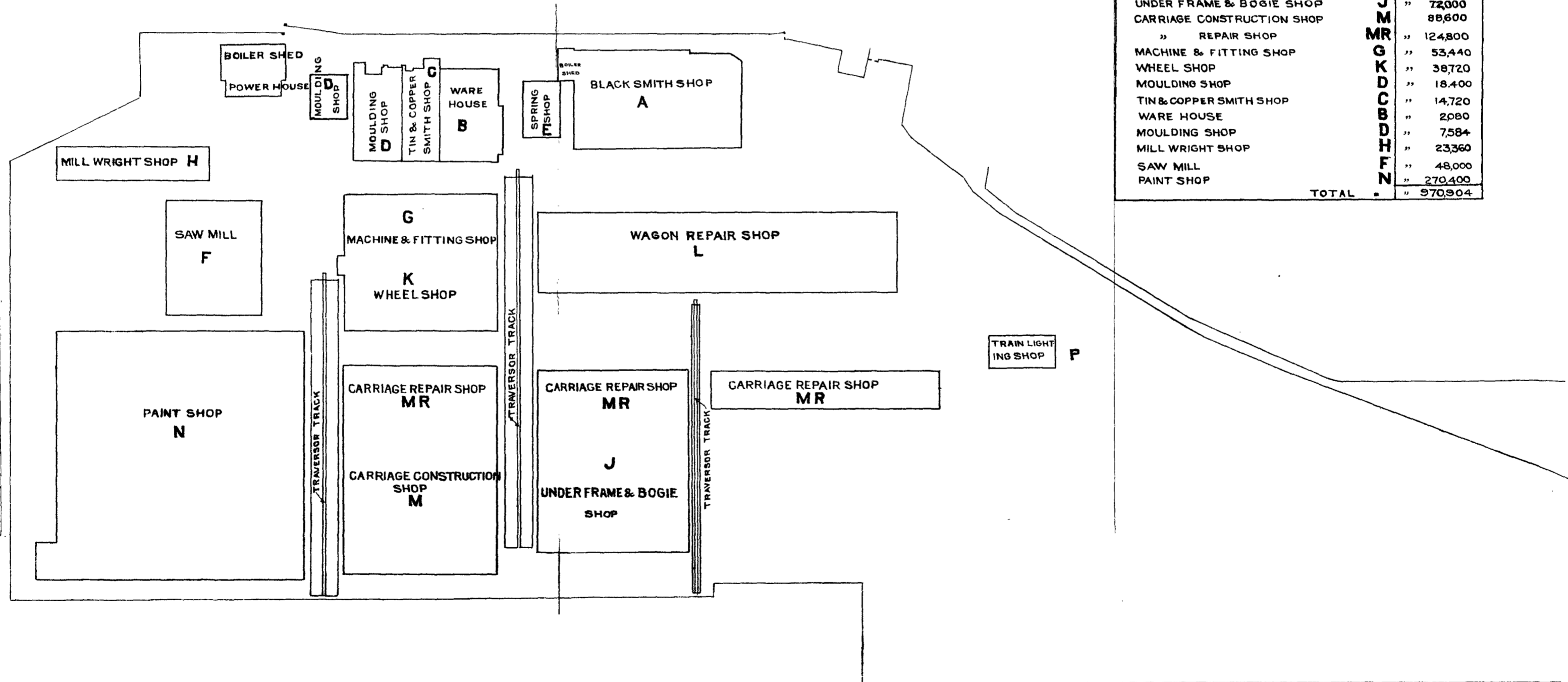
SHOPS	AREA IN SQ. FT.
FOUNDRY LIGHT CASTINGS A, B, C, D, E	11986
HEAVY "	16881
CORE MAKERS	2000
4 OVENS	4198
FETTLERS	5000
MACHINE	2132
SAND BINS	850
BLOWER	560
STAGING	1800
BRASS FOUNDRY	6031
PATTERN SHOP	6031
" STORES A, B, C	4483
STORES	990
OFFICE	590
COKE BINS	6105
BOILER-SHOP MOULDING VERANDAH	28800
MACHINE SHOP	5250
TUBE SHOP	4025
SMITHY	4249
LEAN TO	624
OFFICE	864
ELECTRIC SHOP	3024
STORE	912
PAINT SHOP	4900
STORE	1100
ERECTING SHOP	57804
BRAKE SHOP	2400
SMITHY	1200
STORE	360
OFFICE	426
<b>TOTAL C.O. ---</b>	<b>185575</b>

SHOPS	AREA IN SQ. FT.
<b>TOTAL B.O. ---</b>	<b>185575</b>
TENDER-SHOP	18700
MACHINE-SHOP LIGHT & HEAVY	39604
BRASS TURNING	12150
TOOLS SHOP	4296
OFFICE & STORE	450
BUFFER-REPAIR SHOP	4248
ENGINE-TOOLS STORE	1152
AIR-COMPRESSORS	594
WHEEL-SHOP	24913
OFFICE	216
ACETYLENE-WELDING SHOP	1664
COPPER-SMITH SHOP	4860
FITTING SHOP	17654
OFFICE	400
V.G. REPAIRING	342
MILLWRIGHT-SHOP	5250
"	2808
MISCELLANEOUS	3660
STAY-BOILER	603
OFFICE	744
STORE	624
BLACK SMITH FORGE & SMITHY	27450
SPRING SHOP	5850
BOLT SHOP	2700
STORE	4093
COAL BINS	7567
OFFICE	627
WORK MANAGERS OFFICE	1995
LEAN TO & PORCH	891
<b>TOTAL ---</b>	<b>381880</b>

# E. I. R. CARRIAGE & WAGON WORK SHOPS LILLOOAH.

Scale—1 Inch to 200 Feet.

. Plan 5.  
E. I. R.  
Carriage and Wagon Work Shops, Lillooah.



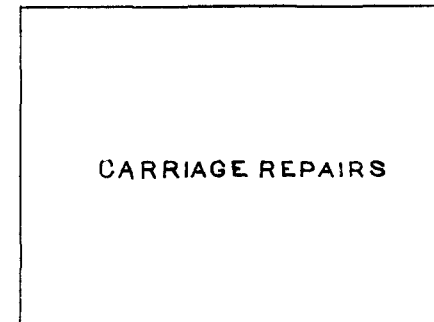
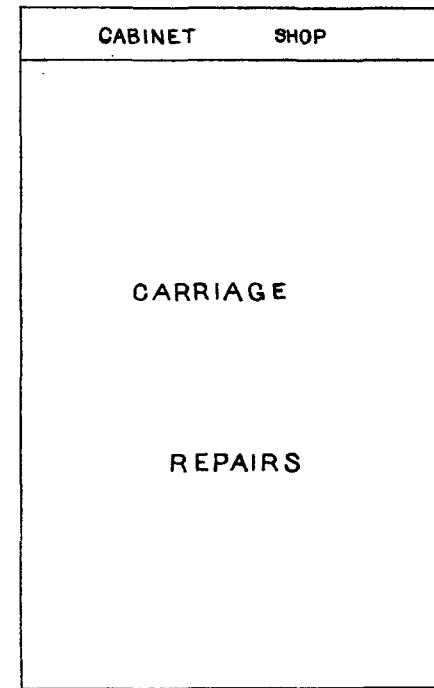
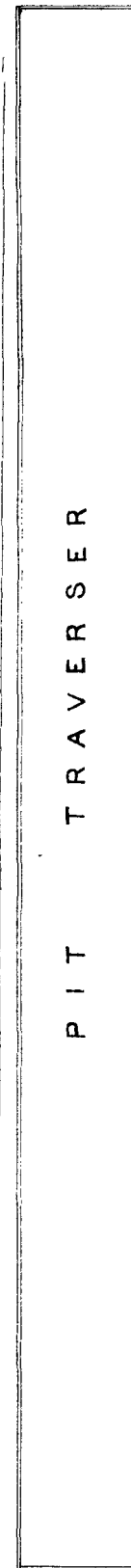
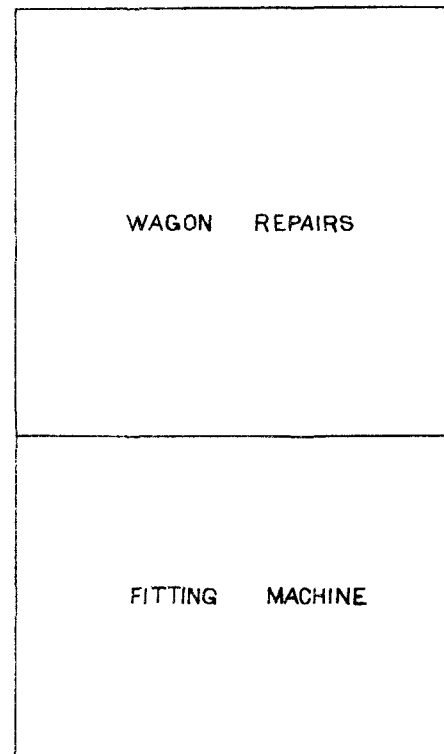
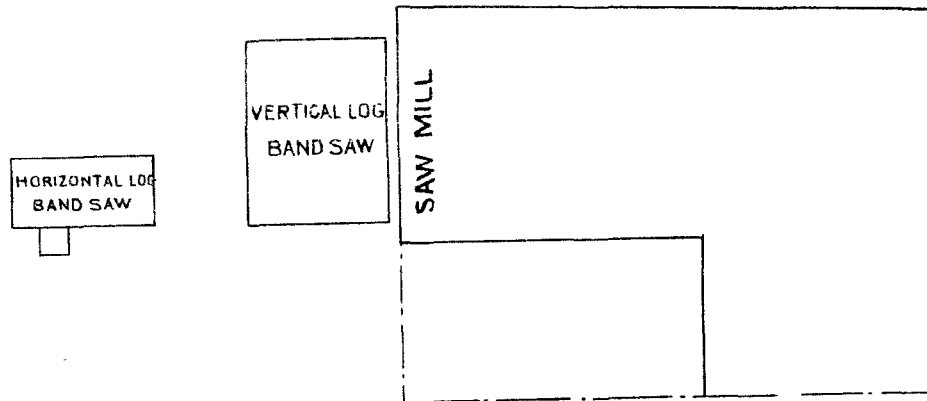
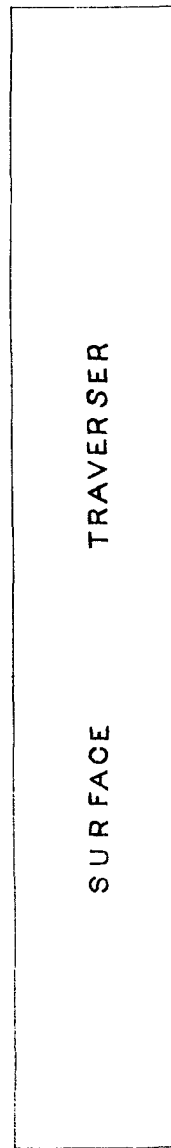
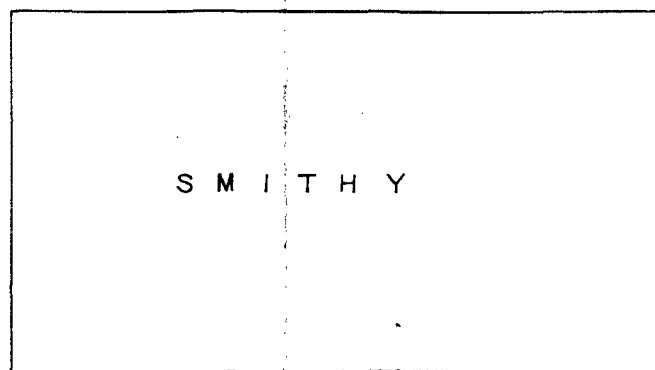
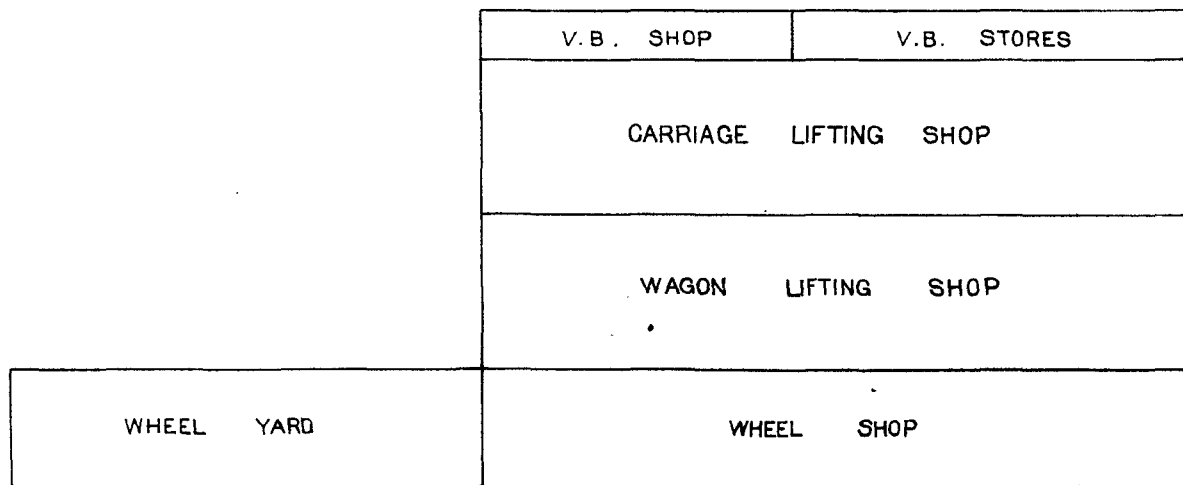
FLOOR AREA OF CARRIAGE & WAGON SHOPS

		S. FT.
TRAIN LIGHTING SHOP	P	8,400
BLACK SMITH SHOP	A	69,200
SPRING SHOP	E	9,600
WAGON REPAIR SHOP	L	121,600
UNDER FRAME & BOGIE SHOP	J	72,000
CARRIAGE CONSTRUCTION SHOP	M	88,600
» REPAIR SHOP	MR	124,800
MACHINE & FITTING SHOP	G	53,440
WHEEL SHOP	K	38,720
MOULDING SHOP	D	18,400
TIN & COPPER SMITH SHOP	C	14,720
WARE HOUSE	B	2,080
MOULDING SHOP	D	7,584
MILL WRIGHT SHOP	H	23,360
SAW MILL	F	48,000
PAINT SHOP	N	270,400
<b>TOTAL</b>	<b>*</b>	<b>970,904</b>

# E. I. R. CARRIAGE & WAGON SHOPS, ALAMBAGH.

*Scale—1 Inch to 80 Feet.*

SHOPS	AREA IN SQ FT
VACUUM BRAKE SHOP	2700
"    "    STORE	3300
CARRIAGE LIFTING SHOP	18500
WAGON LIFTING SHOP	18500
WHEEL SHOP	13000
SMITHY	41625
WAGON REPAIR SHOPS	80100
FITTING MACHINE	24030
CARRIAGE REPAIR SHOPS	72090
SAW MILL	28096
VERTICAL LOG BAND SAW	4680
HORIZONTAL LOG BAND SAW	1944
TOTAL	312465

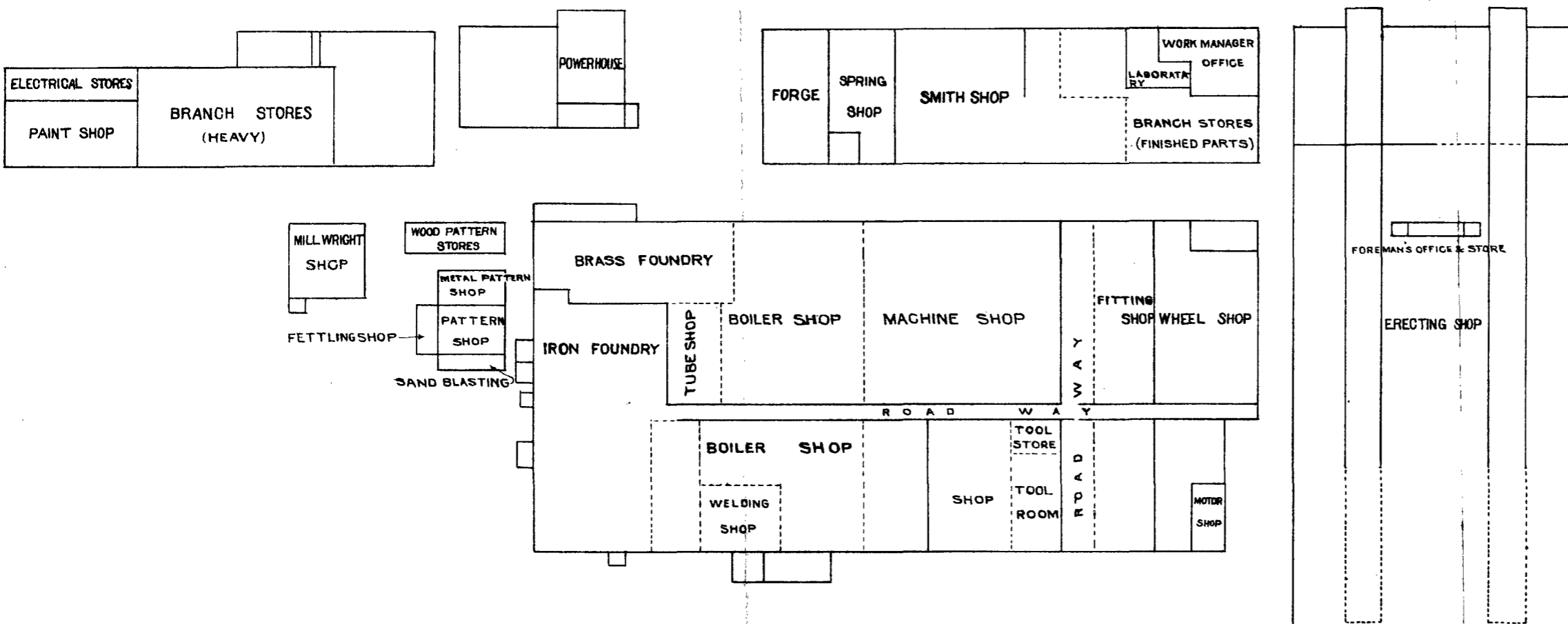




# G. I. P. R. LOCO SHOPS, PAREL.

*Scale—1 Inch to 320 Feet.*

SHOPS	AREA IN SQ. FT.
ELECTRICAL STORES	6400
PAINT SHOP	12800
BRANCH STORES (HEAVY)	52800
MILL WRIGHT SHOP	10000
WOOD PATTERN STORES	4800
METAL PATTERN SHOP & STORE	3200
FETTLING SHOP	1600
PATTERN SHOP	4800
SANDBLASTING	1600
BRASS FOUNDRY	25600
IRON FOUNDRY	45600
TUBE SHOP	16800
WELDING SHOP	1600
BOILER SHOP	70400
MACHINE SHOP	84000
TOOL STORE	2400
TOOL ROOM	4800
FITTING SHOP	30400
WHEEL SHOP	32800
MOTOR SHOP	3200
FORGE	12800
SPRING SHOP	12800
BRANCH STORES (FINISHED PARTS)	32800
SMITH SHOP	25600
LABORATORY	4000
WORKS MANAGERS OFFICE	8000
ERECTING SHOP	250250
<b>TOTAL ---</b>	<b>761850</b>

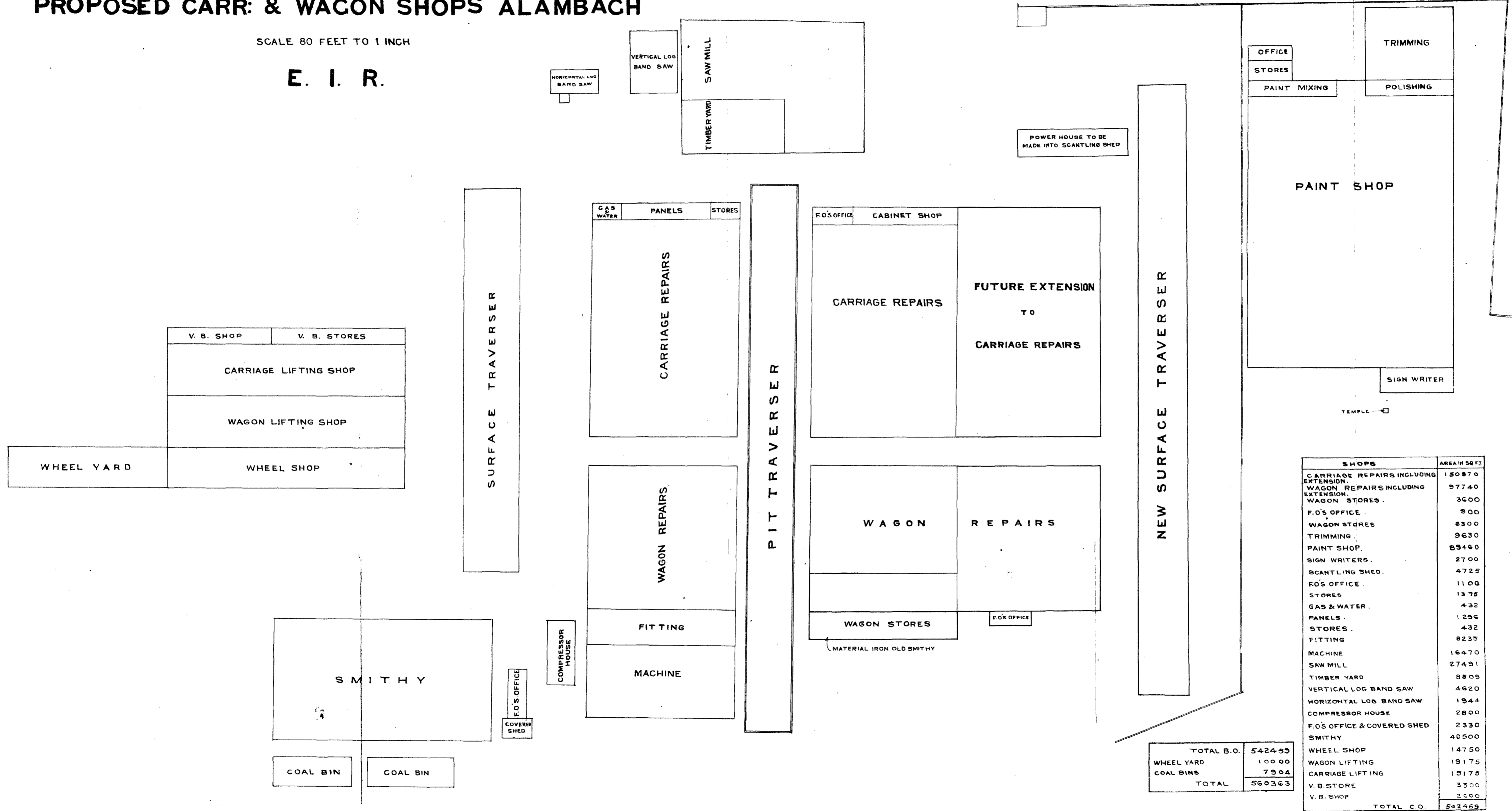


# PROPOSED CARR: & WAGON SHOPS ALAMBACH

SCALE 80 FEET TO 1 INCH

E. I. R.

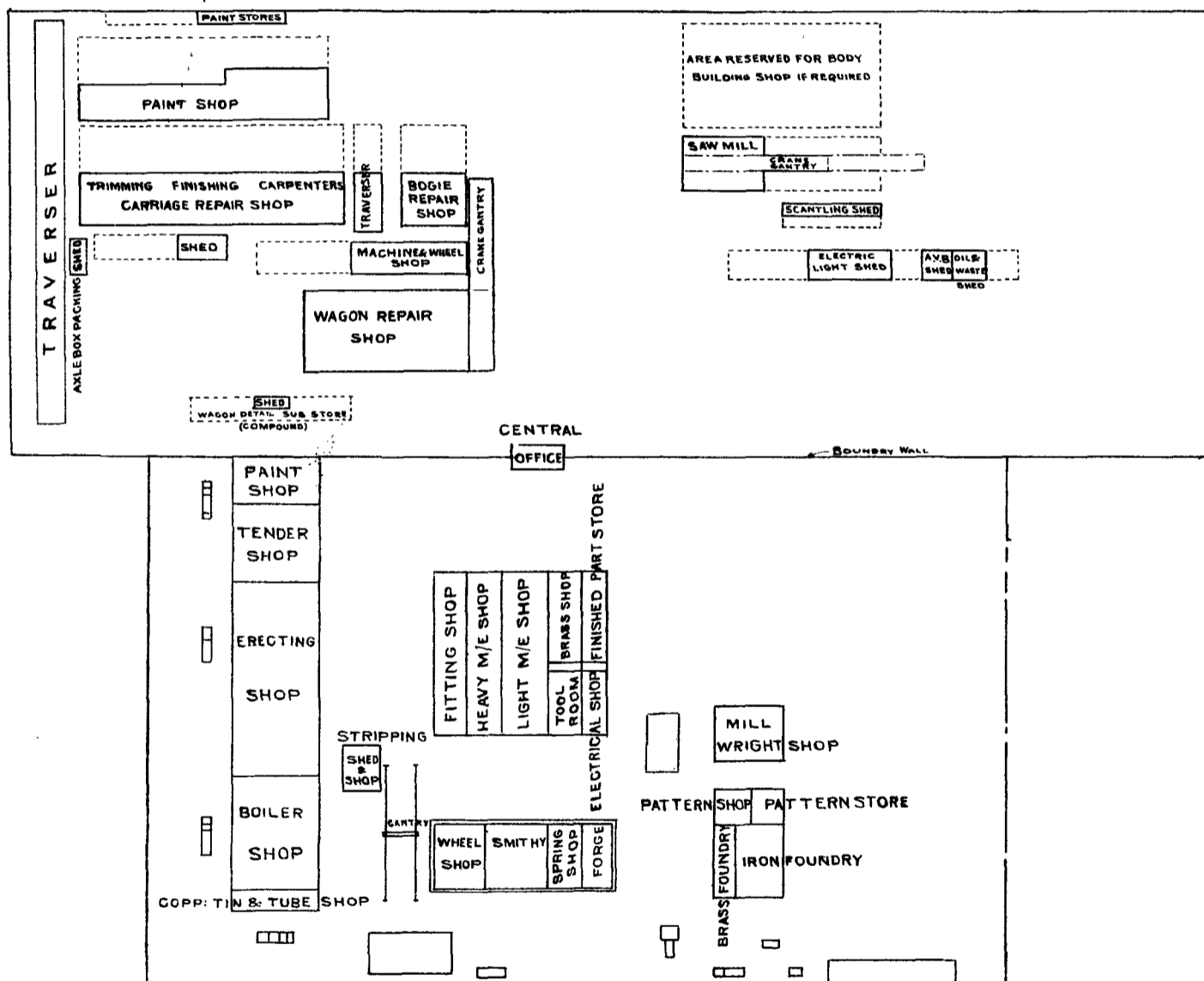
Plan 7.  
E. I. R.  
Proposed Carr.  
and Wagon  
Shops,  
Alambagh.



# G. I. P. R. EXTENSION & REMODELLING LOCO SHOPS, JHANSI.

Scale—1 Inch to 800 Feet.

CARRIAGE & WAGON SHOPS	AREA IN SQ. FT.
PAINT STORES	6600
PAINT SHOP	61155
CARRIAGE REPAIR SHOP	80000
SHED	7200
AXLE BOX PACKING SHED	1804
BOGIE REPAIR SHOP	20000
MACHINE WHEEL SHOP	23800
WAGON REPAIR SHOP	79000
SHED	2700
SAW MILL	25900
SCANTLING SHED	7200
ELECTRIC LIGHT SHOP	16000
A.V.B. SHED	6400
OIL & WASTE SHED	6400
TOTAL .....	343259

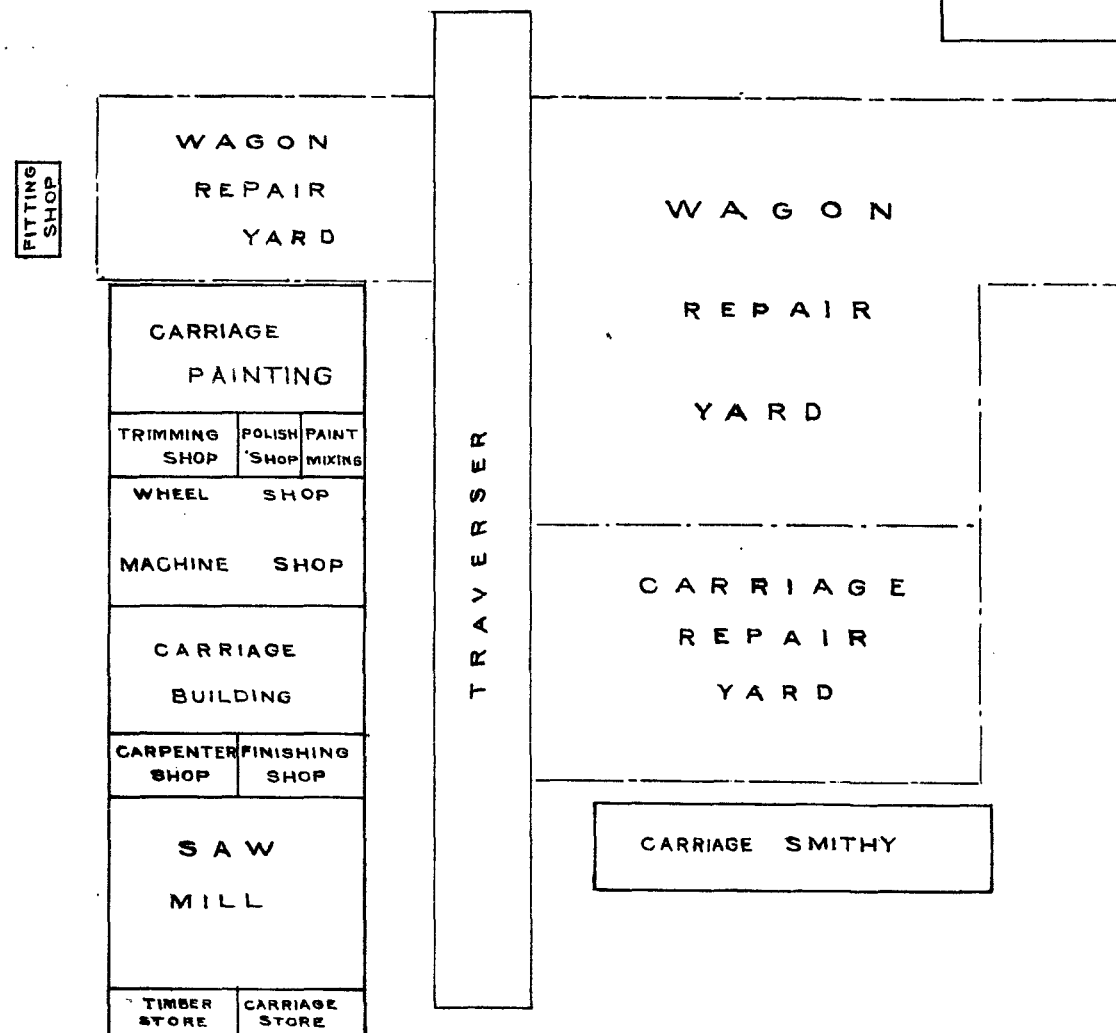
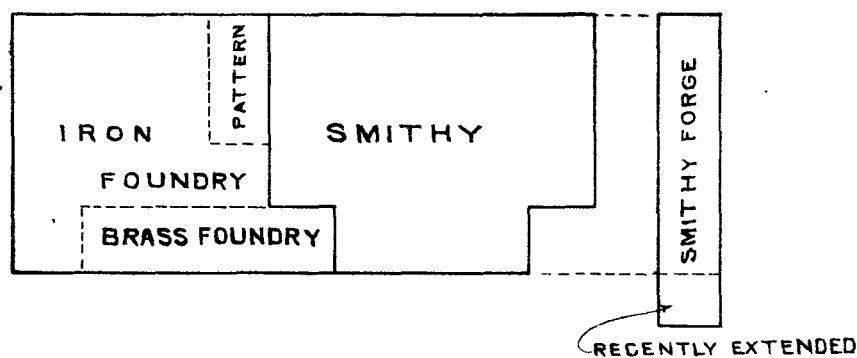
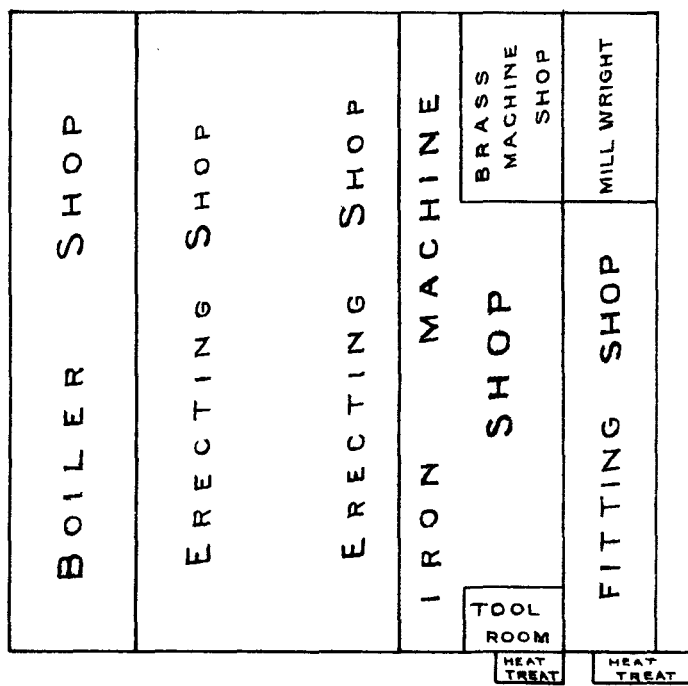


SHOPS	AREA IN SQ. FT.
PAINT SHOP	23100
TENDER SHOP	40425
ERECTING SHOP	98175
BOILER SHOP	57750.5
COPPER TIN & TUBE SHOP	11550
STRIPPING SHED	9600
FITTING SHOP	32000
HEAVY MACHINE SHOP	32000
LIGHT MACHINE SHOP	48000
TOOL ROOM	12800
BRASS SHOP	17600
ELECTRICAL SHOP	8000
FINISHED PART STORE	10400
MILL WRIGHT SHOP	19200
PATTERN SHOP	6400
PATTERN STORES	6400
WHEEL SHOP	15200
SMITHY	25800
SPRING SHOP	12800
FORGE	12800
BRASS FOUNDRY	8000
IRON FOUNDRY	24000
TOTAL ---	535800.5

# G. I. P. R. LOCO & CARRIAGE & WAGON SHOPS, JHANSI.

*Scale—240 Feet to 1 Inch.*

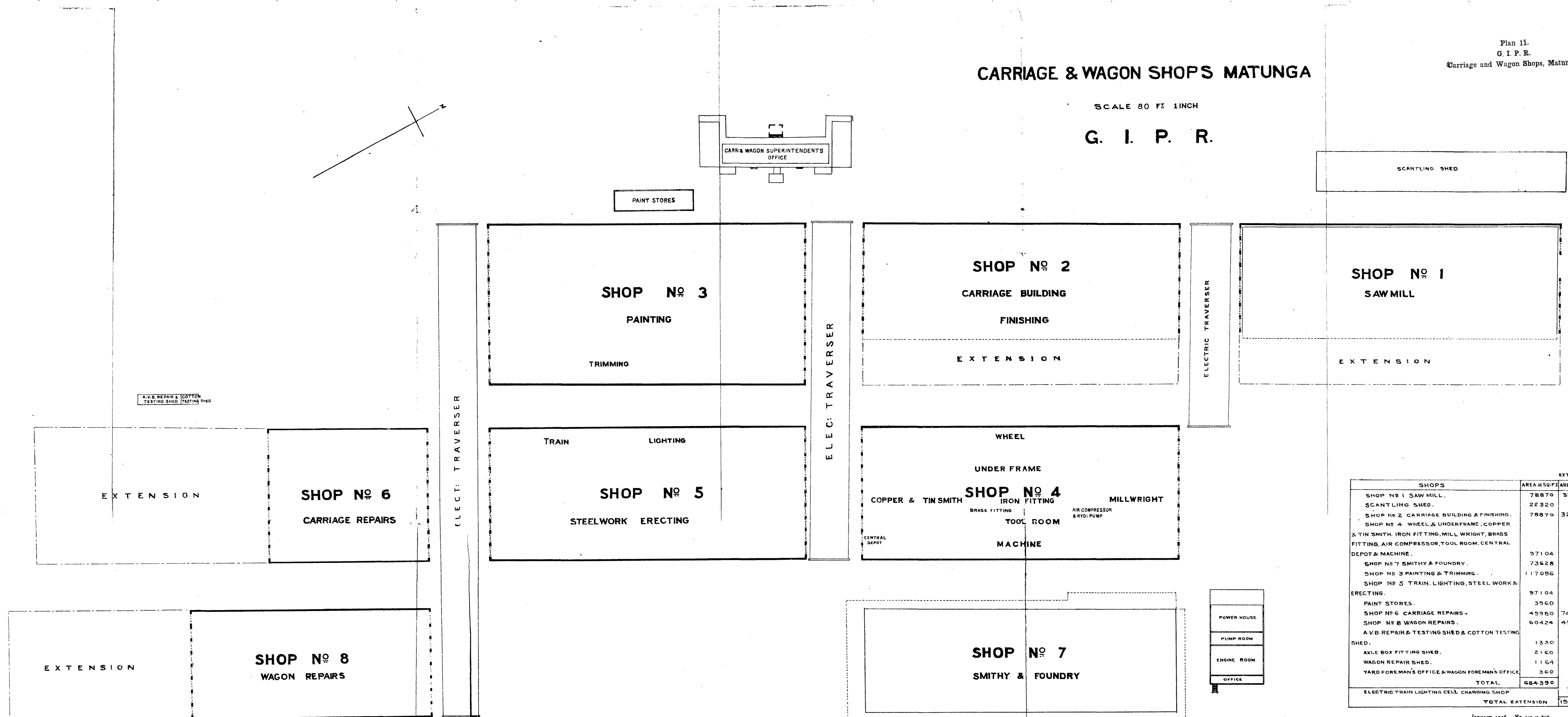
SHOPS	AREA IN SQ. FT.
BOILER SHOP	32000
ERECTING SHOP	65600
IRON MACHINE SHOP	29360
BRASS MACHINE SHOP	7440
TOOL ROOM	2400
FITTING SHOP	16800
MILL WRIGHT	7200
HEAT TREATS	2040
IRON FOUNDRY	27200
SMITHY	28800
SMITHY FORGE	7840
FITTING SHOP	1800
CARRIAGE PAINTING	12800
TRIMMING SHOP	3200
POLISH SHOP	1600
PAINT MIXING	1600
WHEEL SHOP & MACHINE SHOP	12800
CARRIAGE BUILDING	12800
CARPENTER SHOP	3200
FINISHING SHOP	3200
SAW MILL	9200
TIMBER STORE	2400
CARRIAGE STORE	2400
CARRIAGE SMITHY	13392
<b>TOTAL</b> .....	<b>307072</b>



# CARRIAGE & WAGON SHOPS MATUNGA

SCALE 80 FT 1 INCH

G. I. P. R.

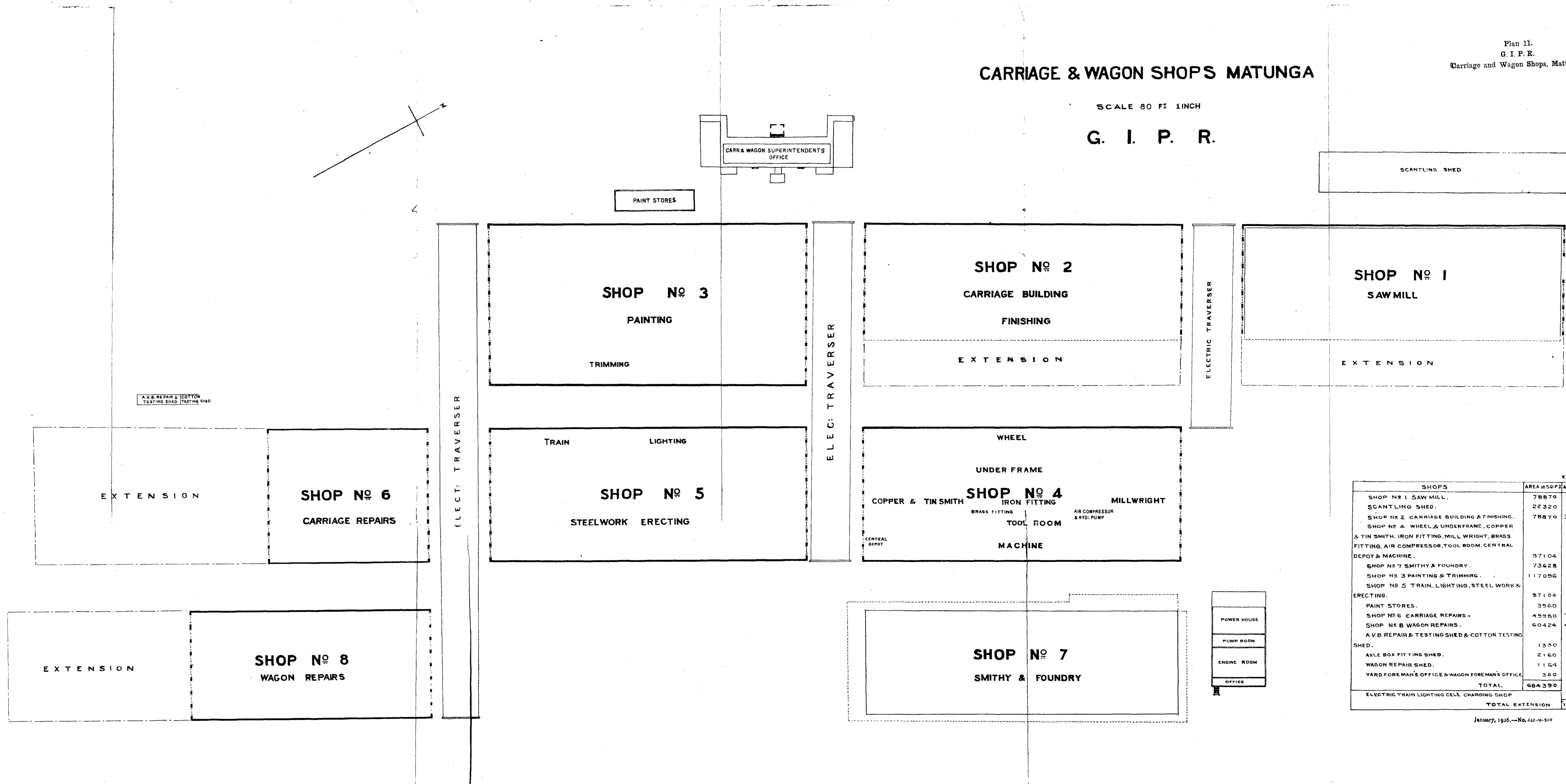


SHOPS	AREA IN SQ. FT.	EXTENSION AREA IN SQ. FT.
SHOP NO 1 SAW MILL.	78870	32582
SCANTLING SHED.	22320	-
SHOP NO 2 CARRIAGE BUILDING & FINISHING.	78870	32582
SHOP NO 4 WHEEL, UNDERFRAME, COPPER & TIN SMITH, IRON FITTING, MILL WRIGHT, BRASS FITTING, AIR COMPRESSOR, TOOL ROOM, CENTRAL DEPOT & MACHINE.	97104	-
SHOP NO 7 SMITHY & FOUNDRY.	73628	-
SHOP NO 3 PAINTING & TRIMMING.	117096	-
SHOP NO 5 TRAIN, LIGHTING, STEEL WORK & ERECTING.	97104	-
PAINT STORES.	3960	-
SHOP NO 6 CARRIAGE REPAIRS.	45980	74860
SHOP NO 8 WAGON REPAIRS.	60424	45650
A.V.B. REPAIR & TESTING SHED & COTTON TESTING SHED.	1350	-
AXLE BOX FITTING SHED.	2160	-
WAGON REPAIR SHED.	1164	-
YARD FOREMAN'S OFFICE & WAGON FOREMAN'S OFFICE.	360	-
<b>TOTAL.</b>	<b>684390</b>	<b>6840</b>
ELECTRIC TRAIN LIGHTING CELL CHARGING SHOP	-	193334
<b>TOTAL EXTENSION</b>		<b>193334</b>

# CARRIAGE & WAGON SHOPS MATUNGA

SCALE 80 FT. 1 INCH

G. I. P. R.



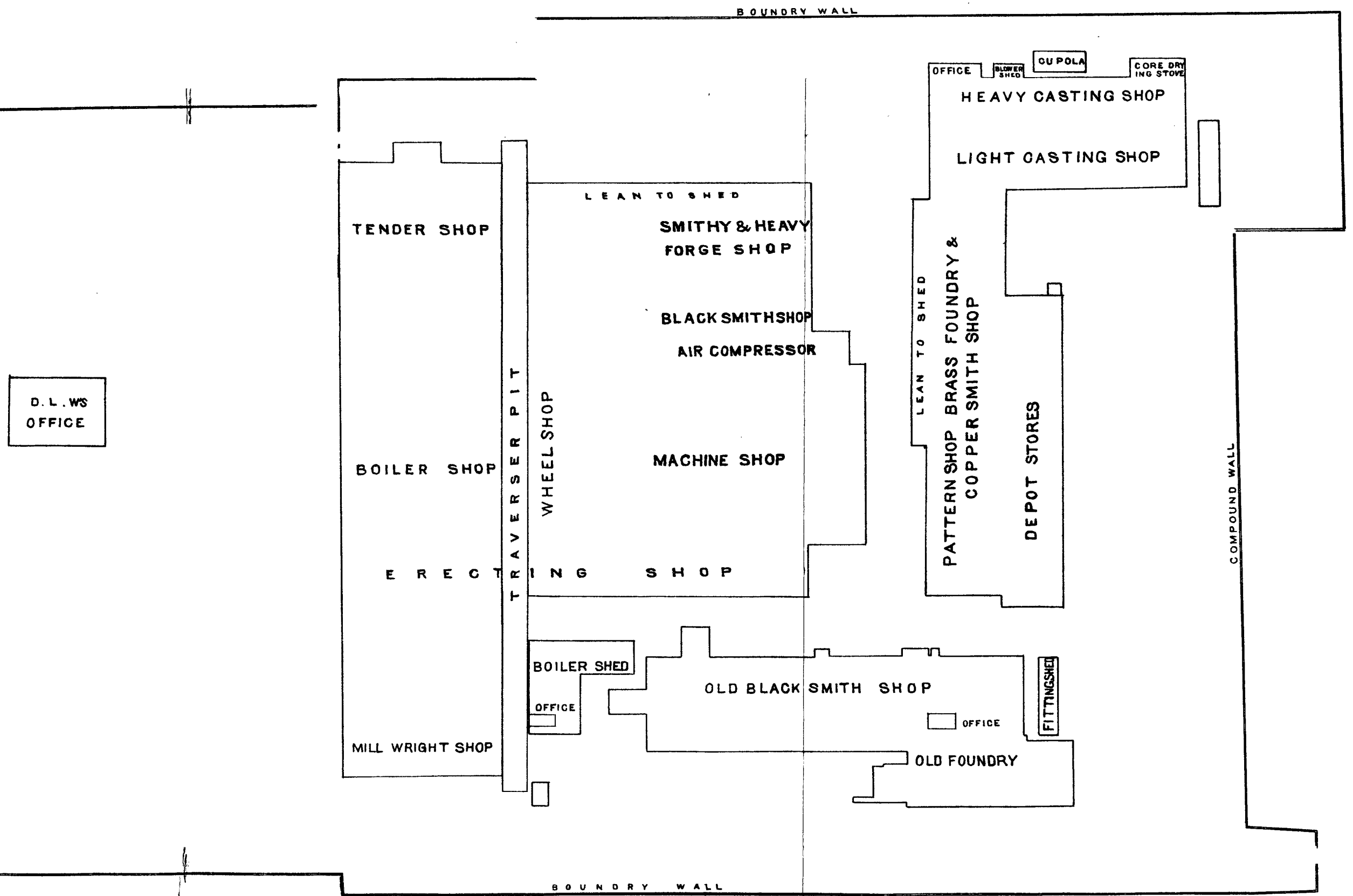
SHOPS	AREA SQ FT	AREA SQ FT
SHOP NO 1 SAW MILL	78870	32582
SCANTLING SHED	22320	-
SHOP NO 2 CARRIAGE BUILDING & FINISHING	78870	32582
SHOP NO 4 WHEEL & UNDERFRAME, COPPER & TIN SMITH, IRON FITTING, MILL WRIGHT, BRASS FITTING, AIR COMPRESSOR, TOOL ROOM, CENTRAL DEPOT & MACHINE	97104	-
SHOP NO 7 SMITHY & FOUNDRY	73428	-
SHOP NO 3 PAINTING & TRIMMING	117056	-
SHOP NO 5 TRAIN, LIGHTING, STEELWORK & ERECTING	97104	-
PAINT STORES	3560	-
SHOP NO 6 CARRIAGE REPAIRS	45960	74860
SHOP NO 8 WAGON REPAIRS	60424	45660
A.V.B. REPAIR & TESTING SHED & COTTON TESTING SHED	13350	-
AXLE BOX FITTING SHED	2160	-
WAGON REPAIR SHED	11164	-
YARD FOREMAN'S OFFICE & WAGON FOREMAN'S OFFICE	360	-
<b>TOTAL</b>	<b>684390</b>	<b>6840</b>
ELECTRIC TRAIN LIGHTING CELL, CHARGING SHOP	-	6840
<b>TOTAL EXTENSION</b>	<b>105334</b>	

WAGON REPAIR SHED  
YARD FOREMAN'S OFFICE  
WAGON FOREMAN'S OFFICE

# E. B. R. LOCO SHOPS KANCHARAPARA.

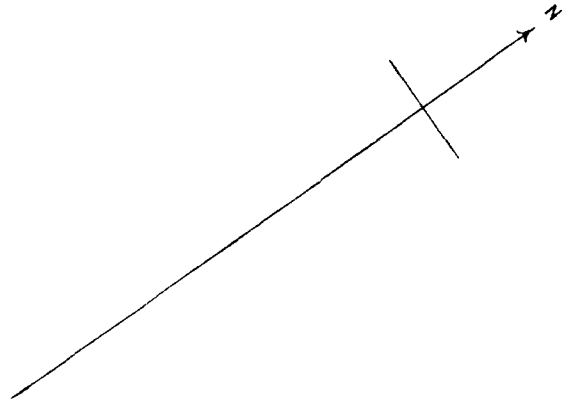
*Scale—100 Feet to 1 Inch.*

SHOPS	AREA IN SQFT
HEAVY CASTING & LIGHT CASTING SHOPS	79852
PATTERN SHOP BRASS FOUNDRY AND COPPER SMITH SHOP & DEPOT STORES	
SMITHY & HEAVY FORGE SHOP BLACK- SMITHS SHOP, AIR COMPRESSOR, WHEEL SHOP & MACHINE SHOP	
OLD BLACK SMITH SHOP & OLD FOUNDRY	45094
BOILER SHED & OFFICE	6000
TENDER SHOP BOILER SHOP ERECTING SHOP, & MILL WRIGHT SHOP	106935
FITTING SHED	1500
CUPOLA	1040
D.L.WS OFFICE	6256
<b>TOTAL</b>	<b>353752</b>

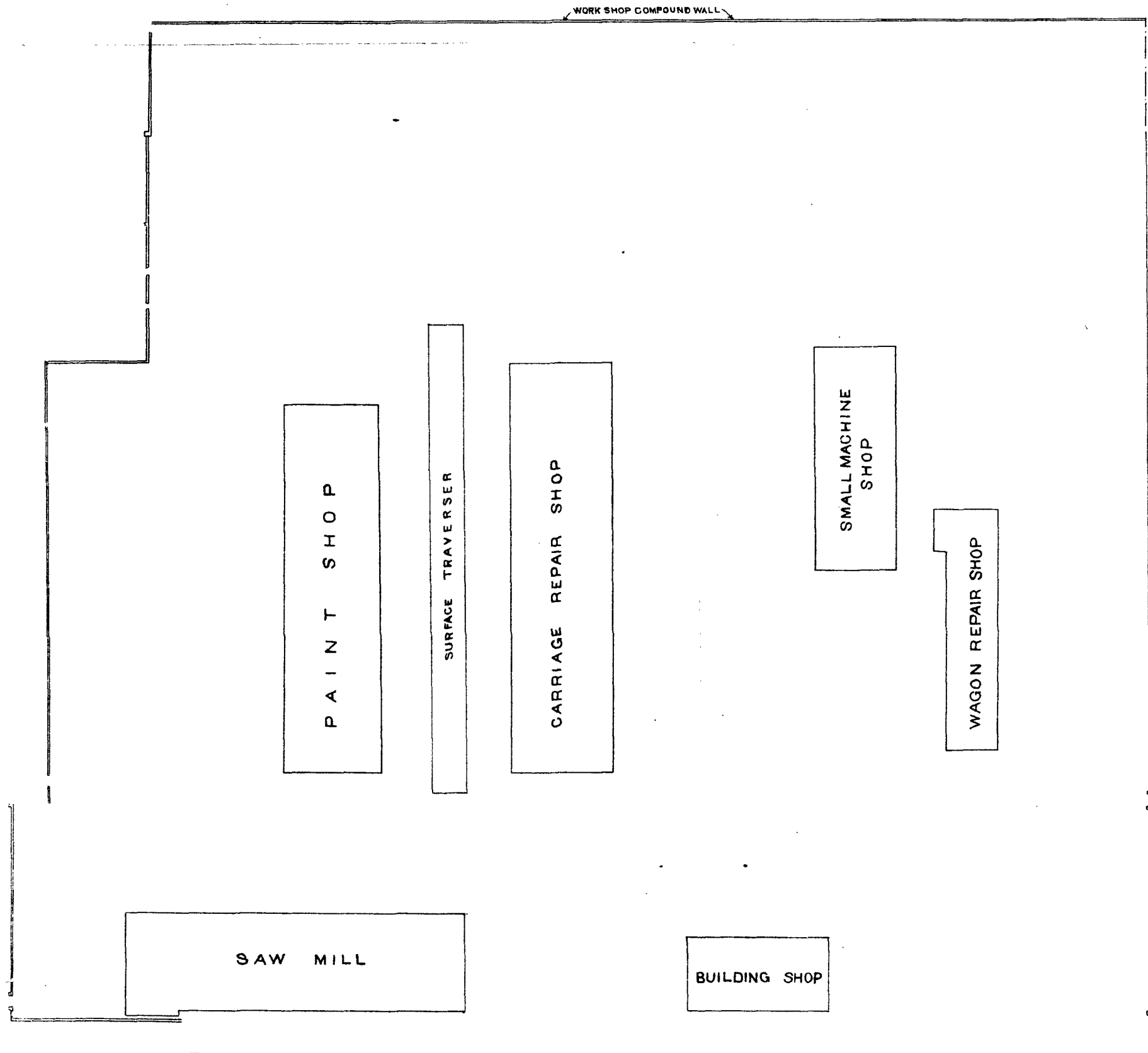


# E. B. R. CARRIAGE & WAGON SHOPS KANCHARAPARA.

Scale—1 Inch to 200 Feet.



SHOPS	AREA IN SQ. FT.
PAINT SHOP	96995
CARRIAGE REPAIR SHOP	108800
SMALL MACHINE SHOP	43200
WAGON REPAIR SHOP	37400
SAW MILL	93600
BUILDING SHOP	28800
TOTAL	410795





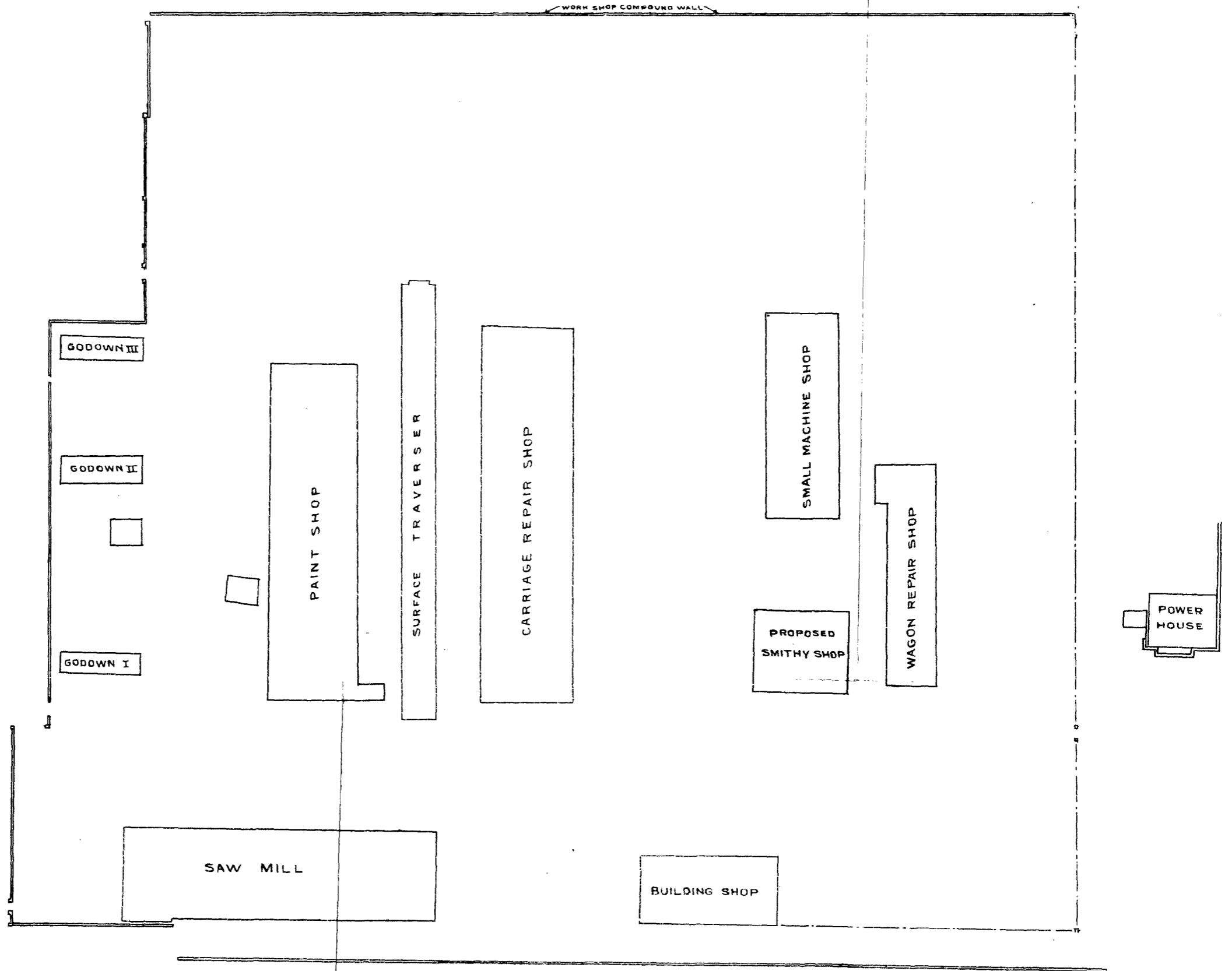
# PROPOSED CARR: & WAGON SHOPS KANCHARA PARA

SCALE 200 FEET TO 1 INCH

## E. B. R.

Plan 15.  
E. B. R.  
Proposed Carr. and Wagon Shops,  
Kanchrapara.

SHOP	AREA IN SQ. FT.
PROPOSED SMITHY SHOP.	25500
SMALL MACHINE SHOP.	48100
WAGON REPAIR SHOP.	37400
BUILDING SHOP.	28800
CARRIAGE REPAIR SHOP.	107200
PAINT SHOP.	97350
SAW MILL .	90500
GODOWN I.	5800
DO II.	7250
DO III.	5800
<b>TOTAL</b>	<b>453700</b>



# PROPOSED LOCO SHOPS KANCHRAPARA

SCALE 100 FEET TO 1 INCH

E. B. R.

SHOPS	AREA IN SQ. FT.
ERECTING SHOP	41520
STRIPPING SHED	6560
STEAMING SHED	6300
TENDER SHOP	28800
BOILER SHOP	45120
MACHINE SHOP	40296
HEAVY MACHINE SHOP	99526
WHEEL SHOP	23564
WHEEL FITTING SHOP	
BLACKSMITH SHOP, HEAVY	58802
FORGE SHOP & SPRING SHOP	
MILL WRIGHT SHOP	30704
IRON FOUNDRY	27121
BRASS FOUNDRY	9338
BRASS CASTING STORE	4608
TIN & COPPER SMITH SHOPS	6350
AIR COMPRESSOR	2244
PATTERN SHOP	6161
" STORE	4792
STORE DEPOT	10135
" OFFICE	2990
FITTING SHOP & BRASS FITTING SHOP	7435
MISCELLANEOUS	7560
GANTRY FOR BOILER & FRAME	100 R.F.
PARKS	1403 SF.
CLEANING SHED	
<b>TOTAL</b>	<b>471319</b>

