

REPORT
ON
DELHI SCHOOL BUILDINGS



समयम जयते

COMMITTEE ON PLAN PROJECTS

GOVERNMENT OF INDIA

NEW DELHI

October 1960

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REPORT ON DELHI SCHOOL BUILDINGS

I. THE PROBLEM

Introduction

1. Education is the essence of a democratic society. The stability of a democratic nation is based on the educated electorate. Recognising this fact, India is now becoming increasingly conscious of the decisive role the school plays in building the nation. Whereas only a decade ago the problem in rural areas was to ensure adequate and regular attendance in the established primary schools, the picture has changed considerably in recent years. The awakened rural population is clamouring for more schools and the enlightened urban citizens demand better schools. The shortage of teachers and the inadequate school buildings are posing serious problems for the planners. The financial resources are being stretched to the farthest limits without meeting adequately the ever-growing demands. School buildings are being raised in large numbers. The rising building costs, which are so inextricably linked with the country's economy, hamper progress considerably. The problem is how to meet the challenge within the available resources.

The Size and Nature of the Problem

2. Here is an assessment of the problem, as given by the Ministry of Education, "Out of 4.8 crores children of the age group 6-11 as many as 2.5 crores were at school on 1st April, 1956 whereas out of 2.5 crores children of age-group 11-14, only 50 lakhs were receiving education. In other words, it means that in order to extend educational facilities to all the children of age group 6-11, we have to provide an additional school place for every place that exists today; whereas in the case of the age group 11-14, four additional school places have to be provided for every place in existence. What a stupendous problem!"*

3. The same Ministry very pertinently raises the query, "Will the economy of the country support a school construction programme of a million class rooms?" and regretfully confesses that "in terms of present practices of school construction and current costs, the answer must be that sufficient funds cannot be made available".**

* Schools for All, Ministry of Education, 1958.

** Planning Schools for India, Ministry of Education, 1950.

How they tackled it in England?

4. It may be worthwhile to examine how this problem was solved in other countries in the post-war era. In U.K. over 5000 or about one in five or six of the country's schools were damaged during the war. These schools had to be repaired or rebuilt. Besides, the postwar 'bulge' in school population posed a serious problem. For every 100 children attending schools maintained or assisted by local education authorities in 1938, there were 102 in 1949, 120 in 1957 and are likely to be more than 125 by 1961. This resulted firstly from the 'birth-rate bulge' and secondly from the raising of the school leaving age from 14 to 15 in 1947.

5. This growth in the school population set up a school building problem of considerable size. About 2,000,000 school place had to be provided to meet the post-war needs.

6. The post-war years in England were years of austerity; labour was in short supply, cement and timber were rationed, enough bricks were not available. The following emergency measures were, therefore, adopted:—

(i) The Hutted Operation for the Raising of the School Leaving Age (HORSAs) was initiated in 1945. Prefabricated huts were supplied and erected by the Ministry of Works to accommodate the extra age group. Usually two class rooms and a practical room were added to an existing school. A total number of 167,880 places had been provided by this operation by 1952.

(ii) Local education authorities were encouraged to make small additions to existing schools by means of minor works costing not more than £5,000 each. By 1949 some 96,000 places had been provided by these means for which standard huts were provided by the Ministry of Works.

(iii) Technical and professional skill was utilised to determine:—

(a) the amount of space needed to provide a workable building, and

(b) the amount of money needed for each unit of that space to ensure an adequate quota of building.

7. Efforts were thus made to reduce the total area without loss of physical standards and even with an increase in the amount of teaching space. Two principal means were used to this end:—

Firstly all the unproductive non-teaching areas (corridors etc.) were cut down to the minimum, and secondly one space was so designed as to do the work of two spaces e.g., an assembly hall may also serve as a gymnasium. Besides, reduction in cost was brought about by (a) comparing and controlling expenditure on constituent

items of a building; (b) reducing not only the area but also the cubic content of schools; (c) finding new, better and cheaper ways of construction; (d) designing small articles suitable for children e.g., sanitary fittings, tables, chairs etc.; (e) designing functional buildings with a simple and straight-forward architecture.*

Approach to the Problem

8. As stated earlier the problem in India is quite stupendous and requires a close study. We may take Delhi as a sample which has witnessed a phenomenal rise in population, from a million to 2½ million within the last twelve years. The concentration of population has, however, been more in the urban area. As against 3 lakhs living in some 300 villages, there are over 21 lakhs inhabiting the city. Whereas in 1951-52 the number of students in the primary, middle and higher secondary classes was 1,32,087; 33,389 and 15,149; in 1959-60 the figures had gone up to 2,34,608; 99,758 and 45,302 recording an increase of 77·61%, 198·77% and 199·04% respectively. At present 87% of the children of age groups 6-11, about 62% of 11-14 and 30% of 14-17 are actually at school. It is estimated that about 90% of children who pass class V go for secondary education. These figures are bound to rise further with the gradual enforcement of compulsory primary education in the Union Territory of Delhi. The pressure on school enrolment, which is already very heavy, will thus be further aggravated.

9. The number of High/Higher Secondary Schools in Delhi has gone up considerably during the last 10 years. In the year 1949-50 there were only 62 High/Higher Secondary Schools, the present number runs to 263. Aided schools account for an increase from 46 to 105, the Government schools have, however, gone up to 158 in July 1960 as against only 16 in 1949-50.

10. Of the 158 Government Higher Secondary Schools only 35 are housed in proper school buildings, the rest are either in rented buildings or in tents. Some of the schools are running in double shifts with additional tented accommodation provided on the same premises.

11. Within the limited financial resources the Delhi Administration has been trying to speed up their construction programme. A provision of Rs. 1,06,33,900 was made in the Second Five Year Plan for raising 95 school buildings. During the period 1957—60, they have incurred an expenditure of Rs. 53,73,652 for the completion of

*The Story of Post-War School Building, U. K. Ministry of Education, Pamphlet No. 33, 1957.

hool buildings. The construction of 31 school buildings is in progress, and 24 more schools are to be constructed during the remaining period of the Second Plan. The proposals for the Five Year Plan envisage the construction of buildings for 56 higher secondary schools, about 40 middle schools besides some extensions to 16 of the existing higher-secondary schools, teachers' quarters etc. at an estimated cost of Rs. 247 lakhs. Even at the end of the Third Plan, quite a number of schools may still be without any building.

The Committee on Plan Projects thought it worthwhile to conduct a thorough study of the problem of school buildings particularly relating to the higher secondary schools in Delhi. Accordingly a Panel was set up in June, 1960 with the following composition—

- | | |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------|
| (i) Shri V. R. Vaish, Superintending Engineer, Delhi State Circle, C.P.W.D. | <i>Chairman</i> |
| (ii) Shri J. P. J. Billimoria, Senior Architect, C.P.W.D. | <i>Member</i> |
| (iii) Shri B. D. Bhatt, Director of Education, Delhi. | <i>Member</i> |
| (iv) Shri B. L. Chadha, Architect. | <i>Member</i> |
| (v) Shri T. S. Vedagiri, Superintending Engineer, and Secretary, Buildings Projects Team, Committee on Plan Projects. | <i>Member</i> |
| (vi) Shri Jagdish Singh, Administrative Analyst, Committee on Plan Projects. | <i>Member-Secretary.</i> |

The following objectives were kept in view:

- (i) Rationalising the area requirements per place so as to bring about economies without sacrificing functional efficiency.
- ii) Planning of requirements in such a way so as to get a high degree of design efficiency by restricting to the minimum the ancillary and circulation space.
- ii) Laying down norms for structural designs and specifications so as to bring about an effective balance between the structure and its functions.

14. The Panel examined the lay-outs of buildings constructed recently as also the designs of some of the proposed buildings. The requirements of the number and dimensions of class-rooms, labora-

tories etc., as given to the C.P.W.D. by the Education Department, were scrutinised in detail. The use co-efficient of each room and the utilisation of space in them were studied in a number of Higher Secondary Schools. The lay-out and arrangements within science laboratories were studied in some detail in a few selected schools. Discussions were held with the teachers, Principals, Zonal Inspectors, Assistant Directors of Education and the Director of Education with a view to rationalising space requirements. The proposals, given in succeeding pages, are the result of joint consultation and collaboration between the teachers, Principals and the officers of the Directorate of Education. The Panel wishes to place on record its appreciation of the co-operation extended by all of them. Special mention may also be made of the active co-operation given by Shri Neki Ram Gupta, Assistant Director of Education, Delhi and Shri D. G. Badhire, Architect, C.P.W.D., both of whom were closely associated with the work of the Panel at all stages.

II. REQUIREMENTS OF SPACE

The Changing Pattern of Education

15. Rapid changes have taken place in designs and fashions in various sectors of our lives and we have adapted ourselves to these. Few people, however, realise that there has been a revolution in the ideas and practice of education since after the First War and more so after the Second War. In India the post-Independence era is marked by two significant changes-acceptance of Basic education as a national pattern of primary education and the new structure of higher secondary education. Basic education is a departure from the traditional approach to class room teaching. Similarly the emphasis in secondary education is on diversified courses and progressive methods of teaching. Those concerned with the designing of school buildings have, therefore, to take note of the changing needs of children for whom the schools are built. The Secondary Education Commission have stated, for example:

"Any design must, therefore, take note of this possibility of expansion as well as of the variety of courses that may be provided. It should be necessary to provide for workshops, for certain laboratories, certain special rooms for drawing, painting or music etc. and it is desirable that any design for a school building should take these into consideration and so adjust the design that, in course of time, without much change of the original building, such additional accommodation may be provided."*

16. The educational administrators usually ask for additional accommodation when new activities or subjects are added to the existing curriculum. A multipurpose use of the existing space is seldom thought of which, however, is closely linked with the type of school furniture being used. The traditional two-seated or multiple-seated desk has been discarded elsewhere since it is not conducive to the development of correct posture besides being cumbersome. There is an urgent need for evolving suitable designs of easily portable and stackable class room furniture. Investigations are already in progress in this field and will be dealt with in a subsequent report. The present report deals mainly with the building of a typical higher secondary school including furniture and other major fittings in science laboratories

*Report of the Secondary Education Commission, 1953.

The Higher Secondary School

17. A Higher Secondary School in Delhi normally has 6 classes, three in the middle department (6th, 7th and 8th) and three in the higher secondary department (9th, 10th & 11th). Each class has two or three sections. Usually, each section has a maximum strength of about 40 students. An average school has on roll approximately 650 students, in 16 sections, distributed as follows:—

| | |
|---------------------------------------------------------------|-----------|
| Three sections each in classes VI, VII, VIII and IX | 12 |
| Two sections each in classes X & XI | <u>4</u> |
| | <u>16</u> |

In a bigger school with an enrolment of 1000 the distribution of sections will be—

| | |
|--------------------------------------------------------|-----------|
| Five sections each in classes VI, VII & VIII | 15 |
| Four sections in class IX | 4 |
| Three sections each in classes X & XI | <u>6</u> |
| | <u>25</u> |

Class Rooms

18. A class room should, therefore, be adequate to accommodate 40 students seated on dual desks of size 2'-9" x 3'-6" (being supplied by the Education Department at present). It was estimated that an area of 400 sq. ft. (37.2 sq. m.) would be sufficient for the purpose. However, the sanctioned strength of 40 is sometimes exceeded by a couple of students under pressure of heavy enrolment. Besides, according to the standing regulations of the Board of Higher Secondary Education, Delhi, a minimum area of 480 sq. ft. (44.6 sq. m.) is prescribed for a class room to accommodate 40 students. The Panel has, therefore, accepted this area for a class room for the present.

19. In addition to class rooms, a few other rooms are required for elective subjects. The size of these rooms will not be as big as the main class rooms since the number of students occupying these rooms at a time is not expected to be more than 20 or 25. The possibility of utilising the class rooms themselves for some of the elective subjects was also considered. On these considerations the Panel has come to certain conclusions regarding the number and size of class

rooms to be provided in different types of schools, which are scheduled below.

(i) *For 650-pupil school.*

| | | |
|---------------------------------------|----|--------------------------------------------------------------------------------|
| Total number of class rooms | 22 | (19 measuring 24'×20' each, 1 measuring 20'×20' and 2 measuring 16'×20' each). |
|---------------------------------------|----|--------------------------------------------------------------------------------|

These may be distributed as follows:—

| | | |
|------------------------------------|----|-------------------------|
| Class Rooms | 16 | (one for each section). |
| Art Room | 1 | |
| Science Theory Room | 1 | |
| History & Geography Room | 1 | |
| Commerce Room | 1 | |
| Craft Room | 1 | |
| Activities Room | 1 | |

For 1000-pupil school.

| | | |
|---------------------------------------|----|--------------------------------------------------------------------------------|
| Total number of class rooms | 32 | (29 measuring 24'×20' each, 1 measuring 20'×20' and 2 measuring 16'×20' each). |
|---------------------------------------|----|--------------------------------------------------------------------------------|

The distribution may be—

| | | |
|------------------------------------|----|-------------------------|
| Class Rooms | 25 | (one for each section). |
| Art Room | 1 | |
| Science Theory Room | 1 | |
| History & Geography Room | 1 | |
| Commerce Room | 1 | |
| Other Optional subjects | 1 | |
| Craft Room | 1 | |
| Activities Room | 1 | |

Laboratories

20. Normally not more than 24 students use the Physics and Chemistry laboratories for practicals. In Biology the enrolment is much less in a boys' school but in a girls' school the number of students taking this subject may exceed the number of those taking Physics and Chemistry. For Domestic Science, however, the position is different. All the girls in a section may have taken up this subject and may be expected to do practical work at one and the same time. These factors have, therefore, to be taken into account in determining the lay-out and specifications of each laboratory.

21. Studies conducted in a few representative schools revealed variations in the dimensions of laboratories as well as in the arrangement of furniture and fittings. It is thus clear that sufficient thought was not given to the planning of laboratories. In many cases provision was not made for the satisfactory conveyance of the service lines

that are necessary in a laboratory. No provision was made for special facilities such as fuming cup-boards. On the whole a laboratory, even in the case of newly completed schools, had a number of improvisations which are not conducive to smooth and efficient working.

22. The planning of facilities within the laboratory naturally depends upon the type of work that is to be done in it. A satisfactory lay-out cannot, therefore, be prepared unless a detailed study of the work within the laboratories is carried out. The Panel gave a lot of attention to this point and evolved a number of lay-out plans for the different laboratories in a school. These were discussed in detail in the Panel meetings as well as with school teachers and other educationalists. The final plans showing the detailed lay-out of the different laboratories, attached stores, science theory room etc. are given in Appendix I.

23. The Panel considers that an area of 30 sq. ft. (2.8 sq. m.) per student would be adequate to meet the normal requirements of Physics and Chemistry laboratories. An area of $30' \times 24' = 720$ sq. ft. (66.9 sq. m.) should be more than adequate for these laboratories. The dimensions of these two laboratories in the proposed lay-out (Appendix I a & b) have been kept at $36' \times 20' = 720$ sq. ft. (66.9 sq. m.) to secure proper arrangement of laboratory tables and other fittings. In addition to this a store of $16' \times 10' = 160$ sq. ft. (14.9 sq. m.) has also been provided. The Biology laboratory (Appendix I c) measuring $32' \times 20' = 640$ sq. ft. (59.5 sq. m.), however, is slightly smaller as the number of students who take up Biology is less. The attached store of $16' \times 10' = 160$ sq. ft. (14.9 sq. m.) may be divided into two portions, one of which may be earmarked for installation of the gas plant with a niche provided for a fire extinguisher on the verandah side wall. In case a larger number of girl students take Biology it is possible to interchange Biology with Physics/Chemistry laboratories. Regarding Domestic Science (Appendix I d) the Panel considered that a room measuring $32' \times 22\frac{1}{2}' = 720$ sq. ft. (66.9 sq. m.), with an attached store of 160 sq. ft. (14.9 sq. m.), should be sufficient. If considered necessary, one of the rooms earmarked for elective subjects may be utilised as an additional room for Domestic Science.

24. A suggested lay-out for store-rooms appended to this report shows the arrangements of open shelves and cup-boards to cater to the varying needs of storage

Hall, Library and Staff Room

25. In most of the schools studied by the Panel, a hall having an area of 3,000 to 3,500 sq. ft. (279 to 325 sq. m.) had been provided. It is mainly used for morning prayers and for some other occasional

rooms to be provided in different types of schools, which are scheduled below.

(i) *For 650-pupil school.*

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24. A suggested lay-out for store-rooms appended to this report shows the arrangements of open shelves and cup-boards to cater to the varying needs of storage.

Hall, Library and Staff Room

25. In most of the schools studied by the Panel, a hall having an area of 3,000 to 3,500 sq. ft. (279 to 325 sq. m.) had been provided. It is mainly used for morning prayers and for some other occasional

gatherings. The use co-efficient of this hall varies from 15 to 35 minutes per day. This does not warrant an expenditure of Rs. 30,000 to Rs. 35,000. The Panel, therefore, considered that it would be better to plan for a multi-purpose hall which can be put to other uses also.

26. Considering the other requirements of Higher Secondary Schools, such as library, staff room, etc. the Panel thought it would be ideal to utilise a portion of the hall as library and another portion as staff room with adjustable partitions in between. However, in a school with a capacity of 1,000 students an additional staff room measuring $16' \times 20' = 320$ sq. ft. (29.7 sq. m.) may be provided on the second floor. Further the educational authorities desired that provision should be made for audio-visual education. The stage portion of the hall can be profitably utilised for this purpose. The Panel decided that the hall should be so planned that there should be some class rooms adjacent to it which can be used as green rooms whenever necessary.

27. The dimensions of the hall for different types of schools are listed below:

| Approximate enrolment of students | Dimensions | Area(sq. ft.) | Remarks |
|-----------------------------------|--------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 650 | $60' \times 30'$ or $64' \times 30'$ | 1800 or 1920 (167 or 178 Sq. m.) | This includes the stage portion measuring $32' \times 20' = 640$ sq. ft. to be used for audio-visual purposes. The remaining portion of the hall will be divided into two sections one to be used as library measuring $32' \times 22\frac{1}{2}' = 720$ sq. ft. and the other as staff room measuring $32' \times 17\frac{1}{2}' = 560$ sq. ft. (52 sq. m.) |
| 1000 | $64' \times 30'$ $+ 12' \times 23\frac{1}{4}'$ Balcony | $1920 + 720 = 2640$ (245 sq. m.) | Do. |

Principal's and Clerk's Office

28. A Principal's office in a school is used by the Head of the institution for administrative purposes, for meeting the parents and for holding meetings. A room measuring over 300 sq. ft. (27.9 sq. m.) is usually provided as the Principal's office with a separate Clerk's

office of an area of about 500 sq. ft. (46.4 Sq. m.). The dimensions appear to be very much on the high side. It may be of interest to note that an area of 150 sq. ft. (13.9 Sq. m.). is laid down in the U. K. for such an office. It has, therefore, been agreed that a single room measuring $20' \times 16' = 320$ sq. ft. (29.7 sq. m.), partitioned into two sections, may be provided, one portion of which may serve as the office of the Principal and the other as the Clerk's office and record room. Staff meetings may more conveniently be held in the staff room, which will further result in administrative convenience and saving on furniture.

Additional Accommodation

29. Keeping in view the expanding activities of a higher secondary school two additional rooms for various types of activities like Scouting (Girl Guiding), NCC, Red Cross, crafts etc., have been provided as per dimensions given below:

- (i) Activities Room $20' \times 20' = 400$ sq. ft. (37.2 sq. m.)
- (ii) Craft Room $24' \times 20' = 480$ sq. ft. (44.6 sq. m.)

Ancillary Accommodation

30. The following provisions have been suggested:—

- (i) *General Stores*: 2 (one on each floor) in a 650—pupil school and 3 (one on each floor) in a 1,000—pupil school, each measuring $20' \times 8' = 160$ sq. ft. (14.9 sq. m.).
- (ii) *Tuck Shop*: Wherever possible a tuck shop of size $16' \times 12'$ may be provided near the main building and away from the compound wall so as to prevent its access to public.
- (iii) *Water Rooms*: located centrally on each floor, 4 water rooms in a school of two-storeyed building and 6 water rooms in a school of three-storeyed building
- (iv) *Class IV quarters*: Two quarters, one for the sweeper and the other for chowkidar may be provided within the school compound at the back side. The areas of these quarters shall be according to the scale prescribed for class IV staff.
- (v) *Sanitary Block*: WCs. may be of squatting type. The floor of lavatory block on the first floor may be depressed by 2 ft. The roof of WCs. also may be similarly depressed so that storage tanks can be screened off from view

The urinals should be of the lipped type and, as an experimental measure, a stall type urinal with terrazo finish may be tried. It is preferable to have automatic flushing arrangements for urinals. The number of WCs and urinals may be as follows:—

| Enrolment | No. of WCs | No. of Urinals |
|-----------------|------------|----------------|
| (Boys' School) | | |
| 650 | 16 | 32 |
| 1000 | 24 | 48 |
| (Girls' School) | | |
| 650 | 24 | .. |
| 1000 | 40 | .. |

A separate sanitary block may be provided for the staff.

III. PLANNING AND LAY-OUT.

General Lay-out

31. In the preceding chapter the Panel has considered the requirements of space and has laid down certain standards regarding the same. This would lead to sufficient reduction in expenditure, but for achieving efficiency in performance, it is necessary to consider in detail the planning and lay-out of various facilities. The efficiency of performance depends, to a large extent, on the proper juxtaposition of the various facilities and the correct sequence of their arrangements.

32. It is also a moot point to consider whether schools should be based on corridor or verandah pattern. The former would be economical from the point of view of space utilisation as circulation space in that case would be much less than in the latter. But from the point of view of lighting and ventilation, the verandah pattern would be more advantageous. The Panel would, therefore, recommend mainly this pattern for school building but with a view to achieving economy in space, short lengths of corridors can be interposed.

33. A number of lay-out diagrams based on the requirements as decided by the Panel were prepared and discussed. Two of the typical lay-outs are given in Appendix II. It is not the intention of the Panel to standardise the lay-out diagrams. The plans given in the Appendix represent only two of the solutions to the problem. Many more solutions are possible depending upon the individuality of the architect. The plans, therefore, should be taken as broadly indicative of the suggested arrangements of the various facilities in a school. The two plans have been conceived in such a way that they should be capable of adoption either for a girls' school or for a boys' school with a capacity of 650 or 1,000 students.

34. Both the plans envisage 2-storeyed construction for a strength of 650 and 3-storeyed construction for a strength of 1,000 students. This is inevitable due to pressure on land in a rapidly developing metropolis. In rural areas, however, where the pressure on land is not much, it is not necessary to go in for 2 or 3-storeyed construction. A single-storey lay-out in that case is desirable.

Design Efficiency

35. The total built up area of any school can be broken into following four categories:

- (a) Area of teaching accommodation.
- (b) Administration area which will include Principal's room, office, general store and staff room.
- (c) Circulation and ancillary area which will include both horizontal and vertical area, toilet block etc.
- (d) Thickness of walls, columns etc.,

Leaving item (d) the rest constitute the floor area of the building which can be broadly divided into teaching and non-teaching accommodation. The break-up of teaching and non-teaching accommodation for the two lay-outs suggested by the Panel is given below:—

Accommodation in Percentages.

| | <i>Plate I</i> | | <i>Plate II</i> (Alternative lay-out) | |
|-------------------------------------|----------------|--------------|------------------------------------------|--------------|
| | Girls' School | Boys' School | Girls' School | Boys' School |
| Instructional | 57.7% | 56.1% | 60.9% | 59.5% |
| Administrative | 6.2% | 6.5% | 6.0% | 6.2% |
| Circulation and Ancillary | 36.1% | 37.4% | 33.1% | 34.3% |

Area per Student (In Sq. Ft.)

| | <i>Plate I</i> | | <i>Plate II</i> | |
|-------------------------------------|----------------|--------------|-----------------|--------------|
| | Girls' School | Boys' School | Girls' School | Boys' School |
| Instructional | 22.6 | 22.3 | 23.6 | 22.3 |
| Administrative | 2.5 | 2.5 | 2.3 | 2.3 |
| Ancillary and Circulation | 14.2 | 14.2 | 12.8 | 12.8 |

It may be seen that teaching accommodation accounts for more than 55 per cent of the total floor space. This figure compares favourably with that achieved in the planning of school buildings in the U. K. and U. S. A. A range of 55—60 can, therefore, be legitimately fixed as a factor for design efficiency for school buildings. It must be the endeavour of architects and planners to achieve a design efficiency figure not less than this in the planning of schools.

Flexibility in Lay-out

36. The lay-out suggested by the Panel has inherent flexibility for expanding the school in stages, if necessary. If the school is to

be ultimately for a strength of 650 students, it need be only two-storied. Some portions shown as terrace in the first floor should be capable of being constructed later on to meet additional requirements. If, on the other hand, the ultimate strength of the school is to be one thousand, the foundation and the structure should be designed as for a three-storeyed construction though initially the construction may be restricted to two storeys. It can be further built up in stages as and when need arises.

37. The Chemistry and Biology laboratories have been located on the ground floor and Physics and Domestic Science laboratories on the first floor. In a school with a capacity of 1,000 boys, the Domestic Science laboratory will be converted into a balcony over the hall and the attached store will be converted into a WC. In a girls' school for 1,000 students, the Domestic Science laboratory and the store will be located on the second floor over the portion of balcony and the attached store over the WC, on the first floor. In case there is difficulty in supplying water to the Domestic Science laboratory on the second floor in certain areas, a separate tank on the roof may be provided for this purpose in addition to those normally provided to feed the water closets.

Furniture and Fittings in Laboratories

38. The size and shape of various laboratories has been arrived at after carefully fixing up the numbers and size of furniture and fittings that are to go into each. The main item of furniture in laboratories is the laboratory table. These tables are normally designed for four to twelve students. The Panel feels that a table for six students or more would be unwieldy for small laboratories. Suggested designs for four students are given in Appendix III. In arriving at the size of tables, the Panel has taken care to see that the dimension of the table top ($6' \times 3\frac{1}{2}'$) is kept the same for Physics, Chemistry, Biology and Domestic Science laboratories. The height only is to vary to suit the functional requirements of each laboratory. The Chemistry table, however, though of the same size, will have sinks and shelves mounted on it.

39. The height of the Chemistry table is 2'-9" and that of Biology and Physics laboratory table 3'. The Domestic Science table will be only 2'-6" high. No drawers or cupboards have been provided for any of these tables as it is felt that, while adding to the cost and making the furniture bulky, they do not serve any useful purpose. As a matter of fact, they hamper free working. It is better to provide for shelves and cupboards along the walls for storage. Such cupboards have been shown in all the laboratories. In

the Biology laboratory, some extra ledges have been provided for keeping exhibits. In the Domestic Science laboratory, ledges and sinks have been provided for cooking, laundering etc. A few shelves have been provided below the ledges for storage.

40. The provision for balances is another item that requires careful planning. In the Physics laboratory separate ledges have been provided for balances. The location of fume cupboards, gas generation plant also have been shown in the lay-out of the Chemistry laboratory.

41. The plan at Appendix I (b) gives also the lay-out of services in the Chemistry laboratory which requires careful pre-planning.

42. In the Physics laboratory, [Appendix I (a)] a small dark room is provided, the access to which is from the laboratory itself. Exhaust fans may be provided above the door of the dark room to secure adequate ventilation.

43. The stores attached to laboratories will have 7' (2.1 m.) high dwarf walls. The gas plant portion, however, would have wall right upto the ceiling.

Lay-out of Class-rooms

44. In the case of class rooms provision has been made for a built-in cupboard in each room, partitioned horizontally into two portions with two separate shutters, one for the use of the teacher and the other for students. Wooden picture rails may also be provided on the corridor side wall between the louvered windows and also at available spaces in the front wall. Though these may add to the initial cost, this will ultimately result in savings on wooden cupboards and other fittings and will add to utility and convenience.

45. With regard to black-boards in class rooms it is suggested that they may be in cement mortar with an admixture of black pigment. They should be three feet above the floor level and may be 3'-9" (1.1 m.) high.

46. A suggested lay out for a class room is given in Appendix IV. Only one door has been provided for each class room. A suggestion was made that every class room should be provided with two doors to facilitate movement of students and for supervision. This, however, would add substantially to the cost and also adversely affect the efficient utilisation of space within. Considering these the Panel thought that the disadvantages of providing an additional door would far outweigh the advantages that can be claimed for it.

IV. DESIGN AND SPECIFICATIONS

47. The cost of construction, to a large extent, depends upon the structural design and specifications adopted for a building. It seems worthwhile to lay down norms regarding structural designs and specifications to be adopted for school buildings with a view to achieving a certain measure of uniformity consistent with economy and functional efficiency. These are given below:

Structural designs:

48. As mentioned earlier, it is necessary for a developing city to go in for two or three-storeyed construction. The structure may be of the load-bearing type. The height of plinth should be 2' above the crest of the road. The floor to floor height need not be more than 12'.

49. The walls on the ground and first floors may be 13½" thick in portions other than the multipurpose hall. For the second floor the outer walls may not be more than 9" thick. Columns in verandah may be 9" × 13½" in R.C.C. on the ground floor and of the same size in brickwork on the first and second floors.

Specifications

50. *Foundations.*—The design of foundations depends upon whether the school will ultimately be double-storeyed or three-storeyed. In either case the foundation may be so designed as to facilitate building up of all portions except the hall shown as terrace in the plan.

51. *Doors and Windows.*—The percentage of window area to floor area may be 20. The height of window sill may be kept at 3'. Fan lights to windows may be eliminated. The doors may be of commercial flush type. On the corridor side no glass panes may be provided within the reach of students. However, for securing effective cross ventilation, glass louvers may be fixed at a suitable height. In places where electricity is not likely to be available in the foreseeable future, windows may also be provided on the verandah side to facilitate better ventilation. The doors and windows of Domestic Science laboratory should have fly proof shutters. The windows and ventilators in the stores attached to all laboratories should be

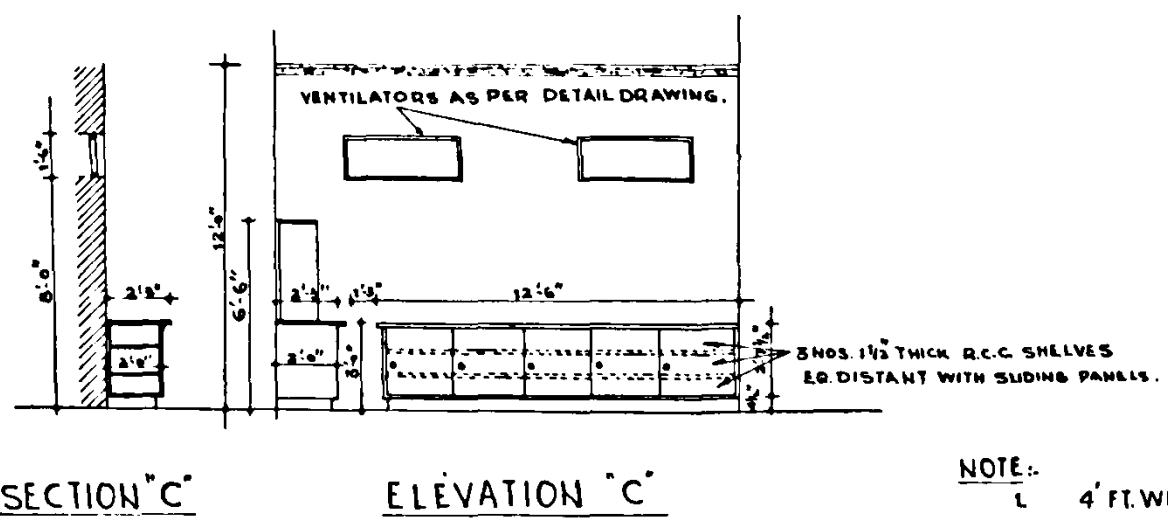
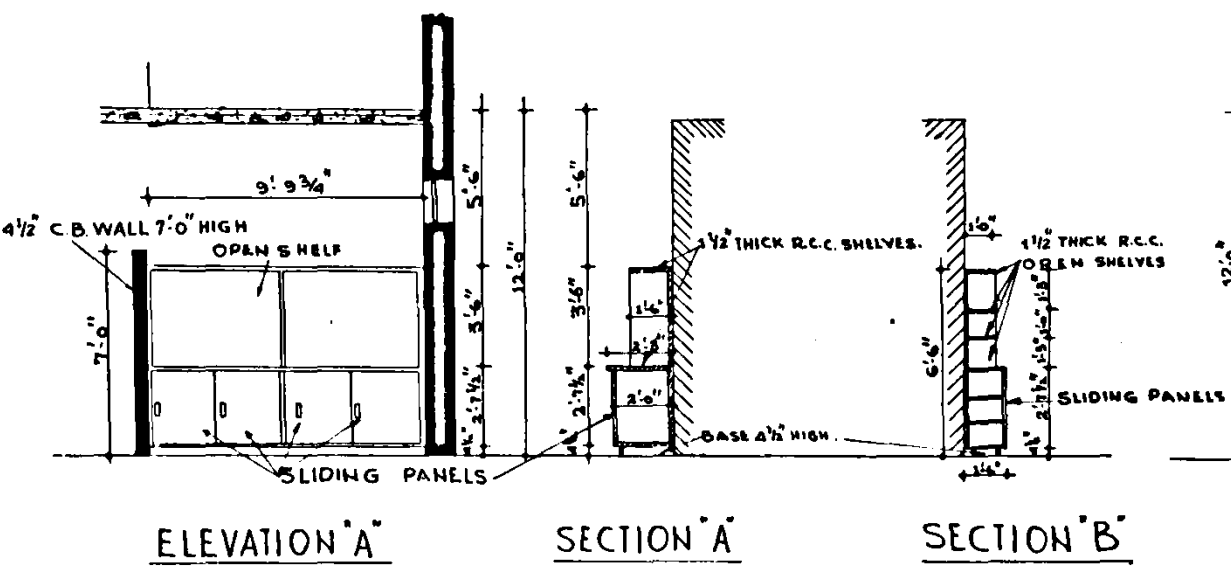
provided with fixed wire gauze frames. The windows of laboratories on the ground floor and the Principal's Office may be provided with B.R.C. fabric or grill of suitable design.

52. *Flooring.*—The flooring may be of 1½" thick cement concrete over a base of lean cement concrete in all the rooms except for WCs., entrance hall and staircases where terrazo flooring is essential. In verandahs also this type of flooring is desirable in view of its durability and longer life. In W.C. blocks a dado of terrazo may be provided upto window sill level. In upper floors a screed 1½" thick can be laid directly over the R.C.C. slabs.

V. EFFECT OF RECOMMENDATIONS

53. The original space requirements of Delhi Administration for administrative and teaching accommodation were 21,020 sq. ft. (1952·82 sq. meters). To give this amount of floor space the built up area which will include circulation and ancillary area, thickness of walls, pillars, etc. would be of the order of 37,000 sq. ft. (3437·41 sq. meters). According to the revised requirements laid down by the Panel, the area of teaching and administrative accommodation would be 16,320 sq. ft. (1516·38 sq. meters) which means a reduction of 22·3 per cent over the original requirements. By proper planning of space it should be possible to give this amount of accommodation together with necessary ancillaries and circulation space within a built up area of 29,700 sq. ft. (2759·22 sq. meters). The difference in built up area would be of the order of 7,300 sq. ft. (678·20 sq. meters), which on the basis of the prevailing rates of construction, would mean a reduction of Rs. 73,000 in the capital outlay for each school. The effect of this reduction on the outlay on new Higher Secondary School buildings proposed to be taken up in the Third Plan will be of the order of Rs. 40 lakhs.

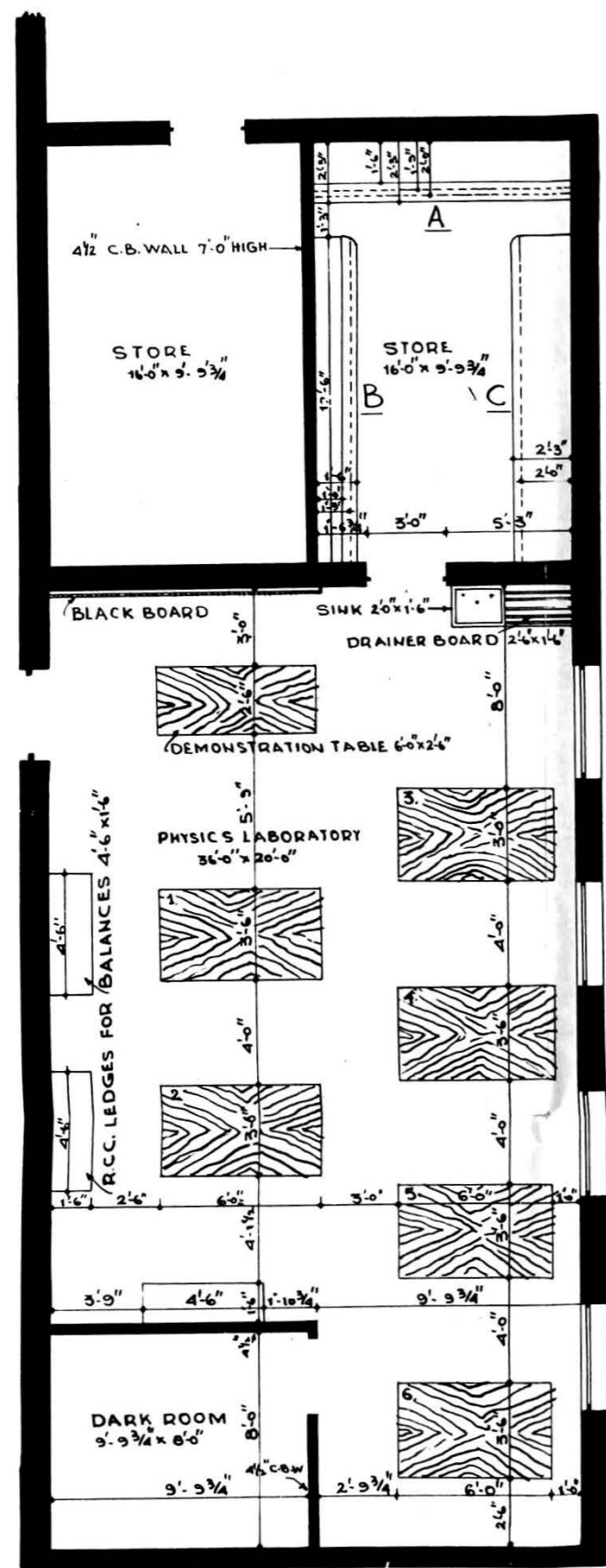
54. Apart from reduction in capital outlay, the norms given in the report would be of help in standardising the plans and estimates of school buildings. Such standardisation is absolutely essential to avoid frequent changes during execution which, in addition to causing delays, add to the cost.



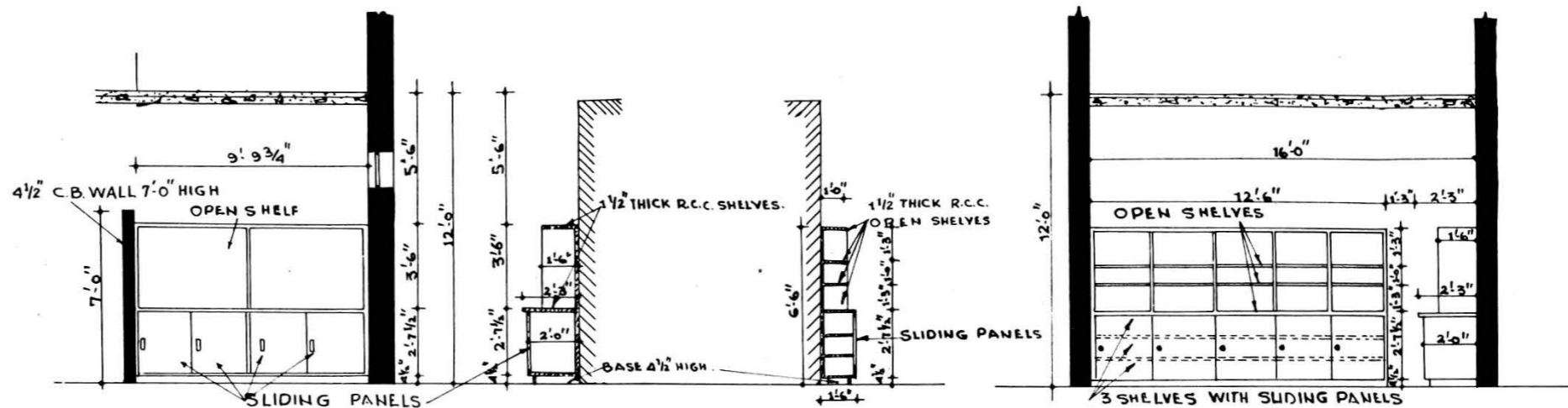
NOTE:-
1. 4' FT. W...
IS UTILIS...
BALANCE...
2. DETAIL C...

LAY OUT DESIGN FOR PHYSICS LABORATORY FOR THE PROPOSED HIGHER SECONDARY SCHOOL, DELHI

SCALE: 4 FT. TO AN INCH.



PLAN

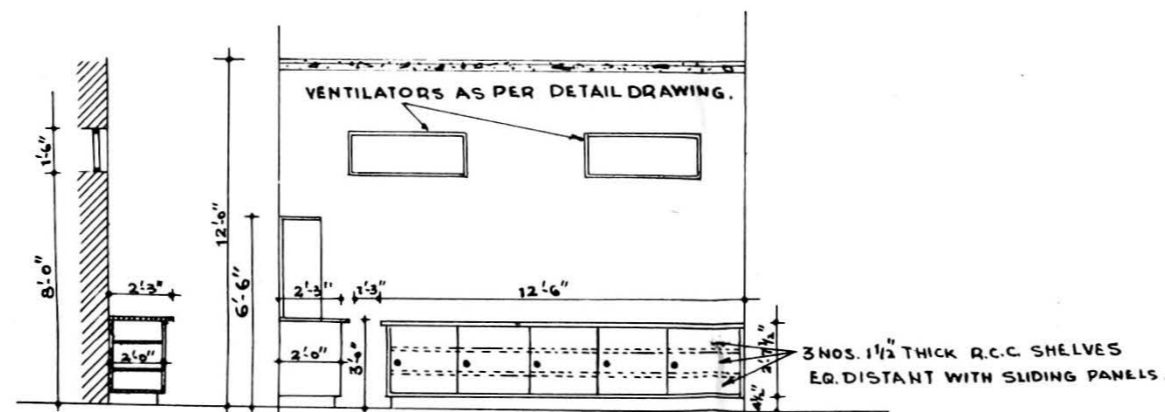


ELEVATION "A"

SECTION "A"

SECTION "B"

ELEVATION "B"



SECTION "C"

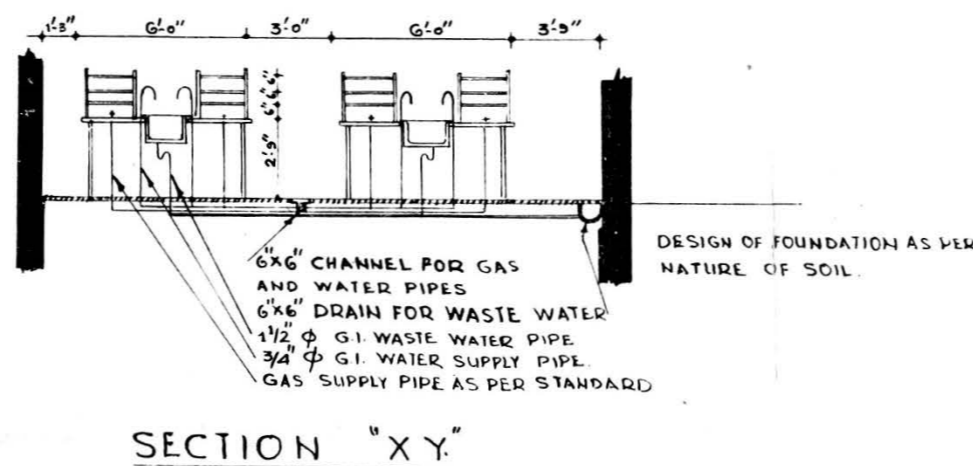
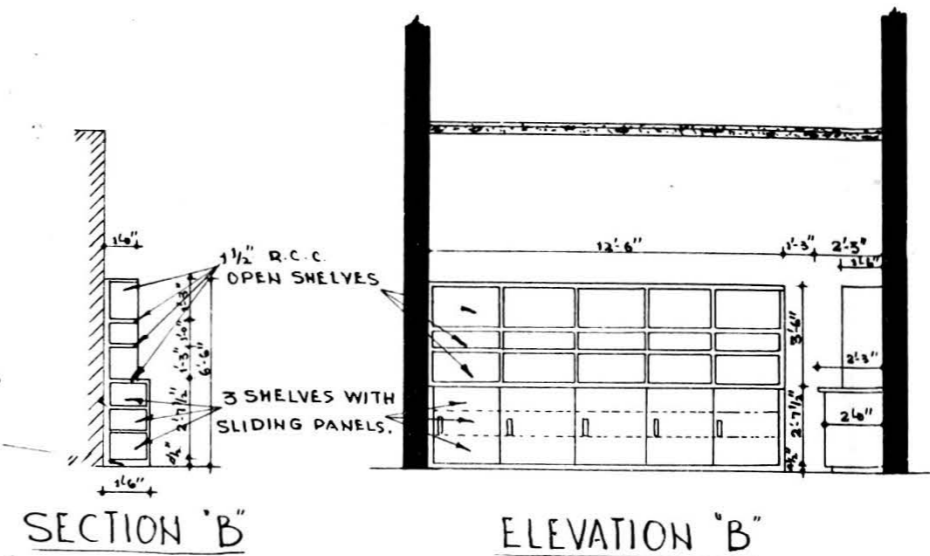
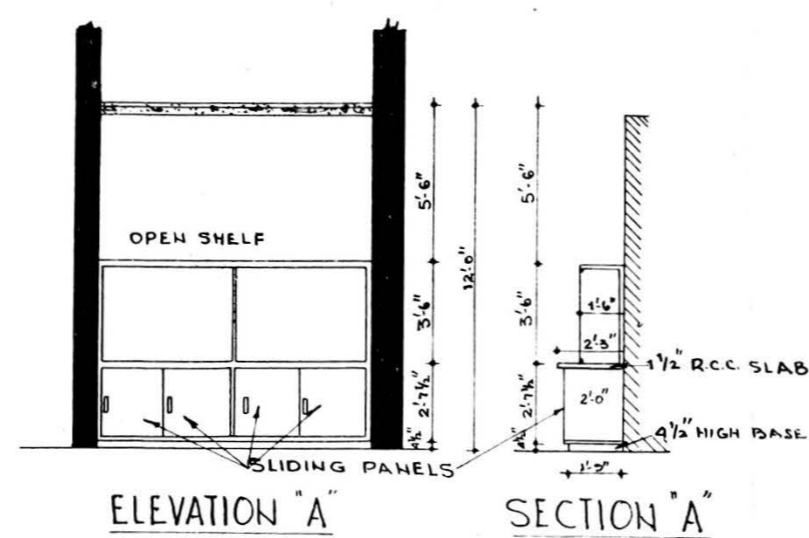
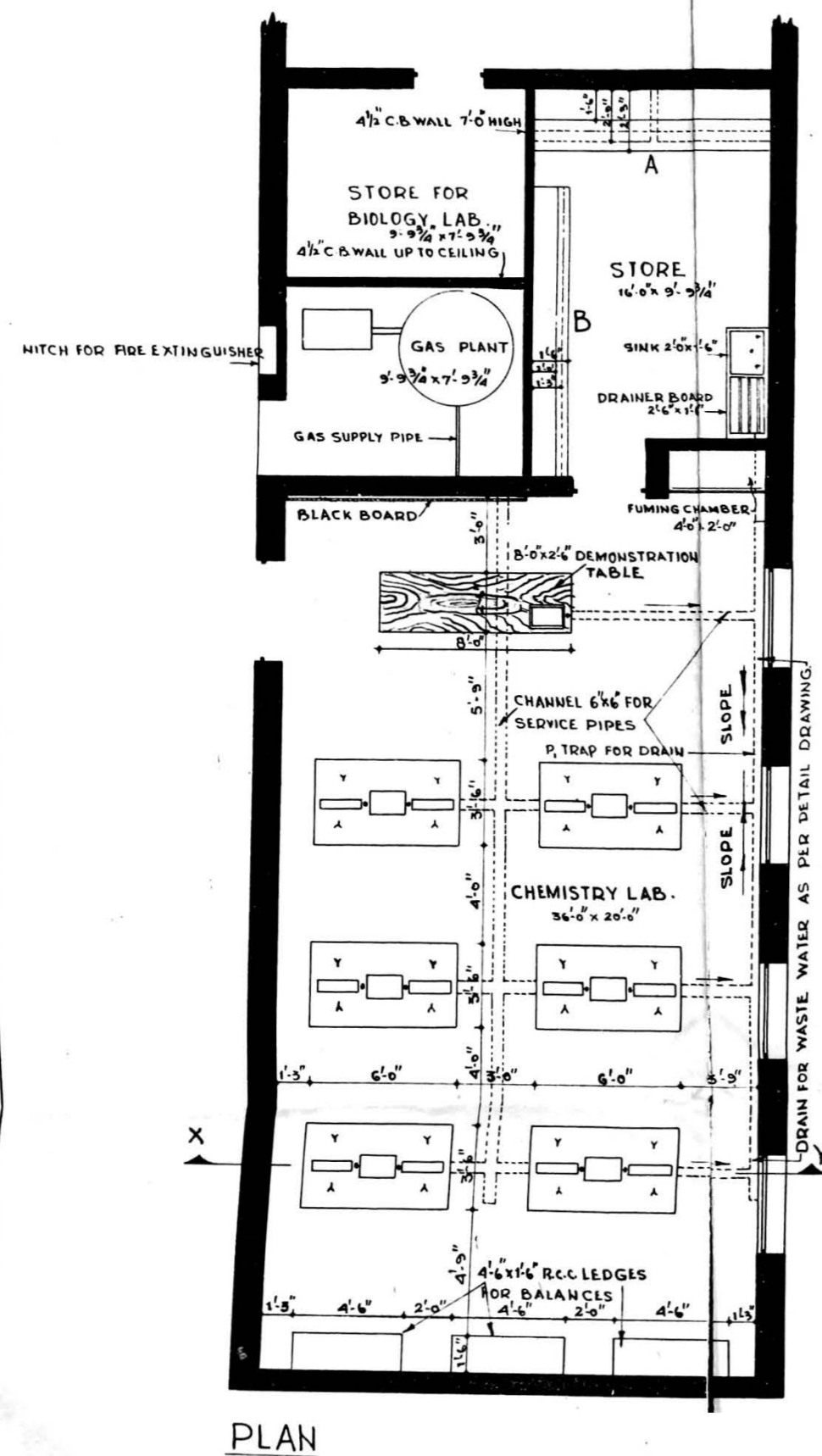
ELEVATION "C"

NOTE:-

1. 4' FT. WIDE SPACE BETWEEN WALL & TABLES IS UTILISED FOR R.C.C. LEDGES TO BE USED FOR BALANCES.
2. DETAIL OF TABLE IS SHOWN ON APPENDIX III.

LAY OUT DESIGN FOR CHEMISTRY LABORATORY FOR THE PROPOSED HIGHER SECONDARY SCHOOL, DELHI.

SCALE: 4 FT. TO AN INCH.

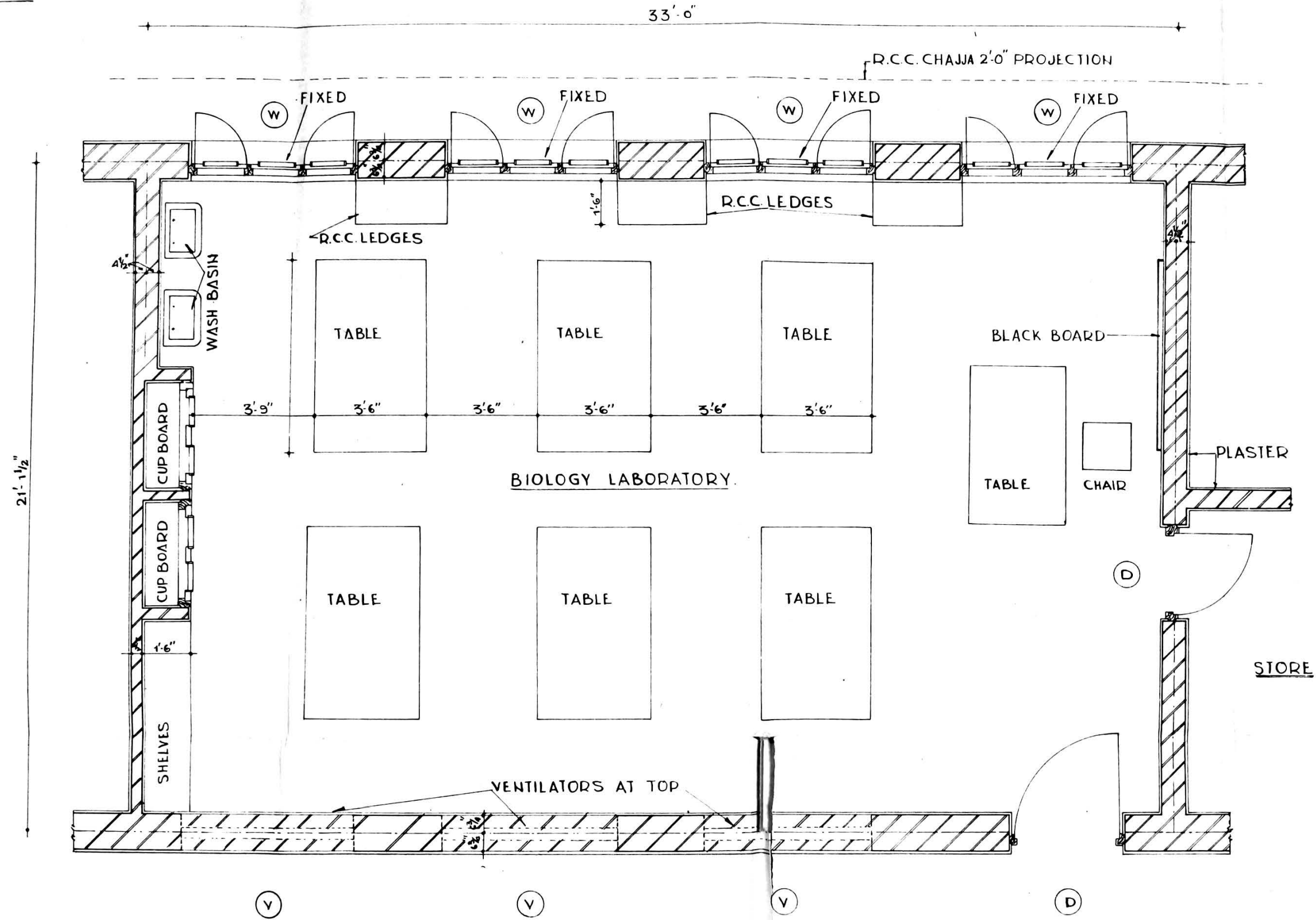


NOTE:-

1. 3'-9" WIDE SPACE BETWEEN WINDOWS AND TABLES CAN BE USED FOR PLACING THE TITRATION TABLES IF NEEDED.
2. DETAIL OF TABLE AND SERVICE PIPES SHOWN ON APPENDIX III

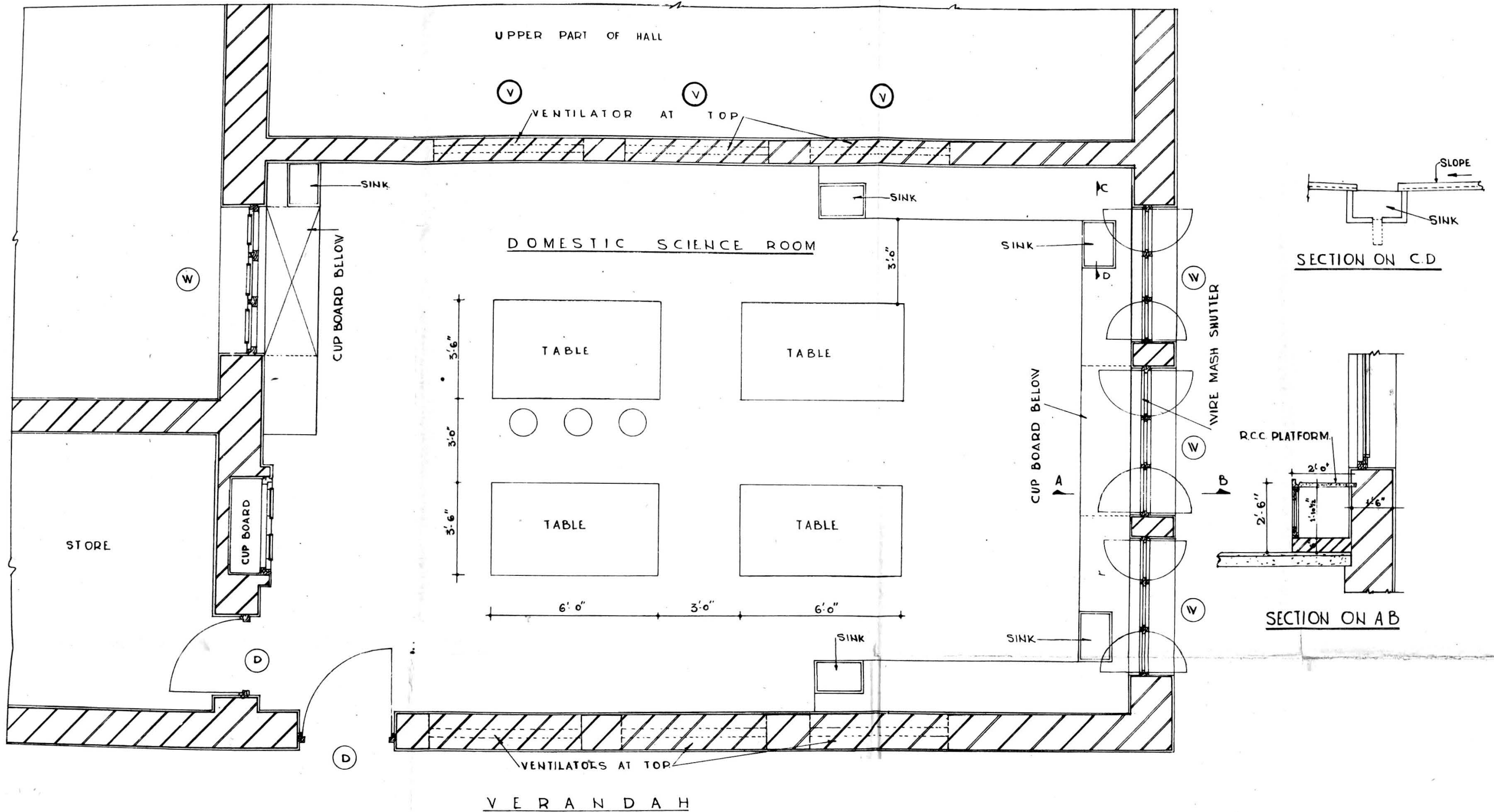
TYPICAL LAY OUT OF BIOLOGY LABORATORY FOR PROPOSED GOVERNMENT HIGHER SECONDARY SCHOOL, DELHI.

SCALE: $\frac{1}{2}'' = 1'$



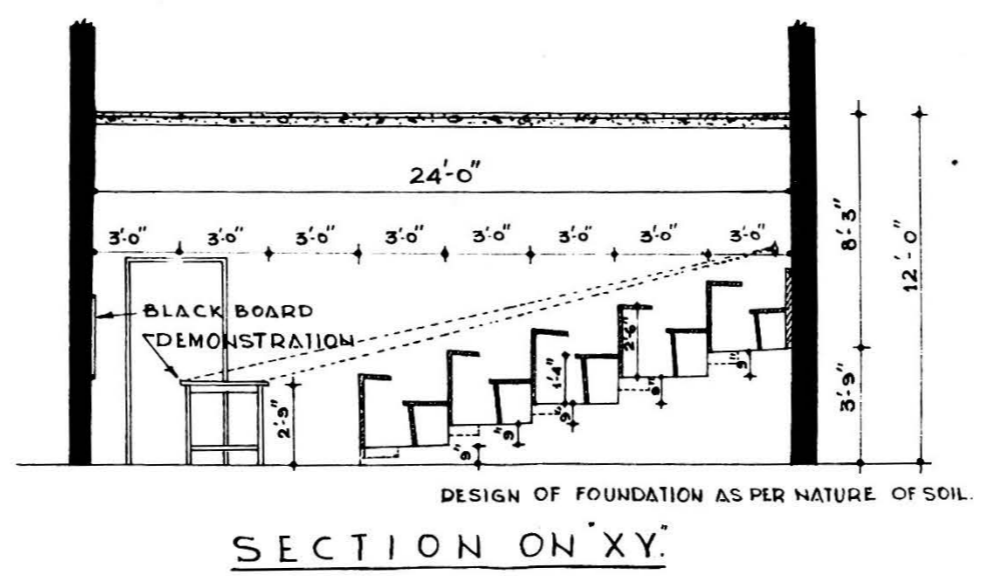
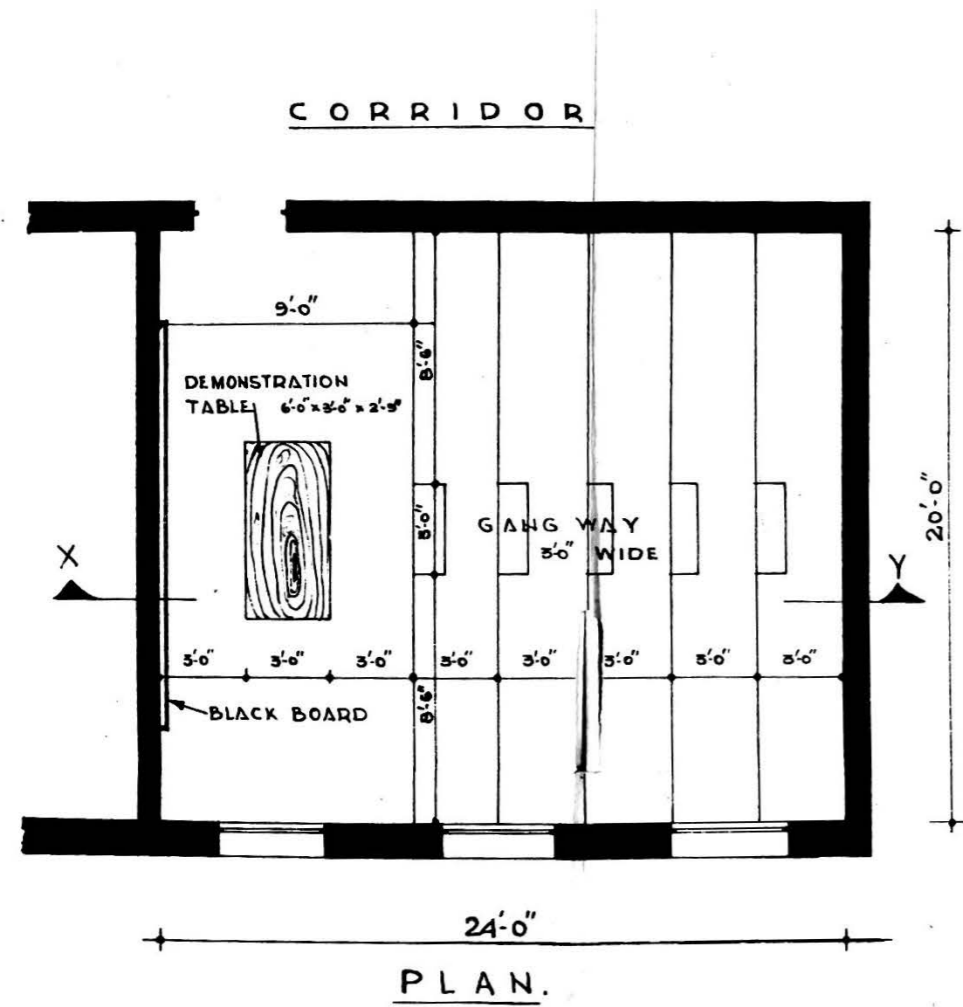
TYPICAL LAY OUT OF DOMESTIC SCIENCE LABORATORY FOR PROPOSED GOVERNMENT HIGHER SECONDARY SCHOOL, DELHI.

SCALE: 1/2" TO A FT.



LAY OUT DESIGN FOR SCIENCE ROOM FOR THE PROPOSED HIGHER SECONDARY SCHOOL, DELHI.

SCALE: 4 FT. TO AN INCH.



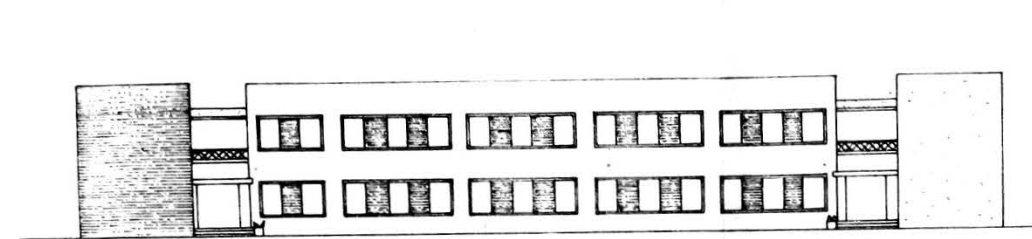
PLAN.

SECTION ON 'XY'.

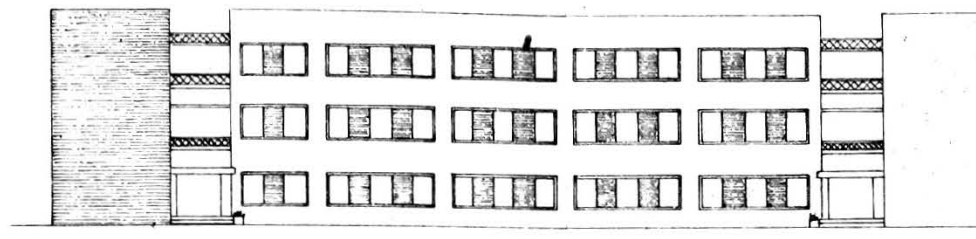
TYPICAL DESIGN FOR A PROPOSED GOVERNMENT HIGHER SECONDARY SCHOOL DELHI.

SCALE: 1/16 FT TO AN INCH

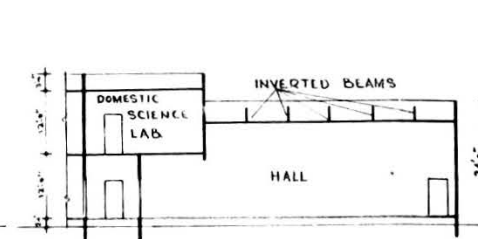
APPENDIX II
(PLATE I.)



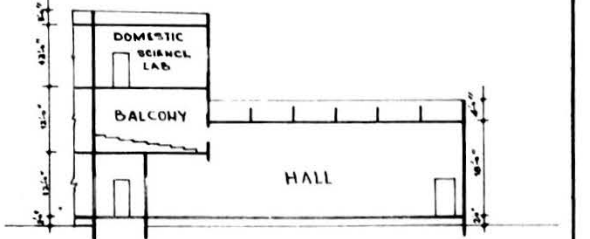
FRONT ELEVATION (FOR TWO STOREYED BLDG)



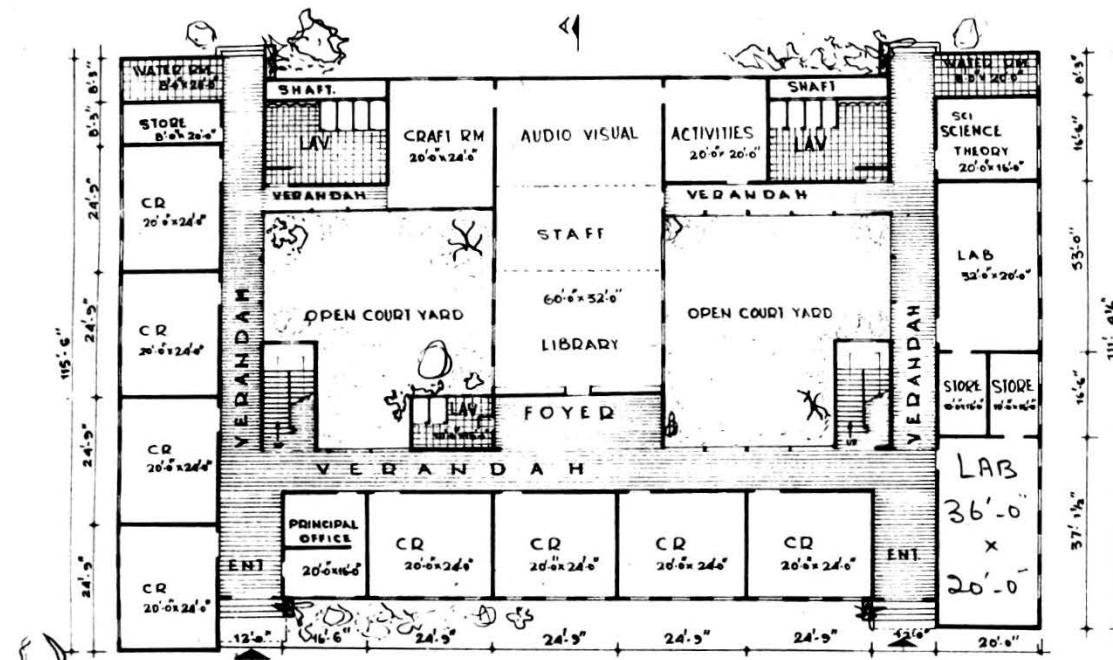
FRONT ELEVATION (FOR THREE STOREYED BLDG)



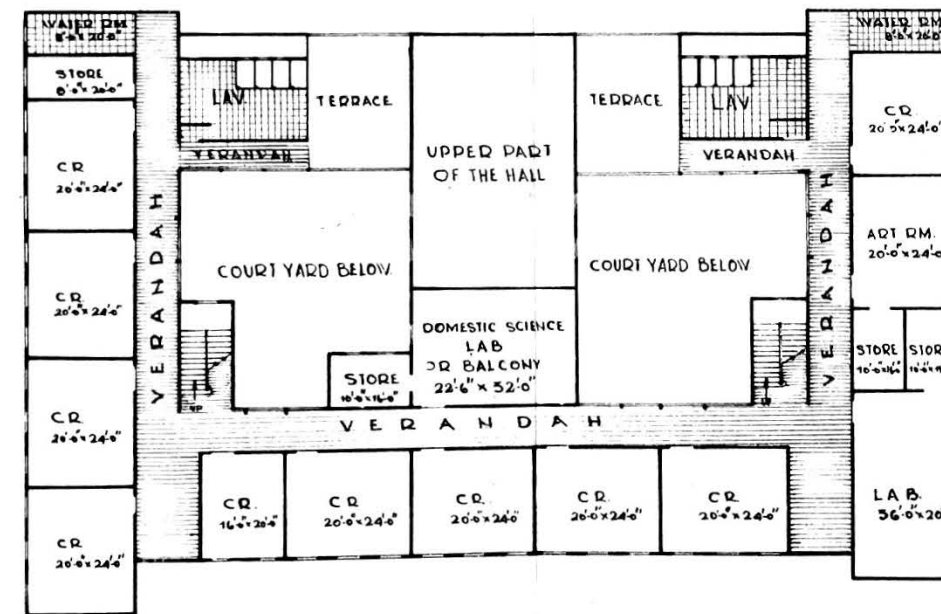
SEC AT A-A (FOR TWO STOREYED)



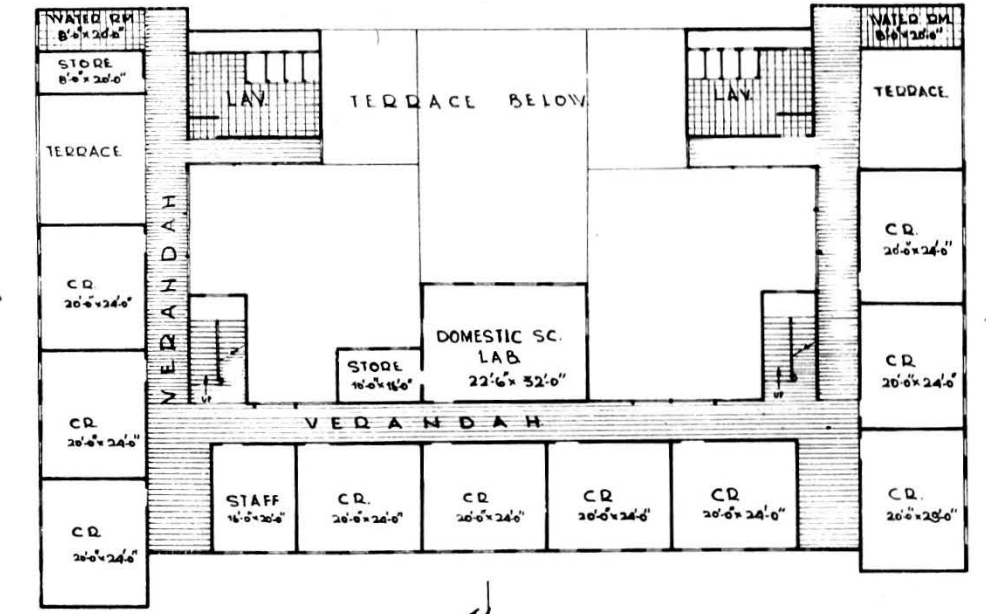
SEC AT AA (FOR THREE STOREYED)



GROUND FLOOR PLAN



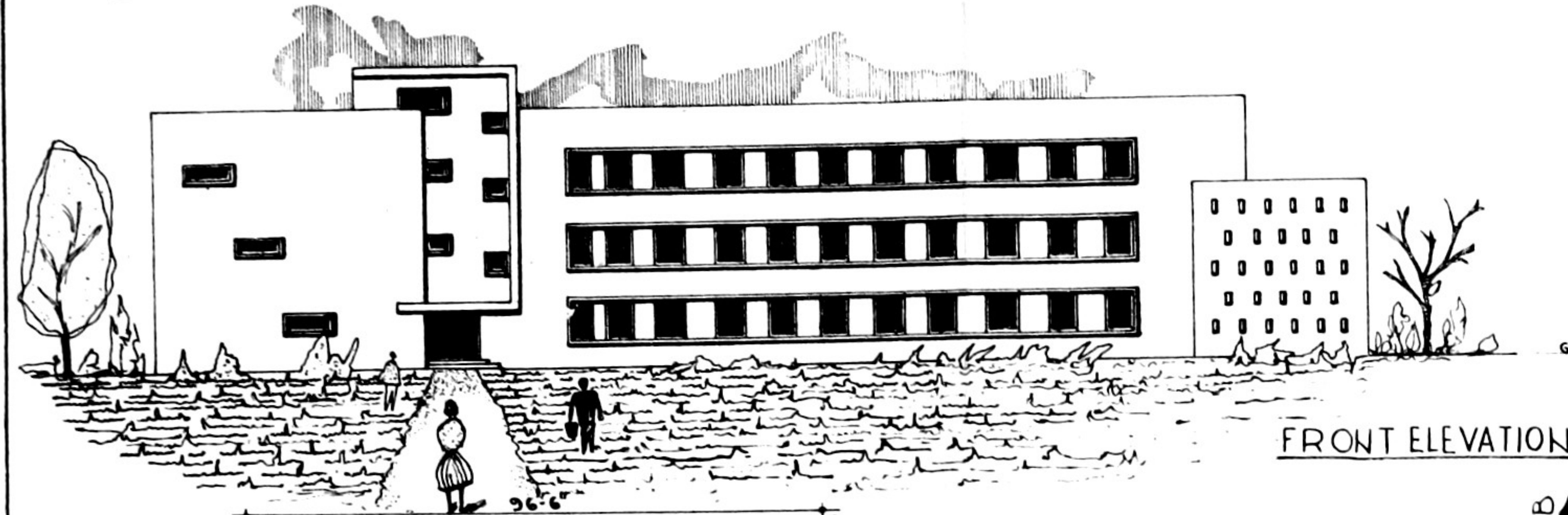
FIRST FLOOR PLAN



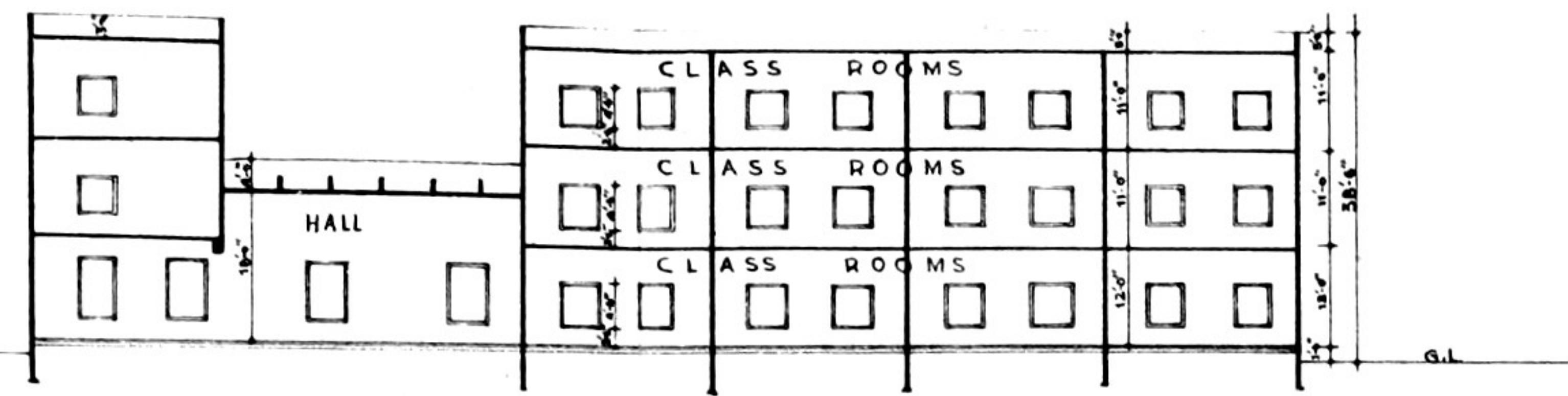
SECOND FLOOR PLAN

TYPICAL DESIGN FOR A PROPOSED GOVERNMENT HIGHER SECONDARY SCHOOL, DELHI.

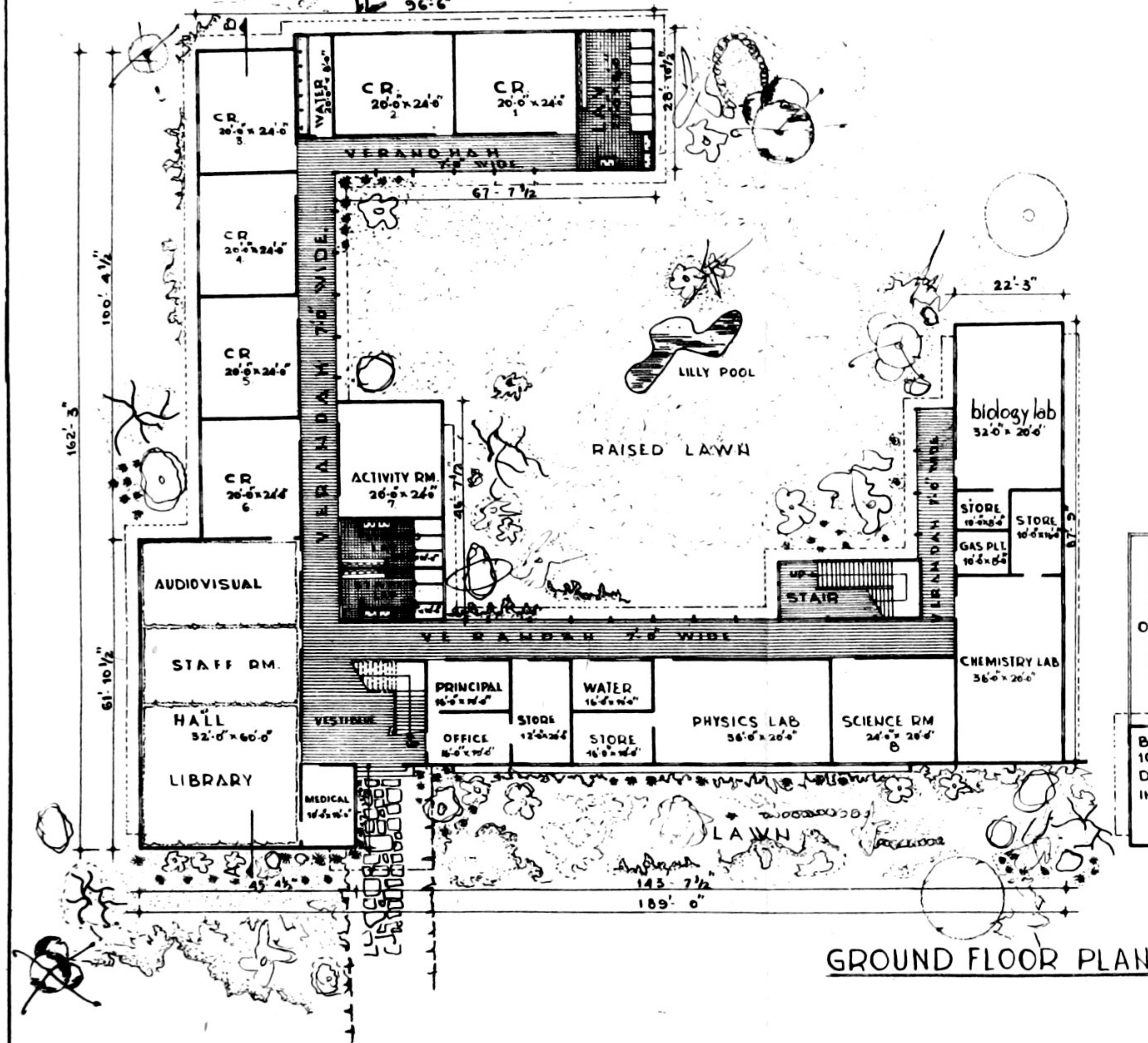
SCALE: 1/16" = 1'-0"



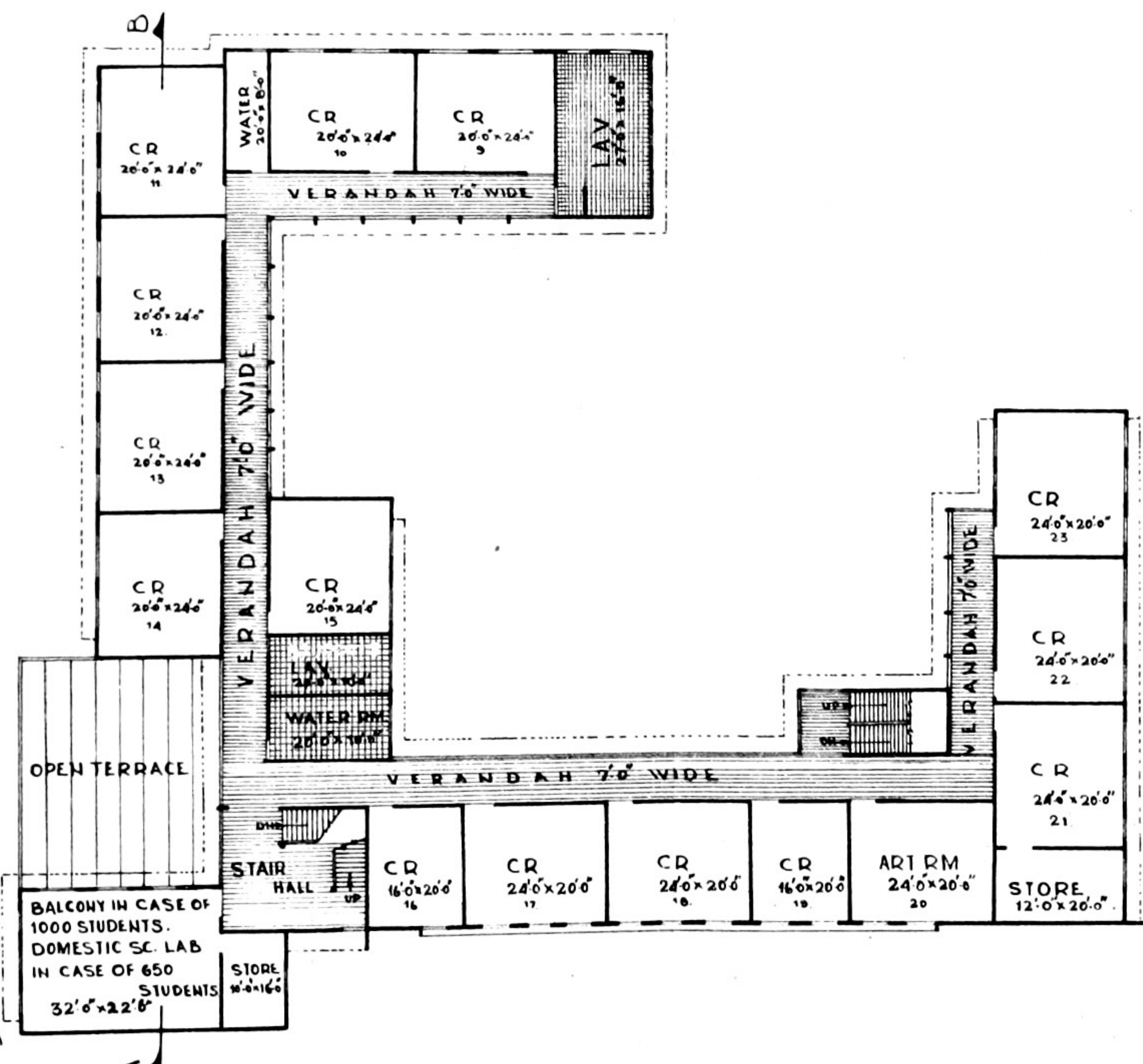
FRONT ELEVATION



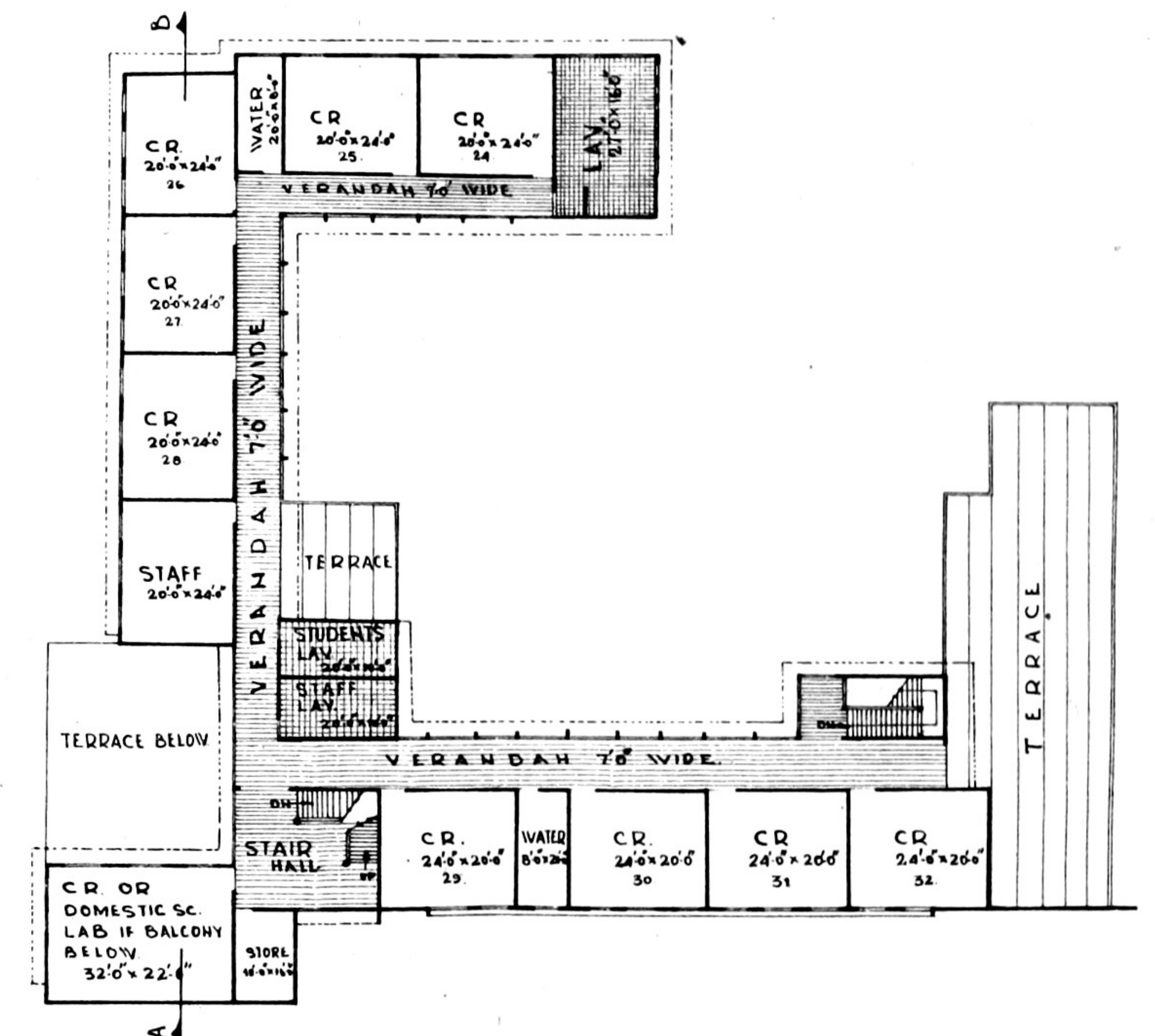
SECTION ON A B



GROUND FLOOR PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN

SKETCH DESIGN OF THE TABLES FOR PHYSICS AND CHEMISTRY PRACTICALS FOR THE PROPOSED HIGHER SECONDARY SCHOOLS, DELHI.

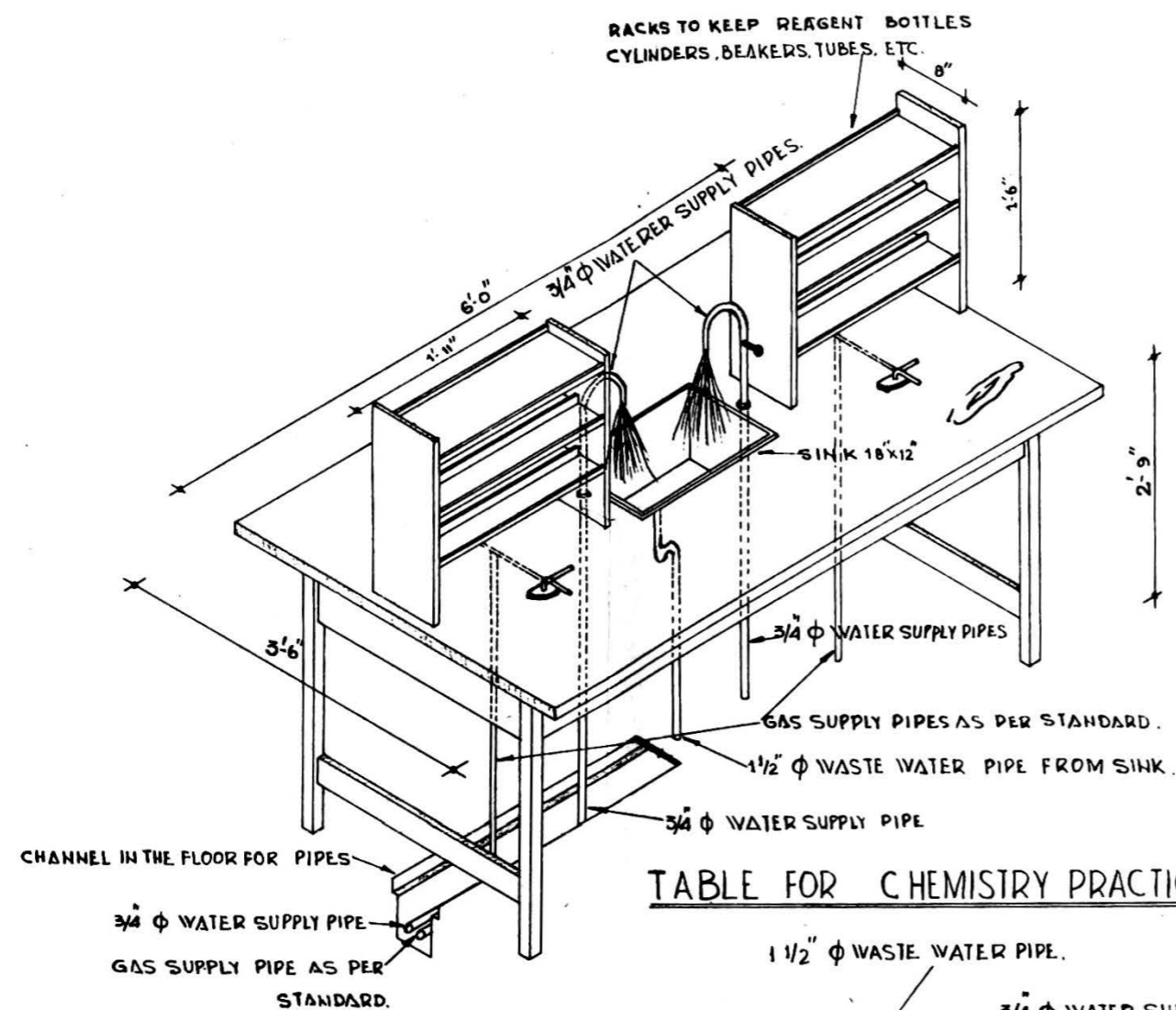


TABLE FOR CHEMISTRY PRACTICALS.

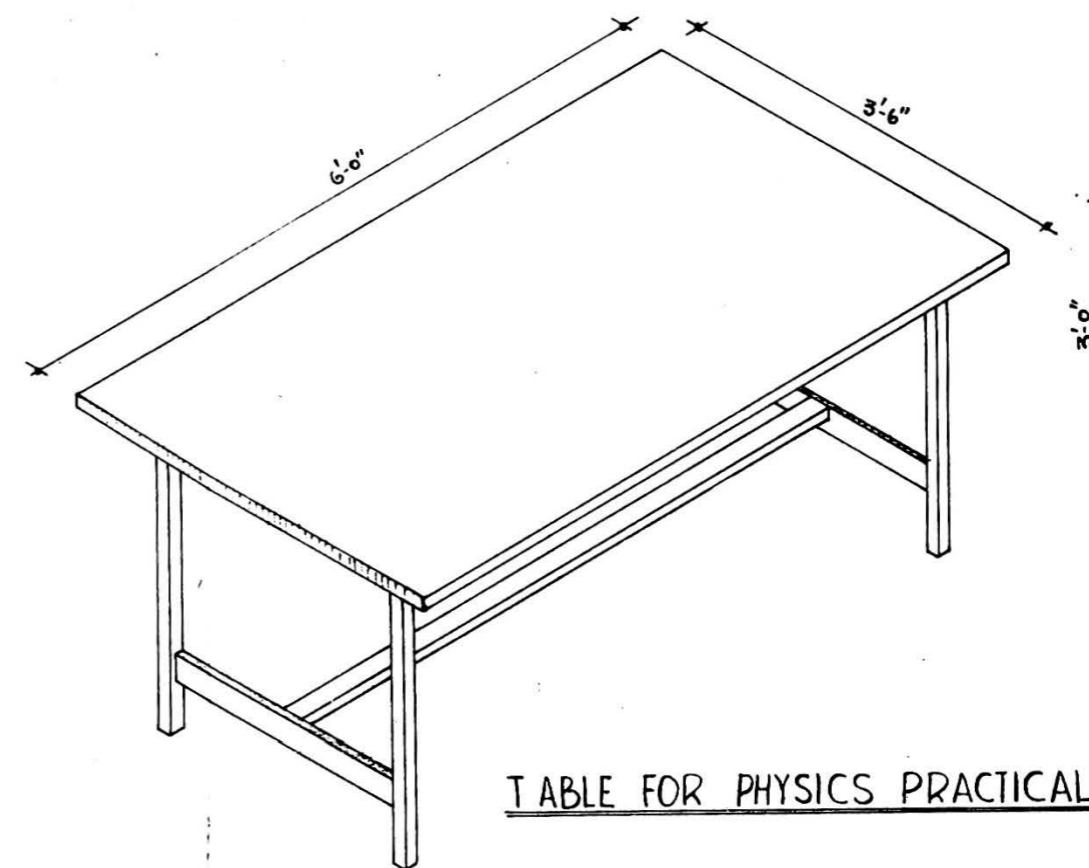
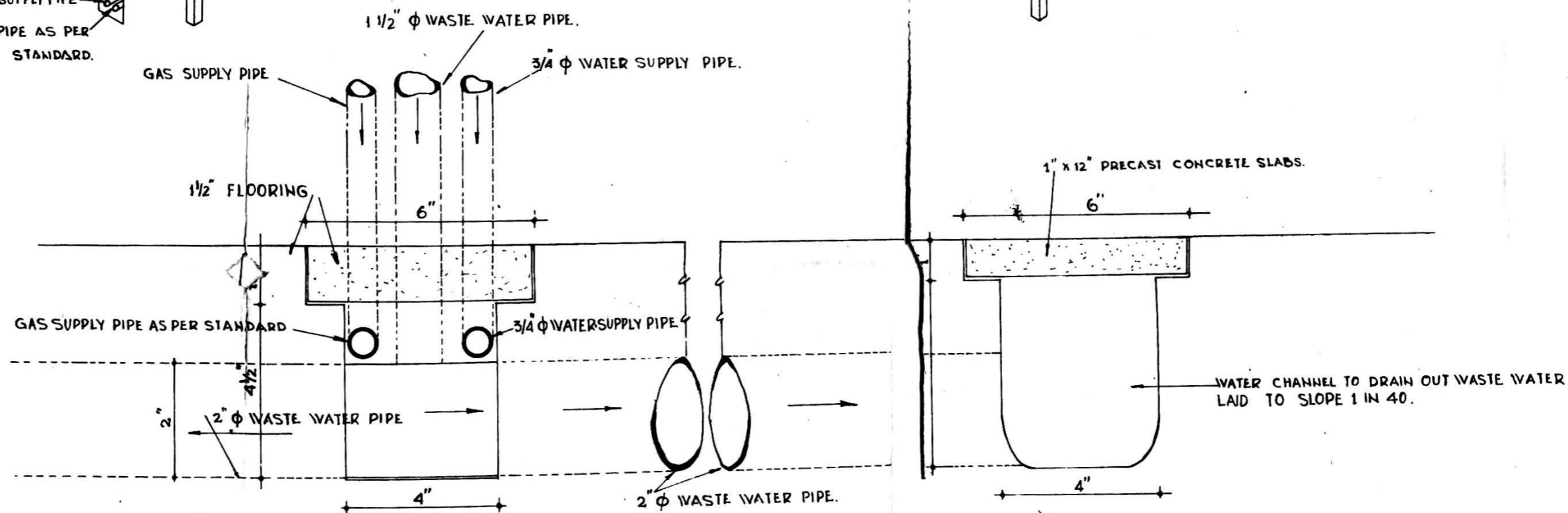
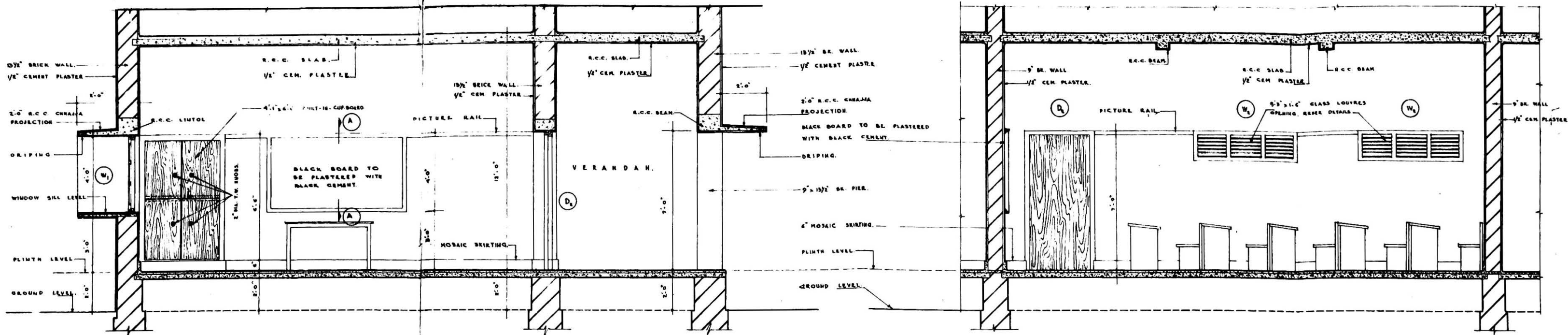


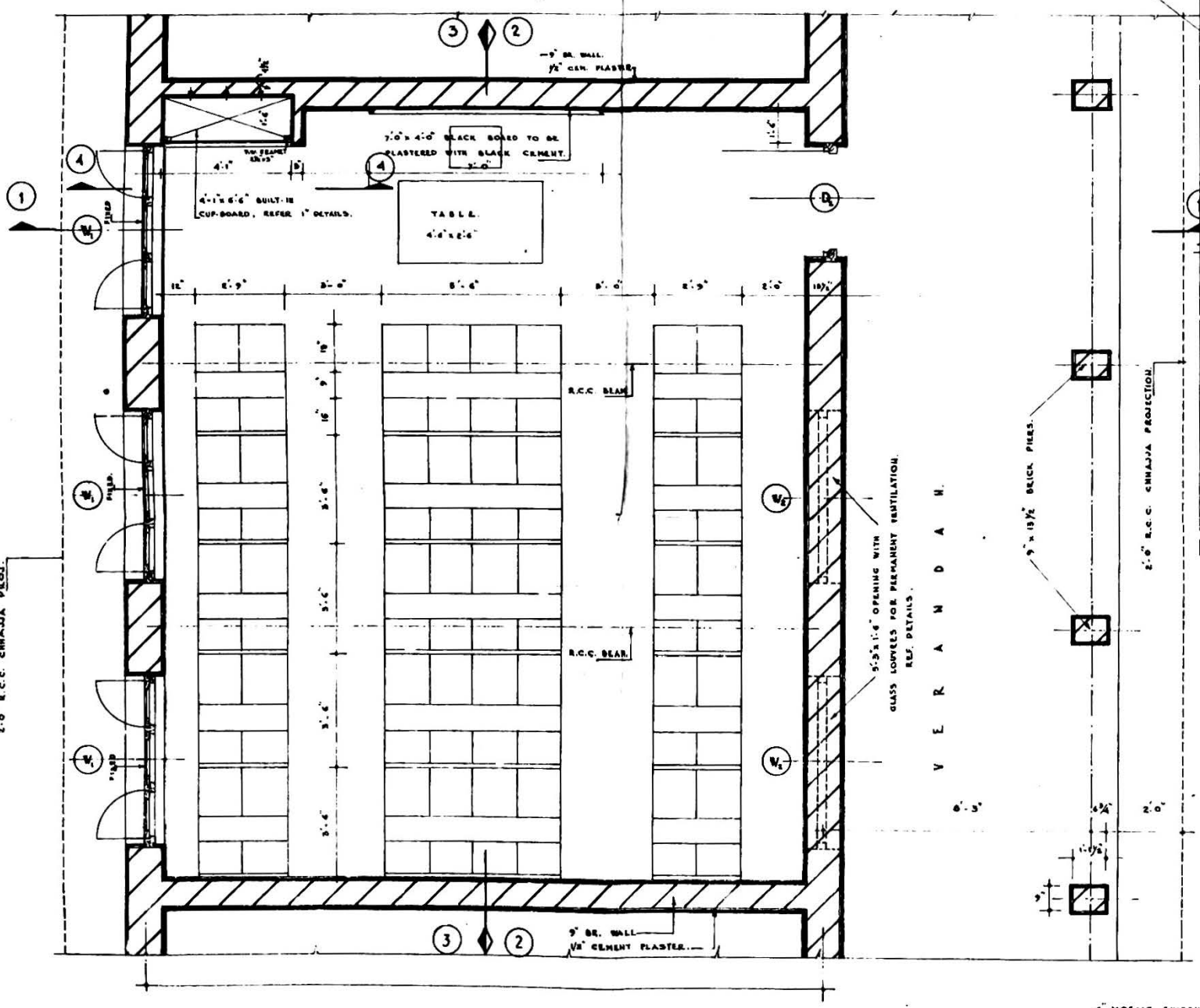
TABLE FOR PHYSICS PRACTICALS.



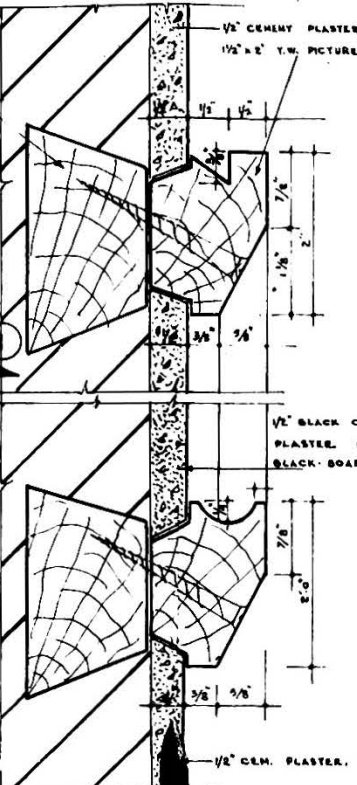


SECTION ON 1-1.

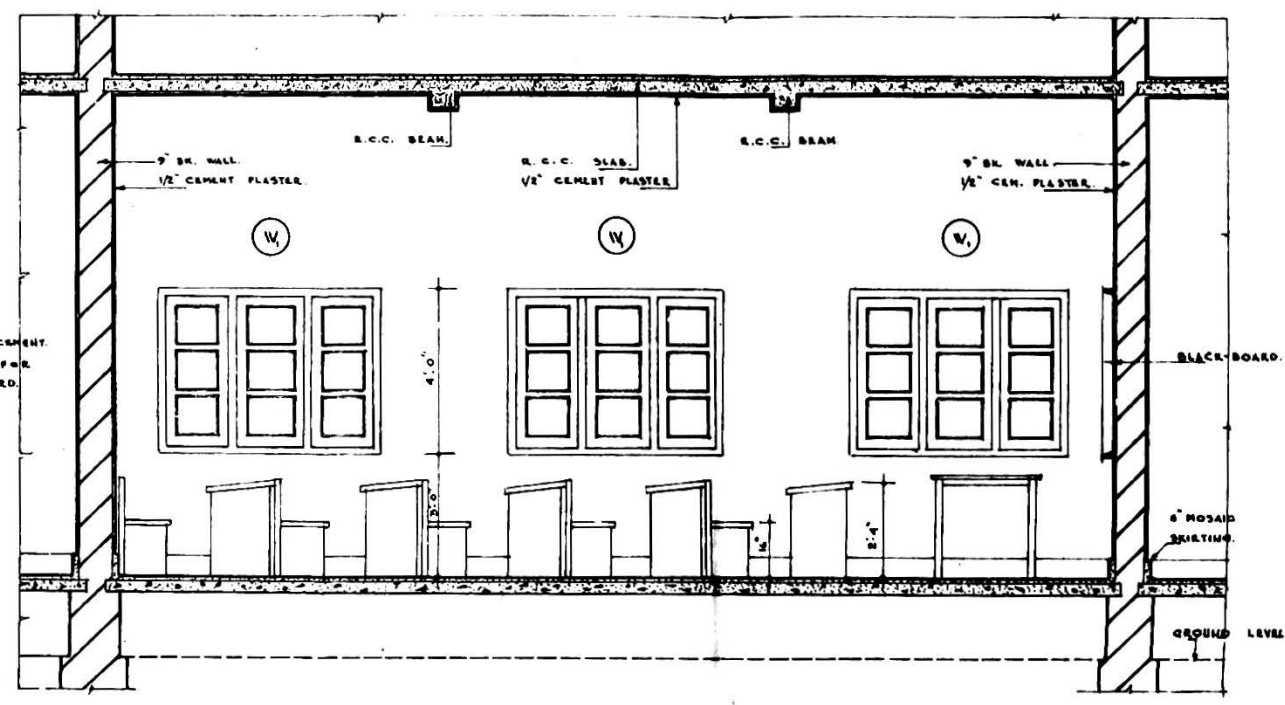
SECTION ON 2-2.



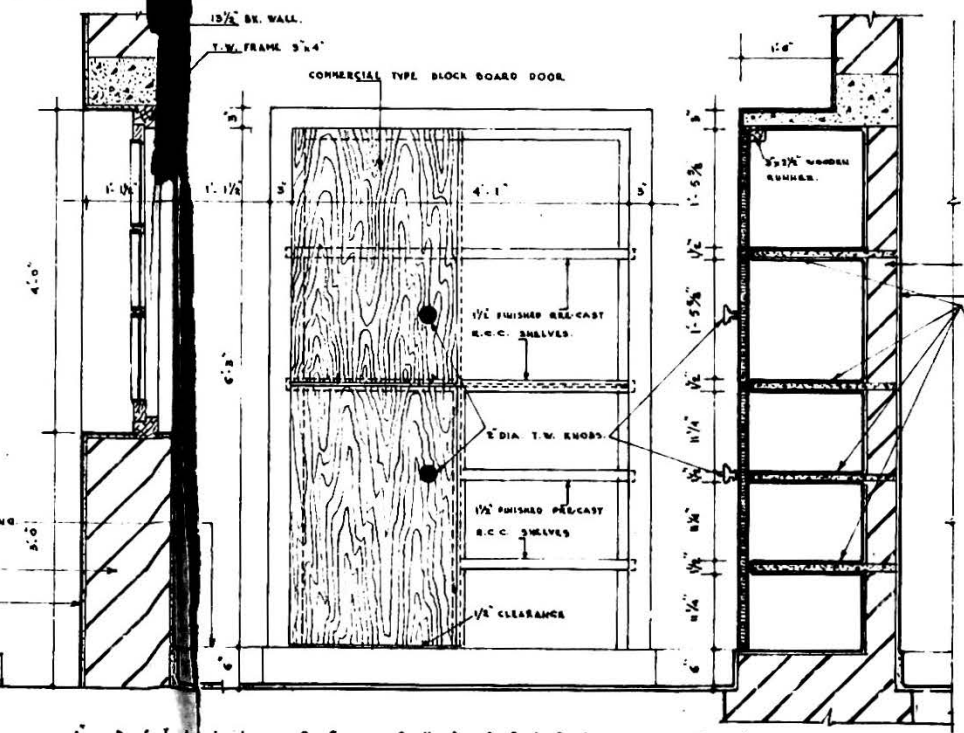
1/2 DETAILS OF CLASS ROOM (SHOWING INTERNAL ARRANGEMENT)



F.S. DETAILS - A



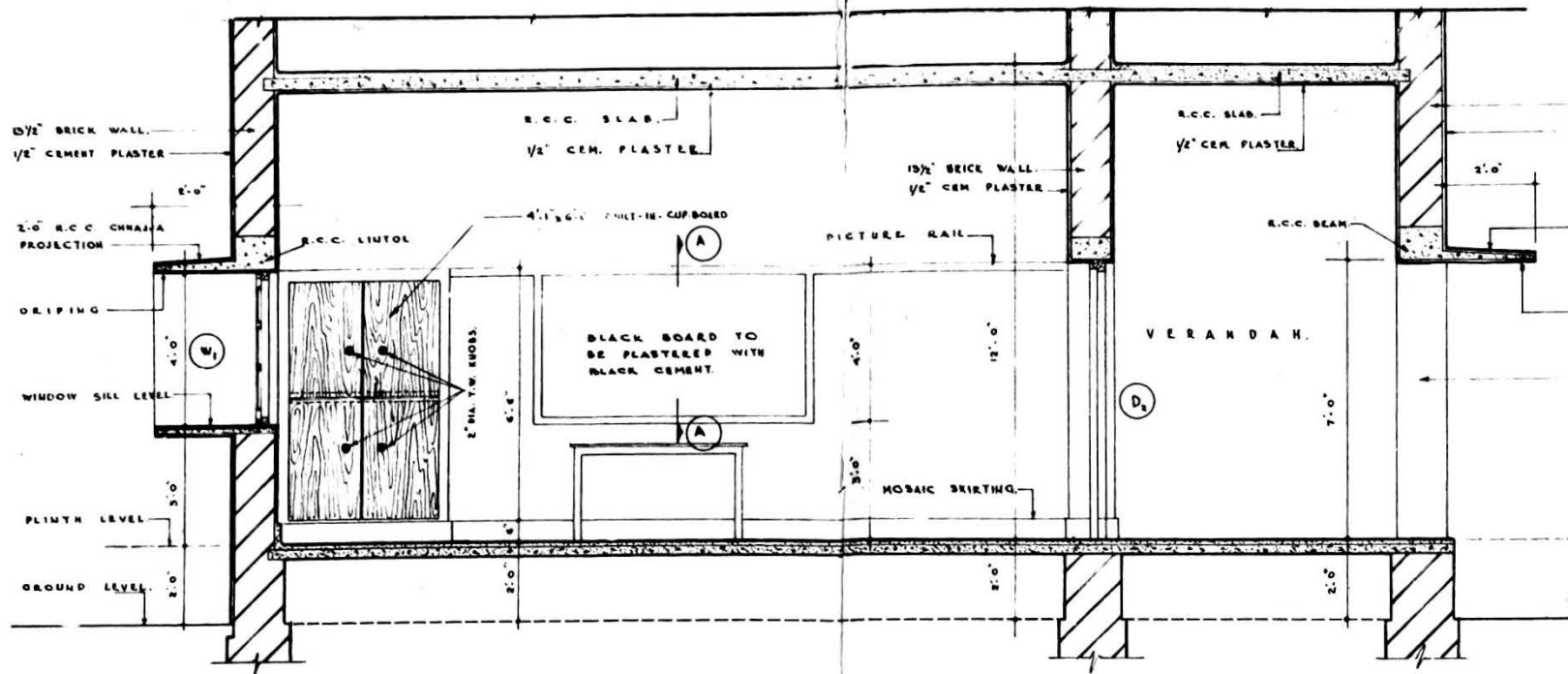
SECTION ON 3-3.



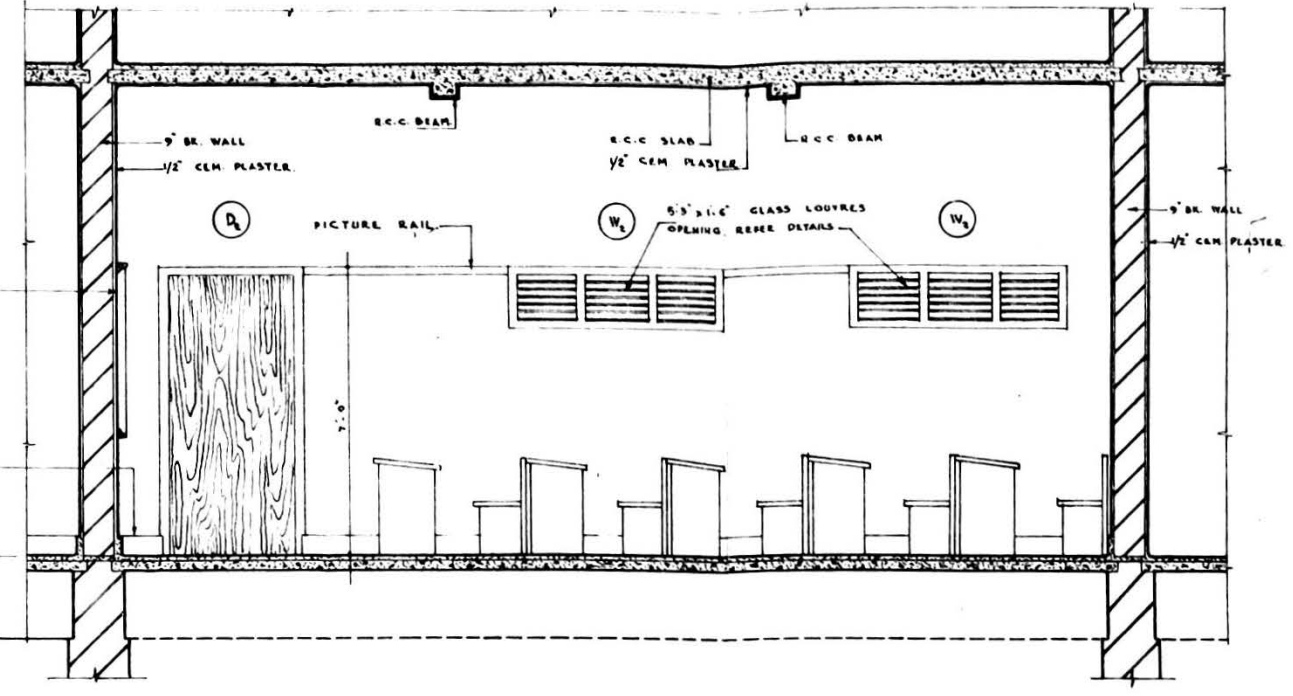
1 DETAIL OF CUPBOARD AT 4.4.

NOTES :-
1. FOR DETAILS OF DOORS & WINDOWS REFER DRG. No. C.2.A.

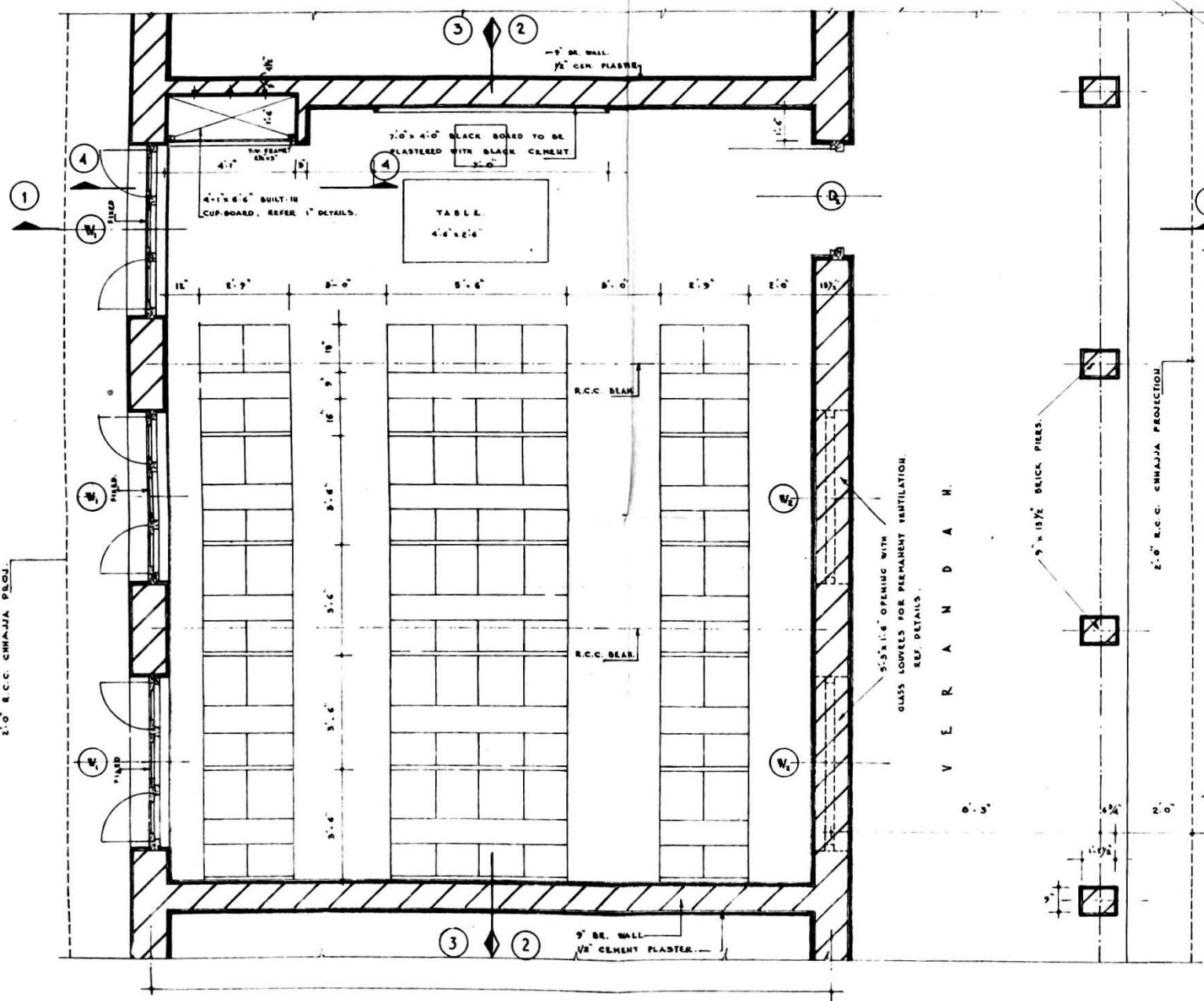
SCALE: 1/8" = 1'-0"



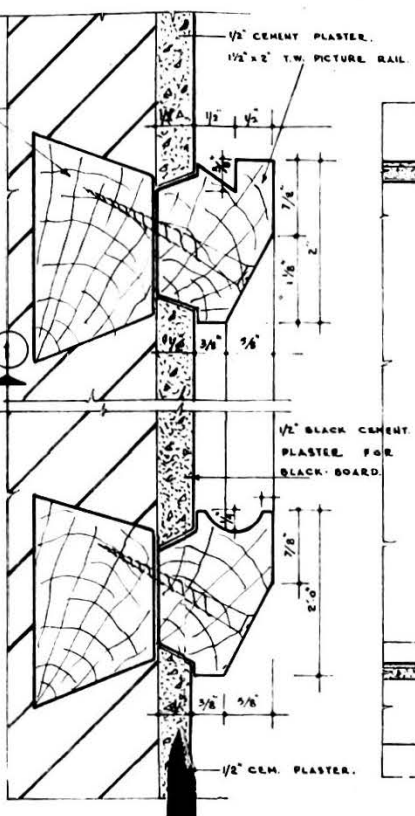
SECTION ON 1-1.



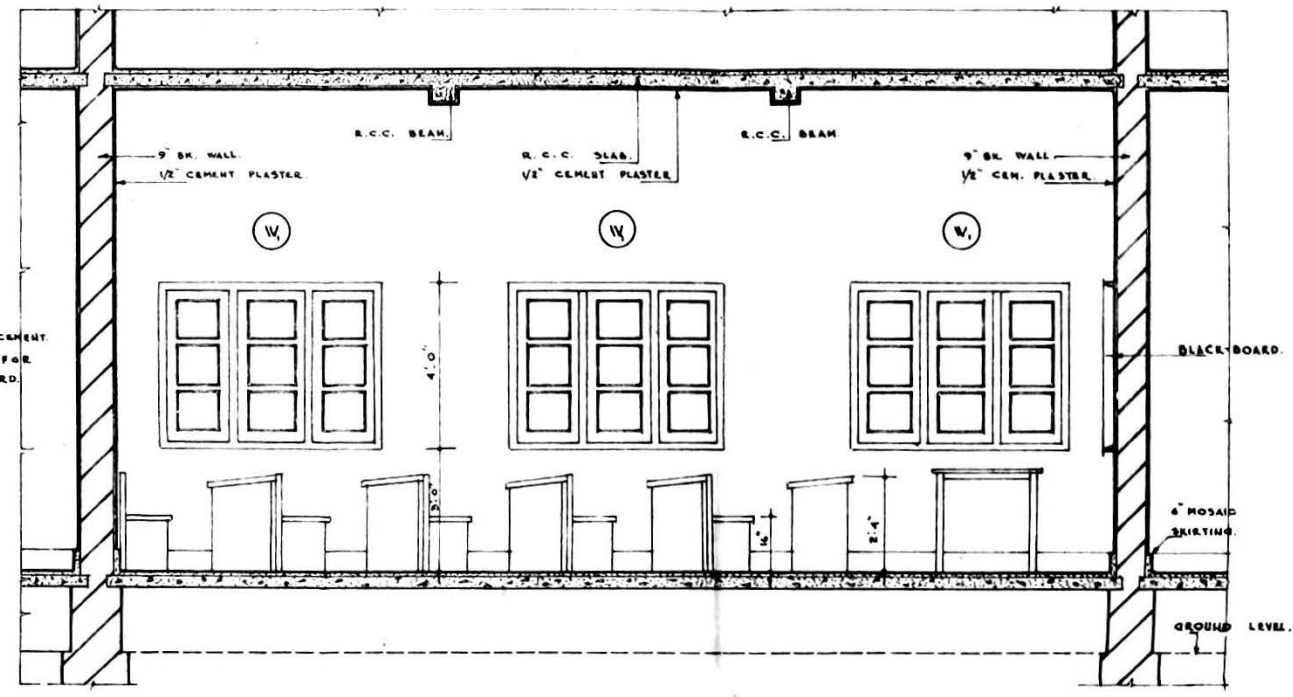
SECTION ON 2-2.



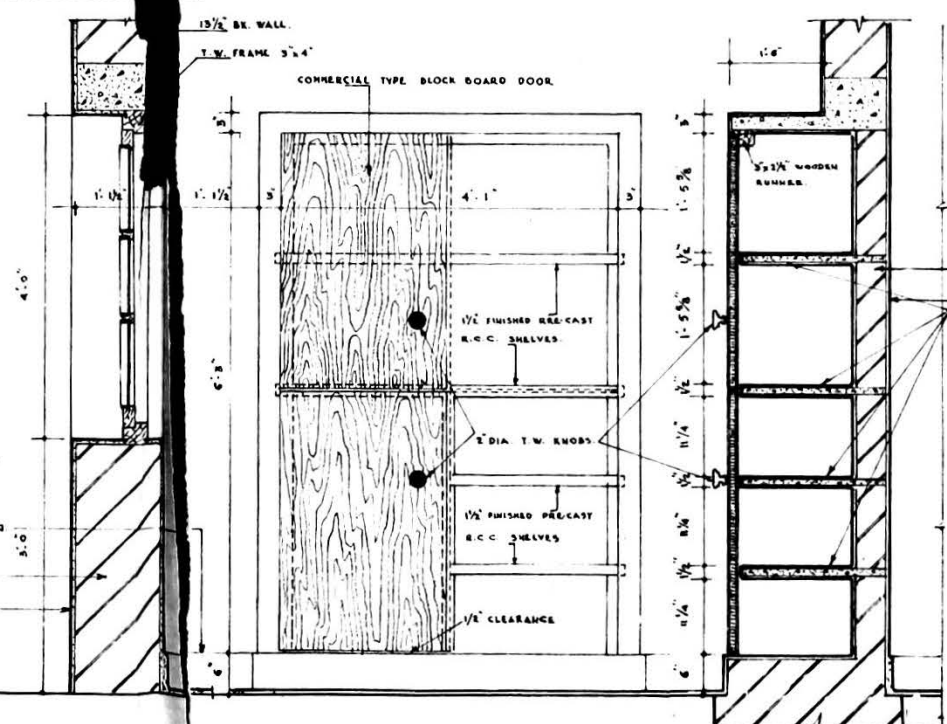
1/2 DETAILS OF CLASS ROOM (SHOWING INTERNAL ARRANGEMENT)



F.S. DETAILS



SECTION ON 3-3.



1' DETAIL OF CUP BOARD AT 4-4.

NOTES -
1. FOR DETAILS OF DOORS & WINDOWS REFER DRG No. C.2/A.

SCALE: _____ OF FEET 1/2" = 1'-0"