

**PHYSICAL INPUTS NECESSARY TO IMPROVE
GIRLS' ACCESS TO SECONDARY EDUCATION**

STRATEGIES and OPTIONS

A STUDY PREPARED FOR THE PROPOSED
WORLD BANK GIRLS' SECONDARY
EDUCATION PROJECT

REPUBLIC OF YEMEN

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Disclaimer

Any views expressed in this study are those of the consultant and do not represent policy or commitment to further action by the the Government of Yemen.

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INTRODUCTION

Background

The Republic of Yemen is a tropical country situated at the southern end of the Arabian peninsular between latitudes 12.5° and 17.5° north and has three climatic zones: the hot, humid coastal zone; the hot and dry desert zone and the cooler mountainous zone. Any school buildings must be designed to cope with the different climates in these three zones and be comfortable for teaching and learning.

Yemen has limited natural resources, belongs to the group of least developed nations and with a per capita GNI of US\$510 is one of the poorest nations in the world. The country has a high (3%) rate of population growth and exceptionally weak health indicators.

While the secondary education system in Yemen has some strong characteristics such as open access for basic school graduates and gross enrolment at or above average for low-income countries, urban/rural disparities are severe and the gender gap is extreme. In 2004/2005 the GER in urban areas for boys was 71.2% but that for girls was only 55.0% and in the rural areas the GER for boys was 45.6% and only 13.7% for girls.

Reducing the high population growth and improving the health of people generally depend largely on increasing girls' enrolment in secondary education. International research has also indicated that failure to reduce the gender gap can cost developing countries up to 1% per annum in economic growth. There is a strong case therefore for targeted expansion of secondary education to improve the equity of access particularly in the rural areas and to increase the enrolment of rural girls.

The major constraints to increasing the enrolment of girls into secondary education appear to be:

- The lack of female teachers, particularly in the rural areas.
- The large number of co-educational schools where girls have to share classes with adolescent boys which many families, particularly rural families find unacceptable.
- The shortage of girls-only secondary schools or the shortage of separate teaching facilities in co-educational schools.
- The lack of separate facilities in schools for girls such as toilets.
- The lack of boundary walls around schools.
- The inappropriate location of some schools close to markets or busy roads where families perceive girls to be at risk.
- The fact that when schools operate double-shifts in order to separate the sexes, the girls are usually given the afternoon shift when they are required to be at home to carry out household chores.

The construction component of any secondary school development programme should therefore confront these issues and seek to provide separate facilities, if not separate schools for girls, to provide other missing facilities such as toilets and boundary walls and to do this at locations where families will be happy for their girls to attend schools.

The Proposed Project

The government's current strategy for secondary education addresses the need to increase access for girls and develop more diverse, relevant and cost-effective curriculum options.

The proposed project will address three key issues facing the secondary education sector:

- Low access, retention and completion rates of all students in secondary education, especially of girls in rural areas;
- Inadequate quality and relevance;
- Weak management and governance.

The proposed project assumes that improved and more relevant secondary education provided to a larger number of students, especially girls in rural areas, will contribute to social and economic development and thus to poverty reduction (42% of the population – 19.2 million in 2004 – living in poverty, with a higher concentration in rural areas).

The proposed project recognises the need for avoiding complex project designs given the existing weak implementation capacity of the government.

The development objective of the proposed project is to 'reduce the gender gap in secondary education while laying the basis for related improvements in the quality, relevance and efficiency of secondary schooling'.

Consultant's Terms of Reference

The consultant visited the Republic of Yemen twice, from May 28th and June 18th and from July 9th to July 30th 2007. The main objectives of the consultant's missions were to assess: the current state of secondary school mapping; assess the existing designs for secondary school facilities and the planning for physical inputs to enhance girls' enrolment in secondary schools and provide the MoE with recommendations on interventions that might be required to further enhance girls' enrolment.

The consultant was also to assist the Project Design Directorate of the Ministry of Education with the preparation of the construction component of the proposed Girls' Secondary Education Project.

See Annex 5 for the consultant's detailed terms of reference.

SUMMARY

SCHOOL MAPPING WITH REFERENCE TO THE PROVISION OF SECONDARY SCHOOL FACILITIES

The School Mapping Directorate has a wealth of information on all or most of the secondary schools in the country. Some information which will be essential when planning new schools or extensions to existing ones (for instance the numbers, ages and sex of school age children within the catchment areas of existing schools or potential school sites) does not however seem to be being collected at present.

For details of the data at present collected by the School Mapping Directorate, see Annex 1: School Mapping Data.

Other statistical information concerning education is collected by the Directorate of Information and Planning but there seems to be little or no co-operation between the two directorates.

When it comes to planning the locations of new schools, the MoE, instead of using the information stored on their data base at present seem to allow governorates or even districts to locate new secondary schools wherever they please. Unfortunately the majority of schools opened in this way are very small and cannot offer the full range of the curricula.

RECOMMENDATIONS FOR THE COLLECTION AND USE OF SCHOOL MAPPING DATA

The MoE should ensure that in future all relevant data is collected and used as the basis for the expansion of existing secondary schools and the location of new schools and that the Directorates of School Mapping and of Information and Planning work closely together on the collection and use of data.

The MoE should also establish an asset register showing the location, condition and expected life of all education facilities using data collected through the annual school mapping exercise and develop an asset management policy for all education facilities. See Annex 4: Asset Management.

SECONDARY SCHOOLS: THE EXISTING SITUATION

Secondary School Provision

Secondary school education is currently provided in a number of ways: in government single-sex or co-educational basic/secondary schools which provide education for grades 1 to 12; in government single-sex or co-educational secondary schools which provide education for grades 10 to 12 and in private schools of both types (which are mainly in the urban areas).

The total number of secondary schools is split almost equally between urban and rural but the total number of girls' schools is much lower than that of boys' schools and of mixed schools and the number of *rural* girls' secondary schools is very low. The average numbers of pupils in rural secondary schools are also much lower than those in urban schools.

There are many more rural basic/secondary schools than urban basic/secondary schools and the total number of girls' schools is slightly higher than boys' schools but

much lower than the total of mixed basic/secondary schools. The average numbers of pupils in rural basic/secondary schools are also much lower than those in urban schools and all are much lower than the numbers of students in secondary-only schools.

The average numbers of secondary students in all basic/secondary schools in rural areas are not sufficient to provide teaching of the full curriculum economically and there are good reasons to close down the secondary departments in these schools if alternative secondary-only schools can be provided economically.

The numbers of girls-only rural secondary schools in particular are very low and if the secondary departments of some of the basic/secondary schools were to be closed it would probably be possible to construct more girls-only schools in more central locations.

Given the low population rates in many rural districts it must however be accepted that it will probably never be economically viable to provide girls-only secondary schools or possibly any secondary schools in some districts.

Existing Secondary School Designs

The government standard for classrooms of 1.3m² per student is lower than in other, comparable countries and will not allow for the flexibility in furniture layout that will be required by more student centred and activity-based teaching methods. The actual sizes of classrooms being provided in schools however vary from 1.33m² to 1.62m² per student.

The facilities provided at secondary schools vary widely in terms of the numbers and type of facility and the size of the rooms. There also seems to be an over-provision of laboratories and of general classroom spaces.

Some schools provide specific facilities for girls but others do not and only a few make any physical separation between the facilities provided for boys and those for girls and at the other schools all classes are therefore presumably mixed if they are not schools running double shifts.

This lack of provision of separate facilities for girls is probably one of the reasons for the low enrolment rates for girls in secondary schools especially in the more traditional societies in the rural areas.

All schools appear to have been designed to accommodate a specific number of students and entry streams but the facilities provided do not fully take into account the requirements of the curriculum and the timetable.

All schools provide the same number of general classrooms as the total number of classes in that school plus additional teaching spaces such as laboratories and multipurpose rooms, etc and no attempt seems to be made to utilise these rooms for general teaching which would reduce the overall number of teaching rooms required, improve the efficiency of use of teaching spaces and reduce the cost of constructing schools.

The numbers of toilets provided differs from school to school and there appears to be no physical separation of boys and girls toilets (apart possibly from separation between different floors). There seems to be no provision of toilets for disabled students.

While the design of most schools provides adequate cross-ventilation to most rooms, most schools offer inadequate or no protection to windows from solar penetration and large parts of all schools are orientated to face east/west. All rooms are therefore bound to have the sun shining into them in at some point in the day making them very uncomfortable and not conducive to learning.

All schools seem to be over-structured, over-complicated in design and generally expensive to construct.

Classroom furniture at present consists of double desks for 2/3 students with attached backless benches. This type of furniture is out-dated, very uncomfortable, provides very little space for the students to work on and is very inflexible in use.

The laboratories as presently designed are inflexible, offer little space for the observation of experiments, make no distinction between biology, chemistry and physics and do not offer all of the services that will be required if teachers and students are going to carry out experiments.

Details of a review of existing secondary school designs from which these conclusions are drawn are given in Annex 2: Review of Existing Secondary School Building Designs. For a discussion of how the design of school facilities fits into an asset management policy see Annex 4: Asset Management.

RECOMMENDATIONS FOR THE DESIGN & CONSTRUCTION OF SECONDARY SCHOOLS

A number of factors have to be taken into account when designing new school facilities in countries such as Yemen. These include climate and geography, teaching methods, furniture, available building materials, local construction methods and skills, maintenance and probably most crucially, cost.

Yemen has a large deficit of secondary school facilities and requires a major school building programme. In order to achieve this, costs will have to be kept low while still ensuring that minimum space and construction standards are met and future maintenance costs are kept low.

When designing the actual teaching spaces a number of factors have to be taken into account including the maximum class size, furniture, teaching methods, light levels, ventilation, thermal comfort, acoustics both within the classroom and between classrooms and the provision of services such as water and electricity.

A number of recommendations are therefore made in this study for the design and construction of secondary schools that encompass the following:

- Design of schools to deal with present demands and future changes.
- Design of buildings to cope with the climate.
- Simple and appropriate construction methods for school buildings.
- Provision of separate facilities for girls and boys (in order to encourage more girls to enter secondary education).
- Provision of appropriate classroom furniture.
- Servicing of the buildings.
- Provision of standardised facilities that are appropriate to the present curriculum but will also allow for future changes.

- Maintenance of school buildings.

Details of these recommendations are given in Section 3: Recommendations for the Design and Construction of Secondary Schools. For a discussion of how resource mapping (i.e. the location and use of appropriate construction materials) and construction methods fit into a policy of asset management see Annex 4: Asset Management.

RECOMMENDATIONS FOR MAXIMISING THE USE OF SECONDARY SCHOOL FACILITIES

The Republic of Yemen is currently suffering a severe shortage of secondary school places particularly for girls. There is a further problem in that many of the existing secondary schools require minor or major renovations or even replacement and many require the addition of extra facilities.

It is important therefore that the use of all existing schools and any proposed new schools is maximised in order to make the best use of limited resources.

In this context, there would appear to be two ways of maximising the use of both existing and any proposed new or renovated schools:

- by rotating the use of all teaching spaces (even of some specialised rooms such as laboratories) that is by using all teaching spaces for teaching any subject and thus fully utilising them
- by using schools for both morning and afternoon shifts i.e. double-shifting them

The use of these options and their effect on the design and provision of secondary school facilities are discussed in Section 4: Strategies for Maximising the Use of Secondary School Facilities and reference should also be made to ways of ensuring the maximum economic use of built resources that are discussed in Annex 4: Asset Management.

RECOMMENDATIONS FOR NEW FACILITIES FOR URBAN & RURAL SECONDARY SCHOOLS

All new or renovated secondary schools should be provided with sufficient numbers of classrooms, specialist rooms, toilets and administration rooms to serve the current secondary school age population and space should be provided for future expansion.

Provision should also be made for a reliable electricity and water supply and for all external works.

All new secondary schools should provide easy access for disabled students and provide at least one disabled toilet for boys and one for girls.

It should be possible to orientate all buildings north/south to reduce sun penetration into rooms and some form of protection from the sun should be provided to all windows.

The facilities to be provided in all secondary schools should be standardised in their size and design. The number of facilities to be provided should only change because of differing numbers of students.

In order to reduce construction costs and because student numbers in rural areas are much lower than in urban areas, different standards should be used for class sizes in rural and urban schools.

It is proposed that the facilities to be provided eventually at all secondary schools should be as follows:

- Adequate facilities for the staff of the school in the form of offices, stores, teachers' rooms, etc.
- General classrooms for 32 students in rural areas and for 48 students in urban areas with an area of approximately 1.4m² per student.
- Multipurpose rooms (or large classrooms) approximately one quarter to one third larger than general classrooms to be used for practical subjects or for project work.
- Science laboratories to be used for teaching all science subjects.
- Libraries or library/resource centres depending on the size of the school. Part of the library/resource centre could initially be used for teaching IT.
- IT classrooms; these will only gradually be introduced as funding and servicing allows.
- A multipurpose/assembly/performance hall in the larger schools.
- Adequate numbers of toilets at a minimum ratio of 1: 40 students (with separate toilets for boys and girls) and a reliable drinking water supply.
- Separate recreation areas for boys and girls with sheltered and protected areas for girls.
- Girls' dormitories at selected schools on a pilot basis.

The actual number and mix of facilities will depend on the total enrolment of the school, the numbers of boys and girls and whether separate facilities are provided for boys and girls:

Decisions will have to be made as to whether separate facilities are to be provided for girls and boys, whether schools will operate double-shifts or whether schools will be co-educational as these decisions will have major implications for the provision of facilities at new secondary schools.

A range of standardised designs for school buildings should be developed that can be used in a variety of locations, that can be put together for new schools of various sizes or that can be used individually or in groups for additions to existing schools.

Proposals for standardised designs are given in Section 5: Proposed New Facilities for Urban and Rural Secondary Schools and in the drawings in Annex 3: Proposals for New Standard Secondary School Facilities.

RECOMMENDATIONS FOR THE IMPLEMENTATION OF SCHOOL CONSTRUCTION PROGRAMMES & OF THE CONSTRUCTION COMPONENT OF THE PROPOSED WORLD BANK GIRLS' EDUCATION PROJECT

School Construction Programmes

Before any schools are selected to be included in any secondary school construction or renovation programme or project, a process has to be undergone that consists of a number of steps:

- The existing situation in all secondary schools must be established in terms of their location, their current and projected enrolment, the existing facilities at each school and their condition, the site conditions, etc
- Criteria will then have to be developed on the basis of which schools to be included in any school construction or renovation programme or project can be selected

Once a short-list of schools that would qualify for inclusion in the programme or project has been established, a preliminary cost estimate can be prepared for the replacement, renovation and extension of each school on the short-list. It will then be possible to establish the number of schools that can be renovated, replaced and/or extended within the budget for the proposed programme or project and a preliminary list of schools to be included can be prepared.

Having established a preliminary list of schools to be included in the programme or project, detailed proposals including cost estimates can be prepared for each school and a final list of schools can then be established.

Criteria for Selecting Schools for Inclusion in the Proposed Project

The main aim of the proposed project is to increase the enrolment of girls into secondary schools particularly in the rural areas.

The project will focus on existing schools that require renovation and/or extension but new schools could possibly be constructed to replace existing schools that are in very bad condition.

A number of criteria to be used in selecting schools to be included in the project have been agreed with government and these criteria are to be used for the:

- Pre-selection of Districts
- Selection of Governorates and Districts
- Pre-selection of schools
- Identification of schools

40 to 50 secondary schools in around 25 to 30 districts in five or six governorates should be identified using the agreed criteria and, subject to costs and the budget available, a number of these schools will be renovated, extended or replaced.

When the School Mapping Directorate has produced a short-list of schools that meet the agreed criteria the Project Design Directorate should carry out preliminary surveys of these schools and prepare cost estimates for each school on the short-list for:

- the renovation or replacement of existing facilities
- the addition of new facilities to bring the school up to the required standards and to provide additional separate facilities for girls

When these preliminary cost estimates have been prepared, it will be possible to establish the number of schools that can be renovated, replaced and extended within the proposed budget for the project and a final list of schools to be included in the project can be prepared.

Preparation for the Construction Component of the Project

Having established a final list of schools to be included in the project, detailed proposals will have to be prepared for each school.

Each school will have to be surveyed and detailed drawings and costings will have to be prepared and a final cost for the civil works at the schools to be included in the project can then be established.

As the construction component of the project will take place over a period of four years (the fifth year should be reserved for the defects liability period for the last schools to be constructed, final payments, etc) the cost estimates must include factors to cover inflation in construction costs and to cover unforeseen contingencies.

A construction programme can then be prepared by the Project Design Directorate showing the schools to be constructed in the first, second, third and fourth years of the project.

For further details see Section 6: Implementation of Secondary School Construction Programmes and of the Construction Component of the Proposed World Bank Girls' Education Project and Annex 4: Asset Management for a discussion of ways of ensuring the maximum economic use of school buildings.

RECOMMENDATIONS FOR THE MAINTENANCE OF SCHOOLS & SCHOOL FACILITIES

At present funding for school maintenance should be provided by the local authorities in the governorates. In practice few if any schools receive any funding for maintenance from their local authority and at present the only funding for school maintenance is being provided through projects.

Government plans in future to hand over the responsibility for school maintenance to the district authorities and MoE will then only be responsible for the construction and renovation of school buildings. It is not clear however where the actual funding for school maintenance will come from although ways for schools to raise their own funds are being investigated.

The neglect of maintenance is a very serious and universal problem in most less developed countries and demands intervention at the national level.

The government, donors and other funding agencies must recognise that the provision of funding for maintenance (and training in maintenance management) is as beneficial, if not more so, than the financing of new facilities. After all, the provision of new facilities will only eventually increase the maintenance burden.

It is important therefore to create a sense of national responsibility for building maintenance based on an appreciation that maintaining existing assets is as respectable and worthwhile as constructing new buildings. All new projects should therefore include a maintenance policy and funding and training for maintenance and the ownership of facilities and the responsibility for maintaining the buildings should also be made clear.

See Section 7: Maintenance of Schools and School Facilities for a detailed discussion of school maintenance and Annex 4: Asset management for a discussion of how maintenance of facilities fits into an asset management programme.

1: SCHOOL MAPPING WITH REFERENCE TO THE PROVISION OF SECONDARY SCHOOL FACILITIES

1.1 School Mapping Data

The School Mapping Directorate has a wealth of information on all or most of the secondary schools in the country. See Annex 1 for the data that the Directorate collects or updates every year. Other statistical information concerning education is collected by the Directorate of Information and Planning.

It is possible to locate and identify any secondary school using Google Earth and there seem to be at least some photographs of all or most secondary schools giving at least an idea of their general condition.

Some information for use when planning schools is however not collected by the School Mapping Directorate and this is information on the numbers, ages and sex of school age children within the catchment areas of existing schools or potential school sites which. This information will be essential when planning new schools or extensions to existing ones. It might be available from the Directorate of Information and Planning but there seems to be little or no exchange of information or co-operation between the two directorates.

1.2 Use of School Mapping Data

The main problems seem to be to do with the way the information is used (or not used). Instead of the MoE using the information stored on the data base for planning the location of schools (and secondary schools in particular) based on school age populations, etc, the MoE seems to allow governorates or even districts to locate new secondary schools wherever they please. If for instance, a basic school has a group of grade 9 graduates and there is no secondary school nearby, the school may be allowed to open a grade 10 class and then a whole new secondary school develops.

Unfortunately the majority of schools opened in this way are very small and cannot offer the full range of the curriculum because there are not enough students to justify the provision of the full complement of teachers. It has to be recognised therefore that in some remote rural locations with very few students of secondary school age, there will never be enough students to justify the provision of a secondary school offering the full curriculum.

The MoE should ensure in future that data on the numbers of secondary school age children within in the catchment areas of existing and proposed secondary schools is collected and used as the basis for the expansion of existing schools and the location of new schools and that secondary schools are only located in rural areas where there are sufficient grade 9 graduates to provide for at least two entry-streams of 30 students in grade 10. The MoE should also ensure that the Directorates of School Mapping and of Information and Planning work closely together, avoid duplication of data and ensure that the data they do collect is used in planning the location of schools, the supply of teachers, etc.

Guidelines for the implementation of school construction programmes in general and for the proposed Girls' Education Project in particular (showing how the school mapping data could be used) are given in Section 7. Notes on how the school mapping process fits into the management of school facilities are given in Annex 4: Asset Management.

2: SECONDARY SCHOOLS: THE EXISTING SITUATION

2.1 Secondary School Provision

The pre-tertiary education system in Yemen now consists of basic education (grades 1 to 9 i.e. what was previously primary and junior secondary education) and secondary education (grades 10 to 12).

Secondary school education is currently provided in a number of ways: in government single-sex or co-educational basic/secondary schools which provide education for grades 1 to 12; in government single-sex or co-educational secondary schools which provide education for grades 10 to 12 and in private schools of both types (which are mainly in the urban areas). See Tables 1, 2 and 3 below.

	Urban			
Type of School	Government	Local Private	Foreign Private	Totals
Secondary	149	8		157
Basic/Secondary	429	132	10	571
Totals	578	140	10	728
	Rural			
Type of School	Government	Local Private	Foreign Private	Totals
Secondary	148	2		150
Basic/Secondary	2,485	2		2,487
Totals	2,633	4		2,637

Table 1: Numbers of secondary schools by provider

	Urban			
Type of School	Boys	Girls	Mixed	Totals
Secondary	84	37	36	157
Basic/Secondary	97	141	333	571
Totals	181	178	369	728
	Rural			
Type of School	Boys	Girls	Mixed	Totals
Secondary	38	6	106	150
Basic/Secondary	186	160	2,141	2,487
Totals	224	166	2,247	2,637

Table 2: Numbers of secondary schools by gender of students

It can be seen from these tables that the total number of secondary schools (302) is split almost equally between urban (157) and rural (150) but that the total number of girls' schools (43) is much lower than that of boys' schools (122) and of mixed schools (142) and that the number of *rural* girls' secondary schools is very low (6).

The average numbers of pupils in rural secondary schools (boys: 209; girls: 174; mixed 237) are also much lower than those in urban schools (boys: 730; girls: 577; mixed 362) but are more or less sufficient to provide adequate numbers of students for a two-stream entry secondary school with 30 students per grade (i.e. 180 students).

	Secondary	Basic/Secondary
Urban/Rural	Average number of pupils	Average number of pupils
Urban boys' schools	730	455
Urban girl's schools	577	358
Urban mixed schools	362	256
Rural boys' schools	209	121
Rural girls' schools	174	75
Rural mixed schools	237	117

Table 3: Average school sizes

It can also be seen that there are many more rural basic/secondary schools (2,487) than urban basic/secondary schools (571) and the total number of girls' schools (301) is slightly higher than boys' schools (283) but much lower than the total of mixed basic/secondary schools (2,474). The average numbers of pupils in rural basic/secondary schools (boys: 121; girls: 75; mixed 117) are also much lower than those in urban schools (boys: 455; girls: 358; mixed 256) and all are much lower than the numbers of students in secondary-only schools.

The average numbers of secondary students in all basic/secondary schools in rural areas are not sufficient to provide teaching of the full curriculum economically and there are good reasons therefore to close down the secondary departments in these schools if alternative secondary schools can be found for the students even if this requires bussing of the students to more central locations or the provision of student dormitories.

There is evidence that many rural families dislike the idea of female students being taught in mixed classes after the onset of puberty and it has been suggested that one reason for the low enrolment rates of female students at mixed rural basic/secondary schools in grades 10 to 12 is the high drop-out rate during grades 7 to 9 and the resulting low numbers of female graduates from grade 9. This high drop-out rate may well have been caused by the switch to basic education which has meant mixed classes from grades 1 to 9 rather than the previous system of mixed classes from grades 1 to 6 with the possibility of single-sex education from grade 7 onwards.

The numbers of girls-only rural secondary schools are very low and if at least the secondary departments of some of the basic/secondary schools are closed it would then be possible to construct more girls-only schools in central locations with the possibility of some girls being bussed to school or staying in hostels at the school.

Given the low population rates in many rural districts it must however be accepted that it will probably never be economically viable to provide girls-only secondary schools or possibly any secondary schools in some districts.

2.2 Facilities to be Provided in Secondary Schools

The MoE 'Standard Criteria for School Mapping' sets out the accommodation to be provided in secondary schools. See Table 4 below.

1	General
1.1	The minimum size for a secondary school should be two intake streams in Grade 10.
1.2	In urban areas and other areas with high populations the class size should be 50 students. For rural areas with medium density populations the class size should be 40 students. For rural areas with low density populations the class size should be 30 students.
2	School Site
2.1	The school site must be in a populated area
2.2	The school should be in the centre of the populated area
2.3	The total site area should be 4.70m ² per student and there should be a play ground area of 2.13m ² per student
2.4	The school site must be safe. It should not be in an area threatened by floods, on dangerous slopes, close to highways, etc
2.5	There should be sufficient space on the site for expansion of the school
3	Classrooms and other facilities
3.1	The school should provide a minimum of six classrooms for a two intake stream school
3.2	In addition the school should have one library/education resources room (1.5m ² per student), one multipurpose room (1.4m ² - 2.4m ² per student), one chemistry laboratory (1.5m ² per student), one biology laboratory (1.5m ² per student), one computer/languages laboratory (1.5m ² per student), one girls' activities room (1.5m ² per student)
4	Administration, etc
4.1	There should be an administration room (155 – 180 m ²), a teachers' room and a store
4.2	In rural areas there should be a hostel for teachers.
5	Toilets
5.1	There should be boys' toilets in the ratio of 1:40 students and girls' toilets in the ratio of 1:35 students
6	Services
6.1	The site must be provided with water and electricity

Table 4: Existing MoE Standards for Secondary Schools

The standard criteria state that the minimum size secondary school should have two 10th grade entry streams with one classroom each (i.e. a total of 180 students if there are 30 students per entry stream). In the 11th grade the streams split into two groups, one studying Arts and the other studying Science and this continues in the 12 grade. Therefore in the 11th and 12th grades the two science groups can combine to form one class and the two arts groups can combine to form one class giving a total of six classes for the three grades.

The criteria also state that other teaching facilities as well as general classrooms should be provided such as a library/education resources room, a multipurpose room, a chemistry laboratory, a biology laboratory, a computer/languages room and a room for girls' activities (presumably such as a home economics room).

A minimum area per student (1.3m²) for general classrooms is also given which gives an area per classroom of 39m² for 30 students and of 52m² for 40 students.

Although this document states in general terms what facilities are required at different sizes of schools, it does not give a breakdown of the numbers of facilities required in order to teach the existing curriculum.

The document also makes no recommendations for the provision of separate facilities for boys and girls which if it was to be implemented, would have major implications for the number of facilities to be provided and their cost.

2.3 Existing Secondary School Designs

Provision of Facilities

The facilities provided at existing secondary schools vary widely in terms of the numbers and type of facility and the size of the rooms. See Annex 1 for a review of seven existing secondary school designs. There also seems to be an over-provision of laboratories (which are expensive facilities to provide) and of general classroom spaces (this assumes that classrooms are rotated i.e. used for teaching any type of lesson). There seems to be no real reason for this as all schools are teaching the same curriculum and the facilities provided should vary only in accordance with the number of entry-groups and the total numbers of students.

The government standard classroom size of 1.3m² per student is slightly lower than in other, comparable countries and lower than that recommended by the World Bank as long ago as the 1980s and will provide crowded conditions for students and not allow for the flexibility in furniture layout that will be required by different, more student centred and activity-based teaching methods. It can be seen however from the review in Annex 1 that the actual sizes provided in the school designs reviewed vary from 1.33m² per student to 1.62m² per student. See Table 5 below for comparative classroom sizes.

Country	Area per Student in Secondary School Classrooms
Egypt	1.25m ²
Yemen	1.3m ²
Eritrea	1.31m ²
Iran	1.4m ²
Indonesia	1.4m ²
East Timor	1.4m ²
UNESCO recommendation	1.45m ²
World Bank recommendation (1980s)	1.5m ²
UK	1.7 – 2.4m ²
USA	3.4m ²

Table 5: Comparative General Classroom Sizes

It should be noted that none of the schools reviewed provide all of the facilities included in the MoE 'Standard Criteria for School Mapping' as set out in Table 4 above and that the sizes of the facilities that are provided as noted above, vary greatly. See Table 6 below.

Facility	Type of School						
	3-stry, 12- crms	2-stry, 13-crms	3-stry, 19- crms	4-stry, 12- crms	3-stry, 48- crms*	2-stry, 24- crms	4-stry, 12- crms
	Areas in m ²						
Classrooms	39.90	40.00	39.90	39.90	48.60	44.08	40.10
Laboratories	70.70	63, 62.40	72.45	70.70	67.00	74.20	54.66
Library	-	64.74	72.45	-	?	74.20	-
IT Room	-	62.4	72.45	-	?	-	-
Multipurpose	49.00, 88.11	63.00, 132.60, 49.00, 70.70, 88.11	72.45	49.00, 70.70	66.20, 44.46	74.20	115.26
Home Economics	-	60.58	-	49.00	?	-	-
Sewing	-	62.40	-	-	?	-	-
Languages	-	-	-	49.00	?	-	-

Table 6: Sizes of teaching rooms and numbers of facilities provided at schools reviewed. Note: * Second floor layout not available

Some schools provide specific facilities for girls such as sewing rooms and home economic rooms but others do not. Only one of the schools (the largest, 48-classroom school) makes any physical separation between the facilities provided for boys and those for girls and at the other schools all classes are therefore presumably mixed if they are not schools running double shifts.

All schools provide multipurpose rooms but the numbers and sizes of these differ and it is unclear, in terms of the curriculum, for what function(s) it is intended that these rooms are used. Two schools have information technology rooms but the others do not. Three schools have libraries but the others do not.

It should also be noted that while each school appears to have been designed to accommodate a specific number of students and entry streams, the facilities provided, as noted in the reviews in Annex 2, do not fully take into account the requirements of the curriculum and the timetable as set out in Table 7 below.

All of the schools provide the same number of general classrooms as the total number of classes in that school i.e. a 3-stream entry school will be provided with nine classrooms plus additional teaching spaces such as laboratories and multipurpose rooms, etc and no attempt has been made to utilise these rooms for general teaching which would reduce the overall number of teaching rooms required (this is known as rotating the classrooms and improves the efficiency of use of teaching spaces and will reduce the capital cost of the school; see Section 4: Strategies for Maximising the Use of Secondary School Facilities.

This also means that the multipurpose rooms and especially the laboratories will be very much under-utilised. The efficiency of both types of room will be greatly increased if they are used for general teaching as well as for specialised activities.

Subject	Periods per Subject per Week per Class and Stream				
	Grade 10	Grade 11		Grade 12	
General Studies	40 students per class	Science	Arts	Science	Arts
Holy Quran	2	2	3	2	3
Islamic Studies	4	3	4	3	3
Arabic	6	6	8	6	8
History	2		3		3
Geography	2		3		4
Social Studies	1				
Social Science			2		
Economics			2		
Psychology					2
Philosophy					4
Maths	5	8		8	
Statistics			2		2
English	5	5	6	5	6
Arts	1	1	1	1	
Biology	3	3		3	
Chemistry	2	3		3	
Physics	2	4		4	
Activities	1	1	2	1	1
Total Number of Periods per Class or Stream	36	36	36	36	36
Total Number of Periods per week					180

Table 7: Weekly Timetable for Secondary Schools

Table 8 shows the relationship between the gross and net floor areas and the areas taken up by the circulation spaces and the internal and external walls for the seven school designs that were reviewed.

School	Gross Floor Area m ²	Net Floor Area m ²	Circulation Area m ²	Wall Area m ²
1	2,095	1,364 (65%)	537 (26%)	194 (9%)
2	1,947	1,138 (58%)	614 (32%)	194 (10%)
3	2,239	1,301 (58%)	783 (35%)	155 (7%)
4	2,369	1,348 (57%)	686 (29%)	334 (14%)
5	1,482	787 (53%)	518 (35%)	177 (12%)
6	3,013	1,686 (56%)	838 (28%)	489 (16%)
7	6,687	3,635 (54%)	2,114 (32%)	938 (14%)

Table 8: The relationship between gross and net floor areas and areas taken up by circulation and walls.

In schools designed for the tropics where maximum cross-ventilation and natural lighting from both sides of the classrooms is required, access is usually from a veranda or balcony on one side and circulation spaces are therefore quite high compared to those in schools in temperate countries where central access corridors serving classrooms on both sides can be used.

The relationship between gross areas (the total built area of the school including all rooms, walls and circulations spaces), net areas (the internal areas of classrooms and other rooms), circulation spaces and the area taken up by walls should be in the range of: gross area 100%; net area 60%; circulation 30% and walls 10%.

It can be seen from the table that in several schools the circulation areas are quite high and the area taken up by walls is particularly high. Both of these factors will increase the cost of the schools.

Toilets

The numbers of toilets provided (and the ratio of toilets to students) differs from school to school and there appears to be no physical separation of boys and girls toilets (apart possibly from separation between different floors).

There is no provision of disabled toilets in any of the schools and in only one school is there an adequate ramp to allow access for wheel-chair users.

The present design for dry toilets is very expensive, poses a health threat to students and will not function properly and it appears that rural communities are very much against the provision of these toilets (which is not surprising given the inadequacies of the design).

Design for Climate

While most of the school designs provide adequate cross-ventilation to most of the rooms, all of the school designs offer inadequate or no protection to windows from solar penetration in their teaching and other spaces and large parts of all the schools by virtue of their design will also be orientated to face east/west. All rooms are therefore bound to have the sun shining into them in at some point in the day making them very uncomfortable and if the schools run two shifts, the classrooms will be particularly uncomfortable in the afternoons for both teachers and students and not conducive to learning.

Construction

The designs of all the schools in terms of construction seem to be over-structured, over-complicated and therefore expensive. The window design at all schools is complicated and expensive and walls are generally thicker than necessary. Floor-to-floor and ceiling heights are also generally very high. All of these factors will add greatly to the cost of the buildings.

Furniture

Classroom furniture as presently being supplied consists of double desks for 2/3 students 400 or 450mm deep with attached backless benches. This type of furniture is out-dated, very uncomfortable, provides very little space for the students to work on and is very inflexible in use i.e. it can only be used for traditional lecturing by the teacher from the front of the class and provides very little working space for the students.

Laboratories

The laboratories as presently designed are inflexible in use and make no distinction between biology, chemistry and physics and do not offer all of the services (such as

gas) that will be required if teachers and students are going to carry out experiments. It will also be very difficult for students to gather round either the teacher's demonstration bench or the fume cupboard to watch experiments and it will be difficult for some students to watch demonstrations at the teacher's desk or to take notes as they will be seated with their backs to the teacher. It is understood in fact, that at present students do not carry out any experiments and the laboratories are used (if they are used at all) purely for teachers to demonstrate experiments.

Services in the laboratories are provided in or under the floor slab and will be difficult to locate for repairs or upgrading. No built-in gas supply is provided for bunsen burners either for the teacher, the preparation room, the fume cupboard or the students. The lighting in the laboratories is likely to be poor in the centre of the room because of the position of the windows.

2.4 Secondary School Construction Costs

Construction costs for secondary schools in Sana'a are at present estimated by engineers in the Project Design Directorate as follows:

- General teaching and administration spaces and circulation spaces: R40/45,000m² (US\$201/226m²)
Laboratories, IT rooms,
Home Economics rooms, toilets: R60/65,000m² (US\$301/327m²)

These estimates are for single-storey buildings and multi-storey buildings could possibly cost a little less. Site works (paths, roads, drains, walls, gates, etc) would cost approximately 15/20% of the total building cost.

Actual construction costs for schools being built in 2007 by the Public Works Project are given in Table 6. There is no breakdown for classrooms and serviced areas. It can be seen however that the PWP costs are at the top end of the estimates provided by the engineers in the Project Design Directorate.

Public Works Project: School Construction Costs 2007			
Type of School	Gross Area m ²	Total Cost US\$	Cost per m ²
3-Classroom	178	45,193	253
3-Classroom	276	69,828	253
6-Classroom (2-story)	442	111,775	253
12-Classroom (2-story)	994	273,213	275
15-Classroom (3-storey)	1,374	377,960	275

Table 9: PWP School Construction Costs, 2007

The breakdown of construction costs is as follows:

- Local materials: 40%
- Labour: 30%
- Imported materials: 20%
- Contingencies: 10%

The contractor's profit margin is usually in the region of 15/20%.

These costs are, as stated above, for Sana'a but urban centres in the Governorates would be similar. Costs in the district centres would be between 5% and 40% higher depending on their location, transport links, etc.

The inflation rate for construction is at present running at between 10%/15% and this will have to be added to any present day cost estimates to cover increases in construction costs due to inflation in the period to be covered by the proposed project.

3: RECOMMENDATIONS FOR THE DESIGN & CONSTRUCTION OF SECONDARY SCHOOLS

3.1 General

A number of factors have to be taken into account when designing new school facilities in countries such as Yemen. These include climate and geography, teaching methods, furniture, available building materials, local construction methods and skills, maintenance and probably most crucially, cost.

Yemen has a large deficit of school facilities at the secondary school level and requires a major school building programme. In order to achieve this, costs will have to be kept low while still ensuring that minimum space and construction standards are met and future maintenance costs are kept low.

When designing the actual teaching spaces again a number of factors have to be taken into account including the maximum class size, furniture, teaching methods, light levels, ventilation, thermal comfort, acoustics both within the classroom and between classrooms and if any services such as water and electricity are required.

A number of recommendations are made for the design and construction of secondary schools that encompass the following:

- Design of schools to deal with present demands and future changes.
- Design of buildings to cope with the climate.
- Construction of school buildings.
- Provision of separate facilities for girls and boys (in order to encourage more girls to enter secondary education).
- Provision of appropriate classroom furniture.
- Servicing of the buildings.
- Provision of standardised facilities that are appropriate to the present curriculum but will also allow for future changes.
- Maintenance of school buildings.

3.2 Secondary School Design

The following issues need particular consideration when designing secondary schools:

Adaptability/Flexibility

It is highly desirable that school facilities offer adaptability and flexibility both in day-to-day use and over time and it should be understood that the drivers of the demand for flexibility and the nature of flexibility that is required are themselves varied.

The demand for flexibility might for instance relate to a building having a range of users or potential users but it could also range from a department wanting to grow and expand to a teacher who wishes to rapidly change the layout of a classroom and has to have the space to be able to achieve this. In other words, school buildings should offer the scope for change over months and years, but also the flexibility to meet different pedagogical needs between and within single lessons.

It should be borne in mind when designing new facilities for secondary schools that any new buildings should have a useful life of at least 30 years and during this time

both the teaching methods used and the subjects taught will undoubtedly change as will such things as the servicing requirements of the buildings. New curricula will be introduced and some will undoubtedly demand very different kinds of teaching methods than those in use at present and be more student-centred and activity-based.

In more-developed countries, the introduction of computers is changing the very method of teaching and increasingly this will be an issue in developing countries, especially for secondary schools in the first instance. The changing demands of science, technology and subjects such as languages also make it imperative that buildings should be responsive to change and development.

It is very important therefore that designs for new facilities take all of these factors into account and allow for short-term flexibility in the use of the new facilities to allow for different teaching methods, furniture layouts, etc and for long-term adaptability to allow for future changes in curricula, etc.

A flexible design approach should therefore be adopted if physical facilities are going to allow for future developments in education. Adaptability to change can be achieved for instance by the use of structural frames rather than load-bearing internal walls, the clear separation of the building fabric from the services and the possibility of additions and easy modification to the buildings

Careful consideration and coordination between the external wall design and the structural grid should allow a variety of positions for internal partitions and allow schools to be flexible in terms of space, size and use. The careful siting of services so that they do not inhibit future change can also assist in the provision of flexible solutions.

An important concept to be considered when designing for long-term change is that of 'loose fit, long life'. Designing in some additional space in classrooms initially can give great benefits over the long term; the extra initial cost is far outweighed by the savings made later when changes have to be made. Classroom spaces should not therefore be designed to fit exactly a given curriculum or teaching method as this could prevent future changes.

Community Use of School Buildings

To maximise the potential use of the physical infrastructure provided for education it is important to keep in mind possibilities for other uses and school designs should if possible allow for these. Community use is an important example but other uses such as adult education and even income generation activities (which could be of benefit in raising funds for school maintenance for instance) may also be significant.

There is research evidence in developed country contexts that the promotion of increased links with the community helps schools to:

- raise pupils' motivation, expectations and achievement
- combat social exclusion
- improve security and reduce vandalism
- break down barriers between school and community

When new school infrastructure is being provided, there are important design considerations that should be taken into account that will maximise the possibilities of community use.

The main consideration is the zoning of areas that might be used by communities outside of normal school hours so that they can be accessed without entering the main school.

The types of secondary school facilities that might be zoned in this way include:

- Facilities for meetings and performing arts, such as school halls;
- Sports facilities;
- Laboratories,
- IT facilities;
- Libraries;

If there are kitchens/cafés these might also be sited so that they can cater for community use or income generation.

Image

The design of schools is important in creating an image that reflects the aspirations of teachers, pupils, parents and the wider community. Bright and stimulating teaching spaces with a positive use of colour and strong links with the outside will help to create an appropriate image for the buildings.

Designing for Information Technology

The introduction of new information technologies within school buildings should be a design consideration. Although these technologies are not in general use in secondary schools at present in Yemen, there is no doubt that they will be increasingly introduced and used in the coming years and the design of facilities now (which will last for 30 years or more) must take account of this.

In recent years there has been a rapid development in the application of IT in schools in developed countries and the choice of computer hardware, software and networking systems are critical issues. Computers are generally seen as tools to be used in support of the curriculum but the increased use of computers by teachers as a management tool and in monitoring and assessment also needs to be considered.

For building designs, an important factor is the way that network cabling is routed (although wireless technology might soon make this obsolete). Such networks might be used for accessing library information and for transferring data between rooms, departments and schools. Increasingly in developed countries networks are likely to be used for:

- access to interactive education programmes;
- administration;
- examination registration;
- facilitating library use and borrowing;
- day-to-day class registration and attendance monitoring;
- aspects of security in school buildings.

Developments in “broadband” transmission of data will create increased scope for educational and other broadcast programmes to be accessed on-line and for visual teleconferencing. Language teaching, for example, may well be increasingly assisted through pupils interacting, for language practice, with peers in a classroom in another country.

Designing for Science

The keynote of science provision is to design spaces that readily adapt to use by all of the traditional science subjects: chemistry, physics and biology. The distinction between the three subjects is chiefly in equipment and with the use of central preparation areas (or by subject stores and preparation rooms attached to a laboratory) specialist equipment can be moved by trolleys to service the needs of a particular lesson, thus lessening the need for individual subject areas.

The main factor that makes flexibility of this kind possible is the choice of furniture and equipment. A wide range of activities can take place in a laboratory, but these can be classified as falling into three broad types: briefing and teaching; demonstration of experiments and pupils’ experiments and evaluation exercises. As with general teaching spaces, a laboratory that is a simple square or slightly rectangular shape allows for a wide range of activities, whilst giving the teacher close supervision of pupils and their work. Rooms that are long or narrow are difficult to arrange, often with long viewing distances and acute angles.

Services to laboratories can be overhead, under-floor, perimeter, or a combination of these three. The choice of systems is of paramount importance to the degree of flexibility possible and to adaptability, maintenance and the furniture that can be accommodated.

If more than one laboratory is required (and at present this will only be in the larger schools) they should if possible be grouped together. There can then be one preparation room per group of laboratories providing an economical use of space and technician time.

Libraries/Information Centres

Libraries in secondary schools are increasingly perceived to be not merely a store for books, but one of the most important learning resources used by pupils. In developed countries they are evolving to become all-purpose “resource centres”, where the latest communications technology has increased significance. It is critical that the library occupies a central position in the school so that it is easily accessible and can encourage student use after school hours for individual study. Ideally, the library should be linked to the entrance and main circulation areas so that it is easily accessible by students and possibly the outside community.

The library should act as an information centre for each school, linked if possible to an IT network and adjacent to any IT rooms.

A well-planned library should have an attractive single entrance and exit, be on one level, screened by a security system next to the control desk. A small area for casual reading of magazines and periodicals with casual seating and good visual display are essential ingredients near to the entrance. Decent areas should be provided for individual study where up to say 30 pupils can use computers. In addition, traditional study areas with chairs and tables might typically be provided for up to 30-40 students. The main book storage should be housed in shelves only 1.2 or 1.4 metres

high, except for wall storage where shelves can be up to 1.8 metres high, thus allowing for good supervision from the control position.

If there are plans to include reprographics facilities, provision might incorporate a range of specialist reprographics equipment, a sink, good cupboard provision, a desk for administration, large tables for layouts and good lighting and ventilation systems.

Design for Climate

In Yemen, all new secondary schools should be able to cope adequately with the climate found in all parts of the country at various times of the year: with the hot, humid conditions found along the coast; with the dry but very hot conditions found in the desert areas to the east of the country and with the tropical but variable conditions found in the mountainous areas.

All facilities should be designed to be only one room deep with large windows on either side that can be opened during the hot season and closed in those areas where there is a cold season. These windows will give good cross-ventilation and good overall natural lighting. Access to all rooms should be from open verandas or balconies on one side to allow for cross-ventilation. Ceilings should be high but not overly so as this will greatly increase costs.

It is very important in tropical countries to orientate all buildings to face north/south if at all possible as this will reduce the incidence of solar penetration into rooms and thus improve comfort for the occupants. All buildings should therefore have a single orientation in order that, when placed upon a site, no rooms will face east/west.

All rooms in countries north of the equator such as Yemen should preferably face north (with access verandas on the south side) to further reduce solar penetration but there will however still be some sun penetration into the rooms at some point in the day unless protection is given to the windows in the form of external projections over the windows, external louvres, etc and some sort of protection should be provided.

School Construction

Construction costs in Yemen in recent years have been driven up by, among other things, a combination of falling exchange rates and increasing world prices for fuel, steel and cement. It is essential therefore that all secondary school facilities are designed with the goal of reducing construction costs and they should therefore be as simple and economic to construct as possible.

The building structure especially for multi-storey buildings should take into account local traditions and should be as simple to construct as possible. Window design in particular should be simplified with, as stated above, external protection for the windows from the sun.

All buildings should also be designed to reduce maintenance costs.

Floor-to-floor heights should be standardised at an acceptable minimum, possibly 3.2 metres in mountain areas and 3.6 metres in the hot, humid coastal areas and the hot and dry desert areas.

Single-storey structures should be designed to be constructed as far as possible of local materials (such as adobe in desert areas and stone in mountainous areas). Multi-storey structures should be designed to be constructed of a simple, economic

reinforced concrete frame with rendered hollow concrete blocks or if more economic, local materials such as stone used for walls and infill panels. The thickness of the walls should however be kept to a minimum in order to reduce costs.

All facilities should if possible be designed to fit within a standard structural module that will enable different types and numbers of facilities to be simply provided at both urban and rural and large and small schools in order to accommodate different student numbers, etc. It should not be necessary to re-design every school but it should be possible to assemble a group of standard facilities in the most cost-effective way.

Separate Facilities for Boys and Girls

Given the reluctance of rural families to send girls to co-educational secondary schools and in order to encourage the enrolment of more girls into secondary education it seems to be important that secondary schools offer separate facilities for boys and girls.

One solution to this problem would be to construct co-educational secondary schools with physically separate facilities such as classrooms for boys and girls who would however share the use (at different times) of specialised facilities such as laboratories, IT rooms and libraries. The administration accommodation would also be shared but the schools would have to have separate and walled recreation areas for girls, separate toilets, etc.

Another solution would be to have double-shifts with the girls utilising the morning shift enabling them to return home in the afternoons in order to carry out any household chores. This option would provide the most efficient use of school facilities although it does mean that some students will have to study in the afternoons when it can be very hot.

Whichever system is used (and a mixture of both will probably be the most efficient in terms of use of facilities) it is important that: general facilities for boys and girls are physically separate; that separate entrances are provided for boys and girls; that adequate numbers of separate toilets (see below) are provided for girls that are located away from the boys' toilets and that adequate protected and walled recreation space is provided for the girls.

A further possibility for encouraging the enrolment of more girls into secondary schools could be the construction of small dormitories for the use of girls from more remote areas who cannot otherwise attend secondary schools. It is proposed that the proposed project could trial the construction of dormitories in a few schools in areas where it is considered that it might work.

Toilets

Functioning toilets must be provided in secondary schools (and this is particularly important in the context of increasing the enrolment of girls) and there would appear to be two options for doing this: 1) the provision of flush toilets (and the supply of water to the school by tanker if there is no piped supply; this would also mean the provision of a budget to the school for paying for the water); or 2) the gradual introduction of dry toilets (such as Ventilated Improved Pit Latrines or Double Chamber Composting Toilets) that have been proved to work in other countries.

If the toilets are introduced gradually and are proved to work (and prove to be culturally acceptable) then they could be used more generally. It should be borne in mind however that these toilets, like any other, require proper management and maintenance and training will have to be given to school staff and students in the use of the toilets if they are to be used successfully.

School Furniture

The sensible choice and use of furniture often enhances a flexible approach by ensuring that little is fixed, allowing teachers to re-arrange their classrooms in order to respond to various projects or simply the need to change the atmosphere of the room.

It is proposed therefore that a more flexible type of furniture is used consisting of loose tables and chairs. In general classrooms the tables would be, because of the limited space available, 1200 wide x 500 deep x 700/750mm high. In large classrooms, etc where more space is required for practical work they would be 1200 wide x 600 deep x 700/750mm high. In the science classrooms they would be similar but 850mm high.

This sort of furniture can be combined and used in a variety of ways, will give teachers much more flexibility in the use of all classrooms and will also give much more flexibility over the life of the buildings.

Services

No services are shown on the drawings reviewed apart from that for the laboratory. It is considered important however to set out some basic recommendations for the provision of services in secondary schools as the facilities provided should have a life span of 30 years or more and the servicing requirements are likely to change greatly over this period of time.

The recommendations are as follows:

- All teaching spaces should have adequate numbers of electrical outlets.
- The use of computers and audio-visual teaching aids is becoming more important especially at secondary level and all teaching spaces should if possible be serviced for the use of these or allow for future servicing.
- If computers are provided then they should be networked either in local area networks within parts of the school or in whole school networks.
- Spaces used for practical subjects should be provided with water supplies and sinks.
- Science classrooms should be provided with electrical, water and gas supplies and fume cupboards if required (they will not be required in physics Laboratories). The services should run along walls where possible to allow for easy access, repair and upgrading and not in the floor where access is more difficult. Some benches such as teacher's benches will however require service ducts run in the floor and these should be made large enough and easily accessible to allow for repairs and maintenance.
- Proper provision should be made in all science classrooms for the safe disposal of chemicals used for experiments.
- The method of distribution of all services should allow the appropriate range of activities to take place conveniently and safely and should allow easy

access for cleaning and maintenance and for changing and upgrading the services over the life of the building.

It should also be noted that it is important to co-ordinate services distribution and furniture and equipment layouts early in the design process.

4: STRATEGIES FOR MAXIMISING THE USE OF SECONDARY SCHOOL FACILITIES

4.1 General

The Republic of Yemen is currently suffering a severe shortage of secondary school places particularly for girls. There is a further problem in that many of the existing secondary schools require minor or major renovations or even replacement and many require the addition of extra facilities.

It is important therefore that the use of all existing schools and any schools that it is proposed to replace, renovate or extend under the proposed World Bank Girls' Education Project is maximised in order to make it possible to include as many schools as possible in the project and to make the best use of limited resources.

In this context, there would appear to be two ways of maximising the use of both existing and any proposed new or renovated schools:

- by rotating the use of all teaching spaces (even of some specialised rooms such as laboratories) that is by using all teaching spaces for teaching any subject and thus fully utilising them
- by using schools for both morning and afternoon shifts i.e. double-shifting them

The use of these options and their effect on the design and provision of secondary school facilities are discussed below.

4.2 Rotation of Teaching Spaces

To make the most effective use of teaching spaces, it should be possible to use them for the teaching of any subject. However, in most of the school designs reviewed (see Annex 1), there seems to be provision of general classrooms for teaching all subjects with the additional provision of spaces such as multipurpose rooms, laboratories, home economics rooms, language rooms, etc. This means that in most cases there is an over-provision of teaching spaces and therefore a waste of resources.

In Section 5, which contains preliminary proposals for revised standards for teaching spaces, it is recommended that multipurpose rooms are provided that can be used for general teaching purposes (i.e. rotated) as well as for specific activities such as for teaching languages or for activities that require more space than that provided in standard classrooms such as practical work, role-playing, drama, etc depending on the timetable.

It is also recommended that laboratories are much more flexible in their layout and furnishing and that they also can be used for general teaching purposes instead of just for practical science lessons. This is particularly important at present as there very few practical lessons and if the laboratories are not used for other purposes then they will stand idle for much of the time which will again be a waste of resources.

The only room that it might not be possible to rotate because of its fixed layout would be the Home Economics Room if constructed as proposed in Section 5. Even this however could be used for lessons in food and nutrition theory for instance.

The rotation of classrooms with the effect of maximising the use of teaching spaces is fairly simple in single-sex schools. However, if the intention is to maximise the use of facilities such as laboratories, libraries and administration facilities and to maximise the use of qualified staff by combining the teaching of boys and girls in rural schools where secondary school age populations are fairly low, then the rotation of classrooms becomes more problematic.

This is because of the necessity of separating facilities for boys and girls in order not to upset the sensibilities of parents and girls and encourage more girls to attend secondary schools.

Boys and girls facilities will have to be physically separated either on the same site or on adjacent sites. It will still be possible to share facilities such as laboratories, libraries (they will be used at different times) and administration rooms and if there are several entry-streams of boys it will be possible to rotate the use of their teaching rooms. However, if there is only one entry-stream of girls (say 30 students) and the school offers both science and arts subjects in Grades 11 and 12 then there will have to be an over-provision of teaching spaces in order to cover all subjects on the curriculum and rotation will be difficult or impossible.

In these cases it will probably be better to consider double-shifting the use of the school (see below).

4.3 Double-Shifts

Double-shifting means the use of a school in both morning and afternoon for either different Grades of the same school or even for two different schools. Sometimes, usually in the first case, the same staff teach both shifts or more usually in the second case, different teaching and administration staff teach and work in the afternoons.

There are a number of problems associated with the use of double-shifts especially in hot tropical countries and these are that in the afternoons it is much hotter than in the mornings and it is therefore more difficult for students (and staff) to work and concentrate. There is also the problem of whether staff who teach both in the mornings and afternoons are paid more than those who only work in the mornings!

It must be recognised however that the use of double-shifts makes much more use of scarce resources and has much to recommend it and with careful design and most importantly location and orientation of the buildings, the worst effects of the hot climate can be mitigated.

As stated above, double-shifting can be achieved in a variety of ways. In the case of a mixed-sex school where girls must be kept physically away from boys, girls could attend school in the mornings and boys in the afternoons. However where there are relatively fewer girls than boys this could be very inefficient in the use of teaching facilities and it might be better to have girls plus Grade 10 boys in the morning (but in separate facilities on the site) and Grades 11 and 12 boys occupying the whole school in the afternoon. Some examples of this are given below. Calculations for numbers of classrooms are based on those in Annex 1: Attachment 1.

5: PROPOSED NEW FACILITIES FOR URBAN & RURAL SECONDARY SCHOOLS

5.1 Facilities to be Provided at New and Renovated Secondary Schools

All new or renovated secondary schools should be provided with sufficient numbers of classrooms, specialist rooms, toilets (flush or dry) and administration rooms to serve the current secondary school age population and space should be provided for future expansion.

Provision should also be made for a reliable electricity and water supply and for all external works including stormdrains, septic tanks, soakaways, paths, entrance roads, walls, gates and landscaping.

All new secondary schools should provide easy access, probably in the form of ramps for disabled students and provide at least one disabled toilet for boys and one for girls.

A variety of facilities are required by all secondary schools but at present there seems to be very little standardisation in either the sizes of the various facilities, such as classrooms, laboratories, etc that are being provided or in the number and variety of the facilities being provided. Some schools for instance have libraries and others do not; some have large multipurpose rooms and other have smaller ones, etc.

It is proposed therefore that the facilities to be provided in all secondary schools are standardised in design, size and number. The number of facilities to be provided should only change because of differing numbers of students.

It is proposed that in order to reduce construction costs and because student numbers in rural areas are much lower than in urban areas, different standards for class sizes are used in rural and urban schools. In rural schools it is proposed that the maximum class size should be 32 students and in urban schools it is proposed that the maximum class size should be 48 students. It is also proposed that the area per student in general classrooms is increased to around 1.4m² per student.

A decision will however have to be made as to whether separate facilities are to be provided for girls and boys, whether schools will operate double-shifts or whether schools will be co-educational as these decisions will have major implications for the provision of facilities at new secondary schools.

It is proposed that the facilities to be provided eventually at all secondary schools will be as follows; the actual number and mix of facilities will depend on the total enrolment of the school, the numbers of boys and girls and whether separate facilities are provided for boys and girls:

- Adequate facilities for the staff of the school in the form of offices, stores, teachers' rooms, etc. The actual number and type will depend on the size of the school.
- General classrooms for 32 students in rural areas and for 48 students in urban areas with an area of approximately 1.4m² per student; the number will depend on the total enrolment of the school. Separate provision could be made for boys and girls.

- Multipurpose rooms (or large classrooms) approximately one quarter to one third larger than general classrooms to be used for practical subjects or for project work. Separate provision could be made for boys and girls.
- In very urban large schools, small classrooms approximately one third smaller than general classrooms to cater for smaller classes in Grades 11 and 12 and for small group work. Separate provision could be made for girls and boys.
- Science laboratories to be used for teaching all science subjects. The laboratories could be used by girls and boys at different times.
- Libraries or library/resource centres depending on the size of the school. Part of the library/resource centre could initially be used for teaching IT. The libraries or library/resource centres could be used by girls and boys at different times.
- IT classrooms; these will only gradually be introduced as funding and servicing allows. The IT classrooms where provided could be used by girls and boys at different times.
- A multipurpose/assembly/performance hall in at least the larger schools.
- Adequate numbers of toilets at a minimum ratio of 1: 40 students (with separate toilets for boys and girls) and a reliable drinking water supply. Where a reliable water supply for toilets is not available then appropriate, properly designed and culturally acceptable dry toilets should be constructed separated from the main buildings.
- Separate recreation areas for boys and girls with sheltered and protected areas for girls.
- Girls' dormitories at selected schools on a pilot basis.

A range of standardised designs for school buildings should be developed that can be used in a variety of locations, that can be put together for new schools of various sizes or that can be used individually or in groups for additions to existing schools. Proposals for standardised designs are given below.

It should be possible to orientate all buildings north/south to reduce sun penetration into rooms and some form of protection from the sun should be provided to all windows. The number of staircases to be provided in multi-storey schools will depend on the height of the buildings, the length of the access verandas and the number of students.

5.2 Performance Criteria for Teaching Spaces

An analysis has been carried out of the performance criteria required for teaching spaces for all subjects and these are set out in Table 10 below.

It should be noted that very few electronic teaching aids such as TVs, computers, etc are used at present but these will probably be introduced during the lifetime of the buildings and where possible, allowance should be made for their future use and for this reason they are included in the fourth column of the table.

	Subject	Teaching Method	Possible teaching aids and equipment
1	Languages: Arabic and English	Students will be taught through listening, speaking, reading and writing the language. Students will participate in class activities singly, in pairs or in groups.	TV, OHP, audio-cassettes, computers, teaching aids
<i>These subjects may in the future require portable audio-cassettes and headphones for each student, access to a TV, computers, projectors and other teaching aids. Teaching can take place in a general classroom with access to a store for equipment and in the IT room when necessary.</i>			
2	Holy Quran, Islamic Studies, Social Studies, Social Science, Economic Principles, Psychology, Philosophy	Taught in whole class groups or small groups	TV, OHP, teaching aids
<i>These subjects may in the future require access to a TV, projectors and other teaching aids but not for all periods. Teaching can take place in a general classroom with access to a store for equipment</i>			
3	Information Technology	Ideally the IT Room should have sufficient computers for every student in a class (ie 40 students) to be able to work individually. It is possible however for two students to share one computer.	Computers, printers, scanners, software, TV, other teaching aids.
<i>IT requires a lot of specialised equipment and an IT Room will be required, preferably air-conditioned. This room however can be used for teaching other subjects such as languages and maths and for students to carry out individual projects. All computers should be networked and connected to the internet and funding should be available to pay for this service.</i>			
4	History	Taught in whole class groups or small groups	TV, OHP, models, maps, teaching aids
<i>This subject may in the future require access to a TV, projectors, etc and can be taught in a general classroom with access to a store for equipment shared with other subjects. Might need access to a large classroom for role play or other activities</i>			
5	Geography	Taught in whole class groups or small groups	TV, OHP, models, maps, other reference material, teaching aids
<i>This subject may in the future require access to a TV, projectors, etc and can be taught in a general classroom with access to a store for specialized equipment. Might need access to a large classroom for practical work on maps, models, etc. Might also require access to IT Room.</i>			
6	Maths, Statistics	Taught in whole class groups or small groups	TV, OHP, computers, maths models, other reference material, teaching aids
<i>These subjects may in the future require access to a TV, computers, projectors, etc and can be taught in a general classroom with access to a store for equipment. Might need access to a large classroom for modelling work. Will require access to the IT Room for some lessons.</i>			
7	Physics	Taught as theory or by demonstration by teacher or through experimental enquiry by students either singly or in small groups.	TV, OHP, computers, physics equipment, laboratory apparatus, models, etc, teaching aids.
<i>Teaching of theory at present takes place in general classrooms and very little practical work is carried out by either teachers or students and therefore little use is made of laboratories. This will undoubtedly change in future and lessons involving theory and teacher demonstrations or theory and student experiments will then have to be carried out in a laboratory. Laboratories will be used for experiments, lectures, note-taking etc and must be flexible in arrangement.</i>			

8	Chemistry	Taught as theory or by demonstration by teacher or through experimental enquiry by students either singly or in small groups.	TV, OHP, computers, fume cupboards, chemistry equipment and chemicals, laboratory apparatus, models, etc, teaching aids.
<i>Teaching of theory at present takes place in general classrooms and very little practical work is carried out by either teachers or students and therefore little use is made of laboratories. This will undoubtedly change in future and lessons involving theory and teacher demonstrations or theory and student experiments will then have to be carried out in a laboratory. Laboratories will be used for experiments, lectures, note-taking etc and must be flexible in arrangement. This laboratory will require at least one fume cupboard for demonstrations and experiments. It could be shared with biology (see below) if there are insufficient chemistry and biology periods to justify the provision of two laboratories.</i>			
9	Biology	Taught as theory or by demonstration by teacher or through experimental enquiry by students either singly or in small groups.	TV, OHP, computers, biology equipment and chemicals, laboratory apparatus, models, etc, teaching aids.
<i>Teaching of theory at present takes place in general classrooms and very little practical work is carried out by either teachers or students and therefore little use is made of laboratories. This will undoubtedly change in future and lessons involving theory and teacher demonstrations or theory and student experiments will then have to be carried out in a laboratory. Laboratories will be used for experiments, lectures, note-taking etc and must be flexible in arrangement. This laboratory could be shared with chemistry (and even physics in small schools) if there are insufficient chemistry, biology and physics periods to justify the provision of two or three laboratories.</i>			

Table 10: Performance criteria for classrooms and subject rooms

5.3 Proposed New Teaching Facilities

The following proposals for teaching facilities for both urban and rural secondary schools are based upon the performance criteria described above.

The existing curriculum and teaching methods and possible new teaching methods have also been taken into account together with standards for similar facilities in other countries.

One of the main objectives in preparing these proposals has been to reduce the cost of construction or renovation by maximizing the use of all facilities, by restricting the number of specialized facilities and by maximizing the flexibility in use of all facilities.

A class size of 32 students has been taken as standard for the rural areas and a class size of 48 students has been taken as standard for the urban areas in order to reduce construction costs and the cost of providing teachers (smaller classes will require more classrooms and teachers) and all of the room sizes indicated below relate to these figures. This does mean however that secondary schools in the rural areas should have sufficient graduates from grade 9 in their catchment area to provide two intake groups of 30 students in order that the full science and arts curricula can be taught. If separate facilities are to be provided for girls, then a similar number of female graduates from grade 9 are required if the full science and arts curricula are to be taught to them. If there are only sufficient female graduates from grade 9 for one entry group, then only half of the curricula can be taught economically.

All of the new facilities to be provided by the proposed project should have a useful life of at least 30 years and during this time both the teaching methods and the curricula will undoubtedly change as will the servicing requirements of the buildings.

As new curricula are introduced very different kinds of teaching methods than those in use at present will probably be required that are more student-centred and activity-based.

The proposals for the new facilities outlined below take all of these factors into account as much as possible and allow for both short-term flexibility in the use of the new facilities and long-term adaptability to allow for future changes.

See Annex 3: Proposals for New Standard Secondary School Facilities for sketch drawings of the proposed facilities. The drawing numbers given below relate to the drawings in this Annex.

The proposed structural module consists of structural bays 3.3 metres wide centre to centre and 7.2 metres deep centre to centre which will give a clear internal width of 7.0 metres. This is the minimum width required to accommodate four 1200mm wide double desks with an 800mm wide centre aisle and two 700mm wide side aisles in a general classroom (see furniture below). This width of aisle will give reasonably easy access to desks for students and provide for escape in case of fire. See drawing YN/01.

This module would be economic to construct and the bay width of 3.3 metres will accommodate a variety of sizes of facility (for both urban and rural schools) such as offices and storage spaces (one bay), small classrooms and teachers' rooms (two bays), larger classrooms (three bays), multipurpose rooms (three or four bays) and IT rooms and laboratories (three or four bays).

The proposals outlined below are for new facilities; the renovation of existing facilities is covered in the section that follows.

Subject Rooms

There are two possible ways of providing subject rooms. One is to provide separate, fully equipped rooms for each subject and the other is to provide separate rooms only for those subjects that require specialized fittings and fixtures such as laboratories and IT rooms. The other subjects should share general classrooms and also share equipment.

The initial cost of providing separate fully equipped subject rooms for all subjects would obviously be very high and this solution would also be very inflexible. Any change in the curriculum or in the timetable would probably require changes to the facilities.

It is proposed therefore that specific subject rooms will be provided only for those subjects requiring specialised fittings and fixtures and these are the science laboratories and the information technology room if provided.

All other subjects will be taught in general classrooms and any specialized equipment that is required for these subjects will be kept in cupboards or stores attached to the classrooms. General classrooms can of course be mainly used for one subject but they should also be available for use for other subjects as required by the time-tabling in order to reduce the total amount of teaching spaces required.

General Classrooms

Rural Schools

Class size: It is proposed that the maximum class size for rural schools should be 32 students seated at 16 double-desks per classroom.

Classroom size: It is proposed that the size of the general classroom for rural schools should be standardized at 7.0 x 6.4 metres net giving a total area of 44.8m² and an area per student of 1.4m². See drawing YN/02

Urban Schools

Class size: It is proposed that the maximum class size for urban schools should be 48 students seated at 24 double-desks per classroom.

Classroom size: It is proposed that the size of the general classroom for urban schools should be standardized at 7.0 x 9.7 metres net giving a total area of 67.9m² and an area per student of 1.41m². See drawing YN/05.

Classroom furniture: It is proposed that the new classroom furniture should consist of double-desks and separate loose chairs. This will give flexibility both in the layout and the use of the classrooms.

The desks should be 1200 x 500mm and they can then be arranged in four rows desks with three aisles to accommodate 32 or 48 students for traditional teaching; or in groups of four desks for group work; or in a horse-shoe layout for class discussions. See drawings YN/02, 03, 04 for rural schools and YN/05, 06 and 07 for urban schools.

Services: The classrooms should be well lit and ventilated from both sides and should have adequate numbers of electrical sockets.

Fittings and fixtures: classrooms should be fitted with chalk-boards at one end for teaching purposes and pin-boards at the other end for display purposes. They should have the possibility of having blinds or curtains fitted in the future so that they can be blacked out if a TV or a projector is used.

Note: The number of general classrooms to be provided at any particular school will depend upon the number of students, the numbers of boys and girls, whether separate provision is made for boys and girls, the number of entry streams and on the time-tabling of lessons.

Multipurpose Rooms

It is proposed to provide some standard multipurpose rooms that will replace the variety of sizes of multipurpose rooms that are currently being provided.

In rural schools these multipurpose rooms will be 7.0 x 9.7 metres net (67.9m² or 2.1m²/student) and will accommodate 32 students at larger tables (1200 x 600mm). See drawing YN/08.

In urban schools these multipurpose rooms will be 7.0 x 13.0 metres net (91.0m² or 1.89m²/student) and will accommodate 48 students at larger tables (1200 x 600mm). See drawing YN/09.

These multipurpose rooms will accommodate the variety of furniture arrangements that will be required for class discussions, group and practical work as well as for traditional teaching. They can be used for practical or project work associated with subjects such as geography, history, mathematics, home economics, etc and for role-play in the teaching of languages or for language teaching using portable tape-recorders. They can also be used for group teaching where different groups are carrying out different tasks at the same time.

See drawings YN/08 and YN/11 (traditional classroom layout with activity space at front of classroom); YN/09 and YN/12 (classroom arranged for practical work) and YN/10 and YN/13 (classroom arranged for language teaching with one group reading, one group having discussions and one group listening to audio tapes in small groups).

The multipurpose rooms should have space for permanent displays on a fixed bench along one wall and the bench should have a sink with a water supply for use in some practical subjects. It should have plenty of display space on the walls and it should be possible to attach up to 4 stores to the room for the storage of specialist equipment.

The number of multipurpose rooms to be provided at any particular school will depend upon the total number of students, the numbers of girls and boys, whether separate classrooms are provided for girls and boys and the time-tabling of lessons but in other countries they are usually provided in the ratio of 1 multipurpose room to 4/5 standard classrooms.

Science Facilities

Science can be taught in two types of facility: science theory can be taught in a general classroom but any sort of practical demonstration by the teacher (even if accompanied by a lecture) or experiments by the students will have to take place in a laboratory.

At present very little practical work is carried out either by the teacher or the students and therefore little use is made of laboratories (see Table 11 below) and the provision of laboratories is low. However as more advanced teaching methods are introduced more use will be made of laboratories by both teachers and students and more laboratories will probably be required. Space should be available therefore on school sites for the construction of more laboratories in the future.

Grade	Subject	Periods in Laboratory per Year
Grade 10	Biology	5
	Chemistry	10
	Physics	10
Grade 11 (Science)	Biology	5
	Chemistry	15
	Physics	10
Grade 12 (Science)	Biology	5
	Chemistry	15
	Physics	15

Table 11: Periods spent in laboratories per year

The main criteria for laboratories are that they should be flexible in use, allow for students' practical work and experiments as well as demonstrations by the teacher, allow for briefing and lectures by the teacher and note-taking by the students and provide all the necessary services.

They should provide plenty of worktop space (at least 0.3m²/student) for students and a demonstration bench for the teacher.

It is proposed that natural gas and bunsen burners are used for heating where necessary for experiments. As very few experiments are carried out either by teachers or students at present it is doubtful whether a piped supply is required at present. However as students start to carry out more experiments both the chemistry and biology laboratories will then probably require a piped natural gas supply (and also a secure storage area for gas bottles) and it should be possible to provide these in the future.

Services should be provided in a way that allows for repair and maintenance and flexibility and change over time (such as the future provision of piped gas). The provision of services to laboratories is very expensive and they should therefore be provided in the simplest and most cost-effective way possible. Services (electricity, water and gas as necessary) to all science classrooms should therefore be provided along the window walls under benches where they will be easily accessible for repairs and upgrading. Services should not be provided in or under the floor unless absolutely necessary as this is expensive and access for repairs or upgrading is difficult.

Fixed benches with cupboards under should be provided to all laboratories along both window walls for use for practical work, long term experiments, computers or display purposes.

Bench and table tops to all laboratories should be made of a material resistant to water penetration, chemical attack, heat and impact. Glazed tiled surfaces as at present used are not suitable as they crack and break up.

Stools with wooden seats (shaped for comfort if possible) should be provided for sitting at the benches and tables.

All science classrooms should have a serviced teacher's demonstration bench at one end with sufficient space for up to half a class of students to gather round and watch the demonstration (it is not possible for a whole class to watch a demonstration).

A chalkboard should be provided on the wall behind the demonstration bench and pinboards on other available wall space. There should be space for a TV or a projector and all windows should have the possibility of having curtains or blinds so that they can be blacked out when these are being used.

In all science classrooms, loose student tables are grouped next to fixed service points that provide electricity, water and gas as necessary to groups of up to seven students allowing them to carry out their own experiments either individually or in pairs.

All of the tables can be re-arranged in a variety of ways to allow all students to sit, look at the teacher and the chalkboard and take notes during briefing and lectures without having their backs to the teacher. See drawing YN/16.

All laboratories should be equipped with a first-aid kit and all teachers and students should wear protective goggles when any experiments are being carried out. All laboratories should also be equipped with the appropriate fire-extinguishers for chemical or electrical fires.

It is proposed that all science laboratories, whether in rural or urban schools, will be the same size and will accommodate up to 32 students. Three types of science laboratories are proposed: one for teaching physics, one for teaching chemistry and one for teaching biology. In many smaller schools only one or two multipurpose laboratories will be required and these should be fully serviced and fitted with fume cupboards so that chemistry and biology can be taught in them (see below).

It is proposed that the standard science laboratory will be three structural bays long giving a size of 7.0 x 9.7 metres (67.9m² or 2.1m²/student). All laboratories should have an attached preparation and store room 7.0 x 3.1 metres wide (21.7m²). In small schools where only one laboratory is provided for the teaching of all three science subjects, the laboratory should be provided with two preparation rooms (one at each end) for the storage of equipment.

A proposal is also made for a demonstration laboratory for 48 students for use in large urban secondary schools where it is not possible (due to limited funds or the limited number of science teachers) to provide for the teaching of half classes.

This laboratory will be for demonstration purposes only as it will not be possible for a teacher to supervise student experiments carried out by this number of students. The laboratory will be three structural bays long giving a size of 7.0 x 9.7 metres (67.9m² or 1.4m²/student) and have an attached preparation and store room 7.0 x 3.1 metres wide (21.7m²).

The total number of science laboratories to be provided at any particular school will depend on the total number of students, the number of science periods taught and on the time-tabling of lessons.

Chemistry Laboratory: The chemistry laboratory will have the standard layout as described above with sinks and water supplies along the side benches for use of the students and in the demonstration bench for the use of the teacher (there is sufficient space for half the class to gather round and watch demonstrations: see drawing YN/15). There could be gas supplies to the side benches and the demonstration bench. See drawing YN/14.

There will also be a fixed fume cupboard in the chemistry laboratory against the rear wall and accessed from an adjacent prep room/store for the use of the teacher in giving demonstrations to students (there is sufficient space for half the class to gather round and watch demonstrations: see drawing YN/15) and for the use of one or two students in carrying out their own experiments.

The fume cupboard must be glazed on the front and sides to allow maximum visibility for students; should have a fixed ducted extract system with a centrifugal fan to remove gases and fumes and the ducts must be taken up at least one metre above the roof line. The fume cupboard should have a water supply, the possibility of a gas supply, a drip cup for waste and a double switched socket outlet. The worktop should be the same material as the benches.

Biology Laboratory: The biology laboratory will have the same layout and services as described for the chemistry laboratory above but without the fume cupboard. See drawing YN/16.

Physics Laboratory: The physics laboratory will have the standard layout as described above but there will be only one sink with a water supply in the side bench adjacent to the teacher's demonstration bench. The only service provided to the side benches and the demonstration bench will be electricity. See drawing YM/17. Drawing YM/18 shows the Physics Laboratory with furniture arranged for lectures and note-taking. This layout will be similar for this purpose in the other laboratories.

Demonstration Laboratory: The demonstration laboratory will have a demonstration bench and a fume cupboard but no side benches to allow space for the provision of loose benches for 48 students. See drawing YM/19.

Preparation Rooms: a number of preparation rooms may be provided each serving one or two laboratories.

Each preparation room should be divided into five zones of activity: 1) a main storage area; 2) a preparation, dispensing and cleaning area; 3) a clean work area and 4) a chemical store.

The main storage area is for the storage of materials and equipment. The preparation, dispensing and cleaning area is the main work area and is used for preparing practical experiments, cleaning and sorting glassware and equipment, dispensing chemicals, etc. The clean work area is used for administrative tasks and will include a computer, filing cabinets, etc. The chemical store must be well ventilated, fire-resistant and secure and shelving should be made of a non-corrosive material. If large quantities of chemicals are kept by the school there should be a separate store in the school grounds.

All sinks in laboratories should be provided with diluting chambers to dilute chemicals before they enter the drainage system. Chemical waste from laboratory sinks should be disposed of safely and separately from the main school drainage.

An eye-wash sink with a shower attachment should be provided if possible in the preparation room for use in case of accidents.

An outside project area for students adjacent to the biology classroom should be provided if at all possible.

Home Economics and Sewing Rooms

Home economics and sewing are not at present time-tabled activities. However these rooms are being provided at some schools and could offer an incentive for more girls to attend secondary schools.

Home economics should be taught in a specially equipped home economics room which will require facilities for half a class (16 students in rural schools and 24 students in urban schools) as it will be difficult to teach a full class.

In rural schools the room should be the same size as the proposed large general classroom, 7.0 x 9.7 metres (67.9m² or 4.2m²/student) and will require an attached store 3.45 x 3.1 metres (10.7m²) for equipment. See drawing YN/20.

In urban schools the room should be the same size as the proposed large general classroom, 7.0 x 13.0 metres (91.0m² or 3.8m²/student) and will require an attached store 3.45 x 3.1 metres (10.7m²) for equipment. See drawing YN/21.

The rooms should provide facilities for food preparation and food and nutrition lessons. Fixed worktops with durable and easily cleaned surfaces should be provided along both window walls with 4No sinks in the rural home economics room and 6No sinks in the urban home economics room. Both sizes of room should provide space for a demonstration cooker with benches to either side at one end of the room. A refrigerator should also be provided probably in the store.

Sewing could be taught in one of the multipurpose rooms (7.0 x 9.7 metres in the rural schools and 7.0 x 13 metres in the urban schools) but again it would be difficult to teach more than half a class in either case. An attached store would be required for equipment and materials 3.45 x 3.1 metres (10.7m²). One sewing machine and table should be provided for every four students together with tables for laying out materials, using patterns, etc. A curtained off fitting space should be provided (or the store could be used).

Information Technology Facilities

Information technology (IT) is again not yet a time-tabled activity but will probably become so in the not very distant future. In the meantime the facilities to be provided could support the teaching of other subjects such as languages, mathematics, etc and be available for project use by students.

It is proposed therefore to provide classrooms with computer equipment for teaching IT to up to 16 students in rural schools and up to 32 students in urban schools. These facilities could also be used for teaching languages, maths, etc.

In rural schools the room should be the same size as the general classroom (7.0 x 6.4 metres; 44.8m² or 2.8m²/student) and should have a teacher's desk, space for a printer, scanner, etc and workstations for individual students around the walls and down the centre. See drawing YN/22.

In urban schools the room should be the same size as the general classroom (7.0 x 9.7 metres; 67.9m² or 2.1m²/student) and should have a teacher's desk, space for a printer, scanner, etc and workstations for individual students around the walls and down the centre. See drawing YN/23.

Plenty of space should be allowed in these rooms as they can get very hot when all the machines are in use. The rooms should be air-conditioned if possible.

All computers should be networked and if possible have access to the internet. All computers should be linked to a central printer and scanner and also to a computer used by the teacher.

Large numbers of electrical outlets will be required and all services and equipment should be easily accessible and upgradeable. Large conduits along the walls and in the floor to the central workstations should allow easy access for changing and upgrading cables and connections.

An office and store should be provided adjacent to the classroom for the IT teacher and/or technician and for equipment (3.45 x 3.1 metres; 10.7m²).

It is proposed that in large urban schools, a separate IT resource room could be provided as part of the proposed Library/Resource Centre and this room could be used for small IT classes as well as a general IT resource room for the school (see Library/Resource Centre below).

Language Facilities

Although it is not proposed to provide specific separate facilities for language teaching, a description of the way the facilities that will be provided could be used now or in the future will be useful.

A variety of teaching methods can be used for language teaching and students can learn from listening, speaking and watching as well as from reading, writing and role-play. They would be taught predominantly in the target language and could learn through a range of activities including:

- Teachers' presentations
- Pupils' presentations
- Role play or drama
- Discussions
- Reading and writing
- Using audio equipment
- Using video equipment
- Using computers

Facilities should therefore be provided for whole class teaching, small study groups, individual study and for the use of audio, video and IT equipment.

Specialist language laboratories have been a feature of many European schools since the 1970s with fixed tables and inset audio-recorders linked to a central teacher's console. It is now generally agreed however that there is insufficient need for such a laboratory which, with its rows of fixed tables with screens between is very expensive to provide and impossible to use for other activities. These facilities are therefore now considered to be outmoded and more flexible kinds of facilities are favoured.

It is proposed therefore that most language teaching should take place in one of the multipurpose rooms with loose work tables (1200 x 600mm) that will provide adequate space for equipment and text books and that can be arranged in different formats.

In rural schools these rooms will be 7.0 x 9.7 metres (67.9m²; 2.1m²/student). See drawing YN/10. In urban schools these rooms will be 7.0 x 13.0 metres (91.0m²; 1.89m²/student). See drawing YN/13.

The multipurpose room should be provided with, or have the potential to be provided with a chalkboard, an OHP and screen, a large-screen TV and a store for equipment such as tape-recorders, etc.

This space can then be used for traditional teaching, class discussions, role-play or drama, watching videos, group work and work using audio-equipment.

It should be noted here that for work that requires listening to audio-tapes, the equipment that is usually provided in Europe is a portable, battery powered cassette-

player that can service up to six students. This kind of equipment does not require fixed benches or electrical installations.

The room should have a fixed bench along one wall that can be used for display or work purposes and should also have plenty of pinboards for display purposes.

The room should also have adequate numbers of electrical outlets for all the different types of equipment that might be used.

Activities that require the use of computers (such as interactive activities using material recorded on CD-ROMs, etc) can take place in the IT Room described above or in half class groups in the IT resource room that is proposed as part of the Library/Resource Centre (see below) in larger schools.

Libraries and Library/Resource Centres

The school library should be a resource centre which is the main information base for the school. Independent study and research will become more important over the coming years and the library should be able to accommodate these activities.

In smaller rural secondary schools it will not be possible to provide much more than a traditional library but this should still provide space for a range of activities such as reading and group study and space for:

- Storage and display of fiction and non-fiction books and film and audio materials
- Informal seating, reading and study areas for individuals and small groups
- A reference section including newspapers and periodicals and resources such as charts, maps and photographs
- A control desk

A proposal for a small library for rural schools providing space for up to 44 students is shown on drawing YN/24. The library is 7.0 x 9.7 metres (67.9m²; 1.5m²/student and has an attached office/control and store 7 x 3.1 metres (21.7m²).

A proposal for a larger library for urban schools providing space for up to 60 students is shown on drawing YN/25. The library is 7.0 x 13.0 metres (91.0m²; 1.5m²/student and has an attached office/control and store 7 x 3.1 metres (21.7m²).

In large, urban secondary schools, the library should become a library/resource centre and it should accommodate a wide range of activities including reading, IT and group study.

The library/resource centre should allow space for:

- Storage and display of fiction and non-fiction books, film and audio materials
- Whole class work
- Informal seating, reading and study areas for individuals and groups
- A reference section including newspapers and periodicals and resources such as charts, maps and photographs
- IT work stations for student research
- Artefacts including models and specimens
- A display and exhibition area
- A control desk

The size of the proposed library/resource centre will vary with the size of the school but they should all be divided into two areas: an IT room and a main reading/book stack/study area with an attached office/store. The reading area can be used by both students and teachers or teachers can take books to their work areas in the proposed teachers' centres.

The IT room should have space for an appropriate number of computer work stations (depending on the size of the school) around the wall and in the centre of the room. These computers should be networked, have access to the internet and be linked to a central printer and scanner and a computer in the adjacent office/store. The IT room will be supervised and controlled from the office/store.

The main library area should have a control desk at the entrance, a display area, reading/study areas, a book stack area and a small reference area for magazines, newspapers, etc.

5.4 Proposed and Existing Standards for Secondary Schools

The size of the proposed facilities as compared with existing standards for secondary schools is shown in Table 12 below.

	Facilities	Existing	Proposed
1	General classroom (rural)	39m ² / 30 stdts/1.3 m ²	44.8m ² /32 stdts/1.4m ²
2	General classroom (urban)	52m ² /40 stdts/1.3m ²	67.9m ² /48 stdts/1.4m ²
3	Large general classroom/multipurpose room (rural)	49-132.26m ²	67.9m ²
4	Large general classroom/multipurpose room (urban)	49-132.26m ²	91m ²
5	Laboratory for Physics, Chemistry, Biology	74.37m ²	67.9m ²
6	Preparation rooms for Physics, Chemistry, Biology Laboratories	17.85m ²	21.7m ²
7	Language classroom (rural)	-	67.9m ²
	Language classroom (urban)	-	91m ²
8	IT classroom (rural)	62.4-70.7m ²	44.8m ²
9	IT classroom (urban)	62.4-70.7m ²	67.9m ²
10	Libraries (rural)	64.74-72.4m ²	67.9m ²
11	Libraries (urban)	64.74-72.4m ²	91m ²

Table 12: Summary of Proposed Facilities for Rural and Urban Secondary Schools as Compared with Current Standards

5.5 Upgrading of Existing Secondary Schools

General

Many or most of the schools to be included in the project will be existing schools with facilities that require renovation.

These existing schools will also undoubtedly require additional facilities especially those such as laboratories, IT rooms and libraries that require specialized services, fittings and fixtures.

Some schools may require additional general classrooms and they will also probably require some of the large general classrooms.

Where schools require additional new facilities the proposals outlined above should be followed as long as there is space on the school sites for the new facilities.

Where existing school facilities are in such bad condition that they cannot be renovated at a reasonable cost (i.e. renovation will cost more than 50% of the cost of constructing new facilities) then they should be demolished and a new school constructed following the guidelines outlined above.

Where schools have existing facilities that can be renovated (i.e. renovation will cost less than 50% of the cost of constructing new facilities) then the following guidelines should be followed.

General Classrooms

Most schools will probably have some general classrooms that require renovation. If they are less than 5% smaller than the size of the proposed new classrooms and are in reasonable condition they should be renovated with new doors and windows, new floors and ceilings, new electrical installations and new pinboards and chalkboards as required.

The renovated classrooms should be provided with 20 double desks and 40 chairs similar to those for new classrooms.

If existing classrooms are in reasonable condition but are more than 5% smaller than the size of the proposed new classrooms, renovation can be considered but class sizes will have to be smaller and this will affect the total number of teachers required.

All renovated classrooms should have the potential for the fitting of blinds or curtains at the windows for blacking out the classroom.

Science Facilities

Some schools might have existing facilities that could be renovated as laboratories. This should only be considered however where the existing facilities are similar in size to the proposed new laboratories as the size of these facilities is critical.

The servicing of laboratories is also critical and therefore renovation of existing facilities should only be considered where the introduction of new services is relatively easy.

If both these criteria can be met, the laboratories should be renovated to similar standards as the new ones described above with similar services, fitted furniture and equipment.

Information Technology Facilities

Some schools might have existing facilities that could be renovated as IT Rooms. This should only be considered however where the existing facilities are similar in size to the proposed new IT Rooms as the size is critical.

The servicing of the IT Rooms is also critical and therefore renovation of existing facilities should only be considered where the introduction of new electrical and data transfer services is relatively easy.

If both these criteria can be met, the IT Rooms should be renovated to similar standards as the new facility described above with similar services, fitted furniture and equipment.

Libraries and Library/Resource Centres

Some schools might have existing facilities that could be renovated as a Library or Library/Resource Centre. The total size will depend upon the number of students in the school.

The servicing of the IT Room (for Library/Resource Centres) if provided is however critical and therefore renovation of existing facilities should only be considered where the introduction of new electrical and data transfer services is relatively easy.

If these criteria can be met, the Library or Library/Resource Centre should be renovated to similar standards as the new facility described above with similar services, fitted furniture and equipment.

6: IMPLEMENTATION OF SCHOOL CONSTRUCTION PROGRAMMES & OF THE CONSTRUCTION COMPONENT OF THE PROPOSED WORLD BANK GIRLS' EDUCATION PROJECT

6.1 Introduction

Before any schools are selected to be included in any secondary school construction or renovation programme or project, a process has to be undergone that consists of a number of steps:

- The existing situation in all secondary schools must be established in terms of their location, their current and projected enrolment, the existing facilities at each school and their condition, the site conditions, etc
- Criteria will then have to be developed on the basis of which schools to be included in any school construction or renovation programme or project can be selected

Once a short-list of schools that would qualify for inclusion in the programme or project has been established, a preliminary cost estimate can be prepared for the replacement, renovation and extension of each school on the short-list. It will then be possible to establish the number of schools that can be renovated, replaced and/or extended within the budget for the proposed programme or project and a preliminary list of schools to be included can be prepared.

Having established a preliminary list of schools to be included in the programme or project, detailed proposals including cost estimates can be prepared for each school and a final list of schools can then be established.

6.2 Establishing the Existing Situation

The current enrolment, number and condition of existing facilities and requirements for new facilities must be established for all secondary schools.

Existing Schools

The School Mapping Directorate should prepare a schedule of all secondary schools in the country giving the following basic information:

Location:

- Location of school: Governorate and district
- Whether in urban/rural/remote area
- Whether in district centre
- Whether there is road access to the school
- Transport services in the catchment area of the school

Enrolment

- Current enrolment at the school with breakdown of the current numbers of boys and girls
- Current numbers of grades and science and arts streams; are there separate streams for girls
- Current secondary school age population including numbers of boys and girls in the school's catchment area

- Secondary school age projections for the next 10 years for boys and girls in the school's catchment area

Existing facilities at the school

- Number of facilities existing at the school: classrooms, laboratories, libraries and other specialised facilities and number of non-teaching facilities such as principal's office, secretary's office, teachers' rooms, toilets
- What other facilities does the school require to serve the current school population: classrooms, library, laboratories, IT rooms, etc
- Whether the school has separate facilities for girls and if so what these facilities are

Condition

- Whether school buildings are temporary or permanent
- Construction type of the buildings: structure, walls, floors and roof
- Number of stories
- Condition of school buildings: do any require major renovations, repairs or replacement

Services

- Whether the school has electricity, drinking water and water for toilets
- Whether the school has toilets; if so what type are they; are they functioning; are there adequate numbers for boys, girls and staff; are there physically separate toilets for girls

Site

- Is the school located close to a market or other busy location likely to affect the enrolment of girls
- Is the site fenced
- Does the site slope or is it flat
- Are there any recreation areas; if so are there separate ones for boys and girls
- Is there room for extending the school to serve the current school population if extra facilities are required
- Is there room for future expansion of the school to cope with school population increases
- Is there room to construct separate facilities for girls away from those for boys; if not, is there a nearby site that could be used for girls facilities and that has space for expansion in the future.

Most of this information seems to be available from the existing school mapping data apart from current and future projections for school age populations in the schools' catchment areas. All information should however be checked before any major investment is planned.

Possible New Schools

The School Mapping Directorate should also prepare a schedule of locations in the country where new secondary schools, especially ones that could cater for an intake of female students, are required.

The Directorate should, using current estimates of secondary school age children, establish which districts if any have sufficient numbers of secondary school age children, particularly girls, to justify the construction of new secondary schools if none exists or the extension of existing schools.

6.3 Criteria for Selecting Schools for Inclusion in the Proposed Project

The main aim of the proposed project is to increase the enrolment of girls into secondary schools particularly in the rural areas.

The project will focus on existing schools that require renovation and/or extension but new schools could possibly be constructed to replace existing schools that are in very bad condition.

A number of criteria to be used in selecting schools have been agreed with government and these criteria are to be used in a number of steps.

Pre-selection of Districts

The criteria for pre-selecting districts will be as follows:

- Current gross enrolment of girls in secondary schools in the district should not exceed 30%
- Current gross enrolment of boys and girls in basic schools in the district should not be below 50%
- The population of boys and girls age 15 to 17 in a district should not be below 2,000

Selection of Governorates and Districts

The criteria for selecting governorates and districts will be as follows:

- Five or six governorates should be selected that each have a minimum of five districts that meet the pre-selection criteria
- Preference should be given to those governorates that already have BEDP operating in them
- There should be a minimum of three secondary schools in the selected districts that have grades 10 to 12 and that are operating the full science and arts curriculum

Pre-selection of Schools

The criteria for pre-selecting schools will be as follows:

- There should be at least 100 girls in 9th grade in basic schools within the catchment area of the selected secondary schools in rural areas and at least 140 girls in 9th grade in basic schools within the catchment area of the selected secondary schools in urban areas
- There should be a minimum of 180 students in the selected secondary schools in rural areas and a minimum of 240 students in the selected secondary schools in urban areas

Identification of Schools

The civil works criteria for selecting schools will be as follows:

- First priority will be given to those schools with the highest student/classroom ratios i.e. those that are the most over-crowded
- Second priority will be given to those schools that do not have specialised teaching spaces such as laboratories, multipurpose rooms, IT rooms and libraries
- Third priority will be given to those schools that do not have separate facilities for girls such as toilets, specialised teaching spaces, recreation spaces, etc
- Fourth priority will be given to those schools that do not have other facilities such as administration offices, toilets, fences, recreation areas
- Fifth priority will be given to schools that are in very poor condition and require major renovations or replacement

40 to 50 secondary schools in around 25 to 30 districts in five or six governorates should be identified using the above criteria and, subject to costs and the budget available, a number of these schools will be renovated, extended or replaced.

Selection of Schools for the Project

When a short list of possible schools has been prepared a further set of criteria should be used to select the schools to be included in the project. These should include the following:

Governorate and District

- The Governorate or District should have good track record of implementing projects

Site

- The site must offer the potential for extension i.e. the land should not slope too steeply and there should be sufficient space to allow for expansion of the school over the next 5/10 years
- There must be space for the provision of separate facilities for girls (and room for future expansion of these facilities) either on the site or on a nearby site (within a short walking distance)
- There should be space for separate recreation areas for boys and girls and it should be possible to enclose the girls' recreation area

Services

- Schools must have a reliable source of drinking water and a reliable electricity supply

6.4 Selecting the Schools to be Included in the Proposed Project

When the School Mapping Directorate has produced a short-list of schools that meet the above criteria and could be included in the proposed project, the Project Design Directorate should carry out preliminary surveys of these schools and prepare cost estimates for each school on the short-list for:

- the renovation or replacement of existing facilities
- the addition of new facilities to bring the school up to the required standards and to provide additional separate facilities for girls

In order to reduce the number of facilities to be constructed at individual schools and thus reduce construction and running costs, the use of double-shifts should be considered i.e. one shift in the morning and one shift in the afternoon.

Separate facilities for girls could be provided in a number of ways: additional general classrooms could be provided for girls separate to the boys' classrooms with boys and girls using specialised facilities such as laboratories at different times; or a form of double-shifting could be used with girls (and possibly some boys) using the school in the morning and boys (or the remaining boys' classes) using the school in the afternoon. If the girls and one class of boys used the school in the morning there would still however have to be separate classrooms for boys and girls though the numbers would not be as large as if there were complete separation of boys and girls in morning and afternoons.

Consideration should also be given, in those schools in those districts where it is thought to be workable, for the construction of small girls' dormitories to cater for girls living in remote areas who could not otherwise attend secondary schools and cost estimates for these dormitories should be prepared.

When these preliminary cost estimates have been prepared, it will be possible to establish the number of schools that can be renovated, replaced and extended within the proposed budget for the project and a final list of schools to be included in the project can be prepared.

6.5 Preparation for the Construction Component of the Project

Having established a final list of schools to be included in the project, detailed proposals will have to be prepared for each school.

Each school will have to be surveyed and detailed drawings will have to be prepared showing:

- the area of the site, site levels, existing buildings (including any that will have to be demolished), any existing roads, paths and walls, existing storm drains, existing services and any areas to be used for extension and future expansion
- plans, elevations and sections of any existing buildings that can be renovated
- A schedule of work for renovating existing buildings
- details of any new buildings (classrooms, laboratories, IT rooms, etc) required to bring the school up to the required standard and provide the necessary separate accommodation for girls (bearing in mind the comments on double-shifting above)

Detailed costings can then be prepared for each school and a final cost for the civil works at the schools to be included in the project can be established.

As the construction component of the project will take place over a period of four years (the fifth year should be reserved for the defects liability period for the last schools to be constructed, final payments, final reports, etc) the cost estimates must

include factors to cover inflation in construction costs over four years and to cover unforeseen contingencies.

A construction programme will then have to be prepared by the Project Design Directorate showing the schools to be constructed in the first, second, third and fourth years of the project. No new construction should start in the fifth year of the project.

7. MAINTENANCE OF SCHOOLS & SCHOOL FACILITIES

7.1 Introduction

At present funding for school maintenance should be provided by the local authorities in the governorates. In practice few if any schools receive any funding for maintenance from their local authority.

The only funding for school maintenance being provided at present is being provided through projects: the BEDP project is providing funds for maintenance of basic schools and JICA is also providing some funds for maintenance of basic schools through a project that it is funding.

BEDP is providing 60% of funding for maintenance in 2,000 schools in five governorates and the government is funding the remaining 40%. Schools are receiving a one-off payment of between US\$500 and US\$1,000 depending on the number of students at the school.

Under this project, head teachers, teachers and heads of Fathers' Committees in the project schools have received training in maintenance and BEDP has funded the preparation and printing of maintenance handbooks for the use of the schools.

Government plans to hand over the responsibility for school maintenance to the district authorities and MoE will then only be responsible for the construction and renovation of school buildings. It is not clear however where the actual funding for school maintenance will come from although ways for schools to raise their own funds are being investigated.

7.2 Guidelines for School Maintenance

In less developed countries many important capital assets including education facilities are run down beyond the point of economic repair. There are many reasons for this but the main reasons would appear to be poor or inappropriate design of the facilities initially, poor construction, inadequate management of the maintenance of the facilities and inadequate finance for maintenance.

It is unfortunately much easier to procure funding for new facilities than it is for maintaining existing ones (and the construction of new facilities is often seen as a better solution than the maintenance of existing facilities) but the construction of new facilities will of course only add to the total maintenance burden. Poor construction of new facilities due to incompetent contractors, inadequate supervision or corrupt practices will also add to the maintenance burden.

Facilities should be designed by trained professionals who have a good understanding of the climate and the culture of the country and the design of facilities should be responsive to the climatic conditions of the country, economic to build and maintain and appropriate to their function. The ease and economy of maintenance should be considered when the buildings are being designed. It might for instance be more economic in the long run to spend more initially on better materials that will require less maintenance.

After the facilities are complete, the MoE should ensure that funding is available for maintenance either from central government or if this is not possible from the local community. It may in fact be better to involve the local community in the ownership, management and maintenance of the facilities but if this is to happen, it must be built

into the construction or renovation programme from the very beginning and training will have to be given to community and staff members in the management of the facilities, in maintenance techniques and also in fund raising for maintenance.

These guidelines attempt to give guidance to MoE staff on the management of maintenance and maintenance techniques.

What is Maintenance?

Building maintenance has been defined as ‘work undertaken in order to keep, restore or improve every part of a building, its services and surrounds to an acceptable standard and to sustain the utility and value of the facility’ and its functional role therefore is to retain the usefulness of the facilities to the users, whether they be staff, students or patients, on a long-term basis.

The financial role of facilities maintenance is to preserve the physical condition of the capital asset that the facilities represent and stop any deterioration and thus loss in value.

Maintenance should be differentiated from renovation or rehabilitation works which are usually one-off projects, large in scale and expensive. Renovation work also usually means that the building being renovated will be out of use for the length of the renovation programme which will cause disruption to the work of the school or health centre. Continuous small-scale maintenance of a building should avoid the need for costly and disruptive renovations.

Before embarking on a maintenance programme for existing buildings however, the buildings should if possible be renovated to a common acceptable standard.

Why Maintain Buildings?

Any building such as a school should be seen as an asset for the whole community and will only be able to serve the community properly if it is kept in good condition. Teachers will find it difficult to teach if the roof leaks or windows are broken.

Regular maintenance will protect the original investment in the facilities.

Buildings that are regularly maintained and kept in good repair can be used productively and continuously during their life while buildings that are not maintained will gradually deteriorate and become unusable and will have to be closed for expensive and disruptive renovations.

Buildings that are regularly maintained and looked after provide a safe, pleasant and healthy environment for staff and students.

In areas prone to earthquakes and cyclones, regular maintenance will also help to minimise damage to the buildings and contents caused by these storms and ensure that the buildings provide safe places of refuge (assuming that the buildings have been properly designed and built in the first place) for the local community.

Types of Maintenance

Maintenance can be classified in a variety of ways but three of the most useful for management purposes are as follows:

- By the size and nature of the works to be executed
- According to the maintenance process
- According to the expenditure budget

By the size and nature of the works to be executed:

Maintenance can be classified according to the size of the works into major or minor but these are relative classifications and will vary according to the country concerned and its economic situation. What is minor in an industrialised country may well be seen as major work in a less developed country.

According to the maintenance process:

Maintenance can be classified more usefully according to the maintenance process and there are three main classifications:

Planned preventative maintenance: This is work directed to the prevention of failure of a facility or building component and may also include service contracts for the regular inspection and servicing of equipment.

Planned corrective maintenance: This is work to restore a facility or replace a component to an acceptable standard and could include for instance re-roofing or re-wiring a building or replacing doors or windows in order that the building can continue to operate efficiently.

Unplanned or emergency repair or maintenance: This is work resulting from an unforeseen breakdown or damage due to external causes and could include a broken water pipe, broken window panes, an electrical fault, etc.

This maintenance process may then be further classified into two complementary systems: the planned system and the contingency system. Planned maintenance consists of planned preventative maintenance and planned corrective maintenance as stated above. Contingency or unplanned maintenance is based upon a policy of waiting for a complaint or report from the building user before any action is taken and if reports are delayed the building can deteriorate badly.

According to the expenditure budget:

Maintenance can be classified as either cyclical maintenance which includes items that regularly recur and must be carried out on a routine basis such as painting and decorating or as occasional items that are carried out only when inspection reveals a fault such as repairs to a roof.

An expenditure budget should therefore be established which takes account of the regular, planned maintenance items such as re-decorating but also allows for a variety of unplanned, occasional items such as broken windows, etc.

The Need for Maintenance

All buildings require regular maintenance if they are to be kept in good condition and have long and useful lives. Maintenance can be divided into three basic types:

- Day-to-day, preventative maintenance.
- Regular corrective or remedial maintenance.

- Unplanned remedial maintenance or repairs.

Wherever possible, maintenance should be carried out on a preventative basis with specific time cycles allocated for each particular task such as for instance a four year cycle for re-painting. Unfortunately there is always a temptation to extend the maintenance cycles when funds are in short supply although this will lead to an ever-increasing backlog of work and increasing difficulty in returning the facilities to an acceptable standard.

The maintenance budget should include funding for all the preventative maintenance cycles together with the planned remedial maintenance items. Some allowance should also be built into the budget for those remedial items or repairs that cannot be foreseen.

The committee or manager in charge of maintenance will be in a stronger position to secure sufficient funds if a fully-costed programme is prepared for all the maintenance cycles from which an accurate budget for the whole maintenance programme can be prepared.

Maintenance policy

The neglect of maintenance is a very serious and universal problem in most less developed countries and demands intervention at the national level. Donors and funding agencies must recognise that the provision of funding for maintenance (and training in the management of maintenance) is as beneficial, if not more so, than the financing of new facilities. As stated above, the provision of new facilities will only eventually increase the maintenance burden.

It is important therefore to create a sense of national responsibility for building maintenance based on an appreciation that maintaining existing assets is as respectable and worthwhile as constructing new buildings. All new projects should therefore include a maintenance policy and funding and training for maintenance.

It is also important that there is a national policy on maintenance and that the government recognises the importance and need for regular maintenance and the need for finance for maintenance.

The ownership of facilities and the responsibility for maintaining the buildings should also be clear.

Management of Maintenance

An organisation will be required to manage the maintenance programme. A maintenance committee should therefore be set up for each facility and one member of staff should be made responsible for maintenance and should be the point of contact for the committee, the community and other members of staff.

Community participation

Maintenance of facilities must be considered from the very beginning of the project in order to protect in the long term the large sums of money spent on the renovation or construction of facilities.

It is likely that government will not be able to provide sufficient funds for the maintenance of facilities and the responsibility for maintenance will have increasingly to be transferred to communities and school or health facility committees.

The involvement of the community from the very beginning of the project should increase the feeling of community ownership and thus the responsibility of the community for the maintenance of the buildings when complete and this feeling should be built on. One way of doing this would for instance to allow for community use of the buildings for purposes other than traditional education.

Training for school staff and communities in managing maintenance, maintenance techniques and in raising funds for maintenance would therefore be useful.

Maintenance manuals

A simple maintenance manual should be prepared by the consultants responsible for the design and supervision of the construction of the buildings to be used by community members and school or health centre staff. The maintenance manuals should include the following information:

- Date of construction, name of builder and architect, location and means of access.
- As-built-drawings of the facilities showing the buildings, construction details and all electrical, water, telephone and drainage services including those that are concealed. These drawings should be up-dated to show any later additions and alterations.
- Specifications of all materials and finishes including paint types and colours, etc.
- Details of any special maintenance requirements.
- An indicative maintenance plan showing what items will require maintenance or replacement and when.
- An indicative maintenance budget showing what expenditure is likely and when and what should be budgeted for.

The manuals should also give guidance on maintaining the buildings, remedial maintenance and on rectifying common faults. Inspections should be carried out regularly and the manual should contain check lists for inspections and preventative maintenance actions that should take place at weekly, monthly and yearly intervals.

Records should be kept of maintenance inspections, actions taken to rectify any faults found and the cost of putting them right and a system should be put in place for reporting more serious problems that cannot be dealt with by the school or health staff or community alone to the district or other authorities.

The manual should cover things like general cleaning, cleaning of toilets, cleaning of drains, checking of roofs for leaks, checking of doors and windows for operation, etc.

Simple maintenance manuals with illustrations in the form of cartoons have been produced for health and education projects in India and Zambia. They have illustrations of basic maintenance tasks and simple check lists and could be used as model manuals for school and health centre staff.

Maintenance guidelines

A maintenance plan should be developed for each facility. This plan should cover regular inspections, preventative and remedial maintenance and repairs. Inspections should take weekly, monthly and annually and maintenance should take place on a 4/5 year cycle.

The daily/weekly action list should mainly cover preventative maintenance actions such as general cleaning in and around the school buildings while keeping an eye open for any obvious problems such as the appearance of termite trails, roof leaks, etc. Floors should be swept regularly, furniture should be moved and the floor cleaned underneath and behind and toilets should be kept clean and functioning.

The monthly inspection list should contain items such as inspecting and trimming trees or bushes close to the building; checking roofs and gutters for damage, loose nails or screws and leaves; checking for termites or nesting insects; checking that doors, windows, locks etc are in working order; checking that toilets, wash-basins, taps, wastes, etc are in working order; checking that storm-drains are not blocked; checking that light fittings are working; checking that furniture is in good order; etc.

The annual inspection list should contain items such as checking the roof for leaks, damage, rust, etc; checking gutters and down-pipes for damage, blockages, etc; checking all exposed roof timbers and fascias for paint finish, rot, etc; checking ceilings for water damage, sagging, etc; checking floors for cracks or damage; checking walls for cracks or damage; checking windows, doors, frames and hardware for faults and damage; checking the electrical system for faults; checking water supplies for leaks and other damage; checking the whole sanitary installation, septic tanks and soakaways for faults, blockages or damage; checking storm-drains for blockages or damage.

An action list should be pinned up within the facility to remind staff of the weekly maintenance and cleaning actions required of them. Inspection check-lists should be devised for the monthly and annual inspections to be used by maintenance committee members, community members or staff. It must be emphasised that *action* must be taken as soon as possible if a problem is discovered. Small problems that can be easily dealt with will become much larger problems that will be difficult and expensive to deal with if they are not resolved as soon as they are discovered.

It would also be a good idea to devise a set of rules for staff and students using the facilities and display these prominently. This is especially important in schools and students should be encouraged to follow the rules and also to take part in the actual maintenance of the buildings.

ANNEX 1: SCHOOL MAPPING DATA

The School Mapping Directorate in the Ministry of Education has a wealth of data relating to all schools in the country and this data is said to be updated annually. The data includes the following:

General

- The school name and code
- The location of the school: governorate, district, village and whether the school is urban or rural
- The area of the school site including used and unused areas, whether there is room for expansion and if so whether this is vertical or horizontal
- The status of the school: i.e. whether it is in use, under construction, permanently or temporarily closed
- The ownership of the school: national or local government, private, etc
- Whether the school is co-educational or for only male or female students
- Whether the school operates morning afternoon or double shifts
- Whether it is a basic, secondary or basic/secondary school
- Whether there is a Fathers' Council and if so how active the Council is
- Details of any proposal to close the school or change its status (from a basic to secondary school for instance)

Buildings

- Details of all buildings (divided into classrooms and service spaces) giving dates of construction, who financed the building, the area of the building, the type and number of rooms and general status i.e. whether being used, not being used or under construction and any requirements for renovation, replacement or expansion
- Details of services in the buildings: water, electricity and telephone
- Details of furniture and equipment: numbers and condition

Students

- Details of numbers of students by grade, sex and scientific and arts streams

Teachers

- Details of teaching and non-teaching staff: numbers, sex and qualifications

Location and Site

- Details of villages supplying students to the school and their distance from the school
- Details of surrounding access roads (including condition), mains water and electricity supplies and telephone services
- Details of whether there are gardens and playgrounds, including their location and condition
- Details of fences/walls, including their condition

All schools can be located using Google Earth and there are photographs of most of the schools from which a general idea of the condition of the school can be gained.

ANNEX 2: REVIEW OF EXISTING SECONDARY SCHOOL BUILDING DESIGNS

1. General

Seven different secondary school designs together with designs for standard laboratories, furniture and 'dry' toilets were reviewed and details of the reviews are given below:

2. Four-Storey, 12-Classroom Secondary School

This is a 12-classroom school presumably designed for a 4-stream intake. Classrooms have an area of 39.9m² and have probably been designed to accommodate 30 students. This gives a total student population of 360 pupils (four classes of 30 x 3 years = 360).

The building is L-shaped constructed on four stories with one access staircase. On the ground floor there are three Classrooms (5.7 x 7.0m), a Chemistry Laboratory (10.1 x 7.0m) with a Preparation Room attached, a Principal's Office (7.0 x 7.0m), a Teachers' Room (7.0 x 7.0m), 3 Toilets and a small Store. On the first floor there are three Classrooms (5.7 x 7.0m), a Physics Laboratory (10.1 x 7.0m) with a Preparation Room attached, a Home Economics Room (7.0 x 7.0m), a Multipurpose Room (7.0 x 7.0m), 3 Toilets and a small Store. On the second floor there are three Classrooms (5.7 x 7.0m), a Multipurpose Room (10.1 x 7.0m) with a Store attached, a second Home Economics Room (7.0 x 7.0m), a Languages Room (7.0 x 7.0m), three Toilets and a small Store.

There are therefore a total of 11 general teaching rooms (including multipurpose rooms), 2 laboratories, 2 home economics rooms and 1 languages room. There is no library or IT room. It should be noted that while home economics is not specifically a time-tabled activity it could be included under the 'activities' heading in the curriculum.

There are a total of 12 toilets (giving a toilet: student ratio of 1:30) but it is not clear what toilets are for staff use, what are for the use of students and what are for boys and what are for girls. There are no disabled toilets shown on the drawings.

The design of the building is fairly simple and straightforward although the window design is quite complicated and expensive. As noted above, the building is designed as an L-shape and because of this at least one wing will be facing east/west. The windows are on the face of the building and there is no protection from the sun in the form of overhangs or louvres.

The ground floor is 60 cm above ground level and there are no ramps shown on the drawings making disabled access difficult. There are no toilets for disabled use. All floor-to-floor heights are the same at 3.5 metres.

3. Three-Storey, 12-Classroom Secondary School

This again is a 12-classroom school presumably designed for a 4-stream intake. Classrooms have an area of 39.9m² and have probably been designed to accommodate 30 students. This gives a total student population of 360 pupils (four classes of 30 x 3 years = 360).

The building is L-shaped and constructed on three stories with two access staircases. On the ground floor there are four Classrooms (5.7 x 7.0m), a Chemistry Laboratory (10.1 x 7.0m) with a Preparation Room attached, two Administration Rooms (7.0 x 7.0m), 3 Toilets and a small Store. On the first floor there are four Classrooms (5.7 x 7.0m), a Laboratory (10.1 x 7.0m) with a Store attached, two Multipurpose Rooms (7.0 x 7.0m), 3 Toilets and a small Store. On the second floor there are four Classrooms (5.7 x 7.0m), a Laboratory (10.1 x 7.0m) with a Store attached, a Multipurpose Room (7.0 x 7.0m), a Multipurpose Room (9.9 x 8.9m) and 3 Toilets.

There are therefore a total of 16 general teaching rooms (including multipurpose rooms) and 3 laboratories. There is no library, IT room, language room or any rooms specifically set aside for girls' activities.

There are a total of 9 toilets (giving a toilet: student ratio of 1: 40) but it is not clear what toilets are for staff use, what are for the use of students and what are for boys and what are for girls. There are no toilets shown on the drawings for disabled use.

The design of the building is similar to the previous design but is made more complicated (and therefore more expensive) by a number of unnecessary setbacks and the same comments as before apply to the window design.

As noted above, the building is designed as an L-shape and again because of this at least one wing will be facing east/west. The windows are on the face of the building and there is no protection from the sun in the form of overhangs or louvres.

The ground floor is 75 cm above ground level and ramps are shown on the drawings making disabled access possible. All floor-to-floor heights are the same at 3.6 metres.

4. Two-Storey, 13-Classroom Secondary School

This again is a 12-classroom school with one extra classroom presumably designed for a 4-stream intake. Classrooms have an area of 40.m² and have probably been designed to accommodate 30 students. This gives a total student population of 360 pupils (four classes of 30 x 3 years = 360).

The building is constructed around a courtyard on two-stories with buildings on all four sides connected at the corners and with three access staircases. On the ground floor there are twelve Classrooms (5.2 x 7.7m), a Chemistry Laboratory (9.0 x 7.0m) with a Preparation Room attached, a large covered entrance, another larger covered area and 5 Toilets. On the first floor there is one Classroom (5.2 x 7.7m), a Multipurpose Room (9.0 x 7.0m) with a Toilet attached, a Multipurpose Room (8.5 x 15.6m), a Library (5.2 x 12.45m) with a Office/Store attached, a Home Economics Room (5.2 x 11.65m) with a Store attached, a Sewing Room (5.2 x 12m) with a Store attached, a Principal's Office (5.2 x 7.7m), a Deputy Principal's Office (5.2 x 3.75m), a Secretary's Office (5.2 x 3.75m), a Physics Laboratory (5.2 x 12.0m) with a Prep Room attached, an IT Room (5.2 x 12.0m) with a Store attached, 5 Toilets and a small Store. On the second floor there are four Classrooms (5.7 x 7.0m), a Multipurpose Room (10.1 x 7.0m) with a Store attached, a Multipurpose Room (7.0 x 7.0m), a Multipurpose Room (9.9 x 8.9m) and 3 Toilets.

There are therefore a total of 15 general teaching rooms (including multipurpose rooms), 2 laboratories, 1 IT room, 2 home economics rooms and a library. There is no languages room.

There are a total of 9 toilets (giving a toilet: student ratio of 1: 40) but it is not clear what toilets are for staff use, what are for the use of students and what are for boys and what are for girls. There are no toilets shown on the drawings for disabled use.

The design of the building is fairly simple and straightforward but the same comments apply to the window design as to the previous buildings. As noted above, the school is built round a courtyard and has buildings on all four sides and therefore two sides will be facing east/west. There are projecting concrete surrounds to the sides and tops of the windows but these are too small to give very much protection from the sun especially to the parts of the building that will face east or west.

The ground floor is 90cm above ground level and some very short ramps are shown on the drawings. Unassisted wheel-chair access would probably not be possible as the ramps are too steep. Floor-to-floor heights are the same on both floors at 4.2 metres which seems excessively high.

5. Three-Storey, 19-Classroom Secondary School

This is an 18-classroom school with one extra classroom presumably designed for a 6-group intake. Classrooms have an area of 39.9m² and have probably been designed to accommodate 30 students. This gives a total student population of 540 pupils (four classes of 30 x 3 years = 540).

The building is L-shaped and constructed on three stories with one access staircase. On the ground floor there are five Classrooms (5.7 x 7.0m), two Laboratories (10.5 x 6.9m) with two Preparation Rooms attached, a Principal's Office (4.5 x 3.5m), an Administration Office (5.7 x 3.5m), a Teachers' Room (5.7 x 3.5m), eight Toilets and two small stores, one of which is accessible from the Teachers' Room. On the first floor there are seven Classrooms (5.7 x 7.0m), a Multipurpose Room (10.5 x 6.9m) with an attached Store, a Library (10.5 x 6.9m) with an attached Store, four Toilets and a small store. On the second floor there are a further seven Classrooms (5.7 x 7.0m), an IT Room (10.5 x 6.9m), a Multipurpose Room (10.5 x 6.9m), four toilets and a small store.

The school therefore has a total of 21 general teaching spaces (including the multipurpose rooms), 2 laboratories, an IT room and a library. There are no languages rooms or any rooms specifically set aside for girls' activities.

There are a total of 16 toilets (giving a student: toilet ratio of 1:34 if the student population is 540) but it is not clear what toilets are for staff use, what are for the use of students and what are for boys and what are for girls.

The design of the building is fairly simple and straightforward although the window design is quite complicated and expensive. As noted above, the building is designed as an L-shape and because of this at least one wing will be facing east/west. It should be noted again that the windows are on the face of the building and there is no protection for them from the sun in the form of overhangs or louvres.

The ground floor is set at two levels: the entrance level is 60 cm above ground level and the two Laboratories are at this level; the main classroom wing is 60cm above this level. There are no ramps shown on the drawings and the different levels would make disabled access difficult and there are also no toilets for disabled students use.

Because of the different ground floor levels and because both wings are at the same level on the first floor, the ceiling height of the Laboratories is 60 cm higher than that

of the general classrooms. Ground to first floor heights are therefore 4.2 metres and 4.8 metres and first to second floor and second floor to roof heights are 3.6 metres. Ceiling heights are therefore very high.

6. 4-Storey 12-Classroom School (mountains)

This again is a 12-classroom school presumably designed for a 4-stream intake. Classrooms have an area of 40.2m² and have probably been designed to accommodate 30 students. This gives a total student population of 360 pupils (four classes of 30 x 3 years = 360).

The building is L-shaped and is constructed on four stories with two access staircases. On the ground floor there are three Classrooms (5.5 x 7.45m), a Chemistry Laboratory (6.2 x 8.8m) with a Preparation Room attached (6.2 x 2.0m) and three Toilets. On the first floor there are three Classrooms (5.5 x 7.45m), a Physics Laboratory (6.2 x 8.8m) with a Preparation Room attached (6.2 x 2.0m) and three Toilets. On the second floor there are three Classrooms (5.5 x 7.45m), a Teachers' Room (6.2 x 3.35m), a Principal's Office (4.2 x 3.45m), a Secretary's Office (3.8 x 2.6m), a Toilet for staff (2.0 x 2.0m) and three Toilets. On the third floor there are three Classrooms (5.5 x 7.45m), a Multipurpose Room (11.3 x 6.2m) and three toilets.

There are therefore a total of 13 general teaching rooms (including the multipurpose room) and 2 laboratories. There is no library or IT room or any rooms for girls' activities. There are a total of twelve toilets (giving a toilet: student ratio of 1:30) and one toilet for staff use.

The design of the building is fairly simple and straightforward although the window design is quite complicated and expensive. As noted above, the building is designed as an L-shape and because of this at least one wing will be facing east/west. It should be noted that the windows are on the face of the building and there is no protection for them from the sun in the form of overhangs or louvres.

The ground floor is 75 cm above ground level and although a ramp is shown it will be too steep for disabled access. There are no toilets for disabled use.

7. 2-Storey, 24-Classroom Secondary School (desert)

This is a 24-classroom school presumably designed for an 8-group intake. Classrooms have an area of 44.08m² and have probably been designed to accommodate 30 students. This gives a total student population of 720 pupils (four classes of 30 x 3 years = 720).

The building is constructed on two floors around two courtyards with buildings on all four sides and across the centre with two access staircases. On the ground floor there are twelve Classrooms (5.6 x 7.6m), a Chemistry Laboratory (7.0 x 10.6m) with a Preparation Room attached (7.0 x 3.4m), a Physics Laboratory (7.0 x 10.6m) with a Preparation Room attached (7.0 x 3.4m), a First-Aid Room (3.4 x 4.4m), several stores and two Toilets. On the first floor there are twelve Classrooms (5.6 x 7.6m), a Library (7.0 x 10.6m) with an Office (7.0 x 3.4m) and a Store (3.4 x 4.4m) attached, a Multipurpose Room (7.0 x 10.6m), a Principal's Office (7.0 x 3.4m), a Secretary's Office (3.4 x 4.4m), three Teachers' Rooms (4.60 x 3.17m), several stores and two Toilets.

There are therefore a total of 25 general teaching rooms (including the multipurpose room), 2 laboratories and a library. There is no IT room, languages room or any rooms for girls' activities. There are only four toilets (giving a toilet: student ratio of 1:180!) and no separate toilets for staff use.

The design of the building is quite complicated with many insets and round corners. As the building is designed around courtyards, at least two sides will be facing east/west. The windows have concrete hoods to the top and sides but these are not large enough to keep the sun out of the rooms. The classrooms in the centre on both floors have a central corridor and do not therefore have adequate through ventilation.

Ramps are indicated on the drawings but they are fairly short and will probably be too steep for disabled access. There are no toilets for disabled use.

8. 3-Storey, 48-Classroom Secondary School (coastal)

This is a 48-classroom school presumably designed for a 16-group intake. Classrooms have an area of 48.60m² and have probably been designed to accommodate 30 students. This gives a total student population of 1,440 pupils (sixteen classes of 30 x 3 years = 1,440). The school is designed to have two halves with boys' facilities on one side and girls facilities on the other with shared facilities such as laboratories, multipurpose rooms and administration offices in the centre.

The school is designed in an 'H'-shape with two wings joined by a central building with eight access staircases. On the ground floor there are sixteen Classrooms (6.0 x 8.1m), a Multipurpose Room (7.8 x 11.8m), a First-Aid Room (3.4 x 3.8m), a Principal's Office (7.8 x 5.2m), two Secretary's Offices (3.8 x 5.4m), two Teachers' Rooms (4.3 x 5.4m), two other offices (3.2 x 3.8m), several stores and twenty Toilets. On the first floor there are sixteen Classrooms (6.0 x 8.1m), four Multipurpose Rooms (5.7 x 7.8m), two Laboratories (7.2 x 9.5m) with attached Preparation Rooms (3.5 x 3.8m), two Teachers' Rooms (4.3 x 5.4m), a Social Worker's Room (4.4 x 3.4m), several stores and twenty Toilets. A third floor drawing was not available but presumably there are another sixteen classrooms; details of the other accommodation are not known.

The design of the building is very complicated with many insets and a great many staircases. Again the design of the building will mean that parts of it will be facing east/west. Many of the rooms in the central connecting block are back-to-back with no through ventilation and light from only one side.

Ramps are indicated on the drawings but they are fairly short and will probably be too steep for disabled access. There are no toilets for disabled use.

9. Standard Laboratory Design

The standard laboratory design consists of two laboratories (10.7 x 6.95 metres) with two preparation rooms (5.25 x 3.4 metres) set between them. The laboratories have the entrance doors and windows on the short walls of the rooms and because of this the light levels in the centre of the laboratories must be low.

Each laboratory has a teacher's demonstration bench with a sink set on a slightly raised dais immediately inside the double entrance doors. There are five students' benches (approximately 3.3 x 0.9 metres) each with a sink in the middle and places

for eight students giving each laboratory a teaching capacity of 40 students. Each laboratory has a fixed bench on the short walls at the ends of the rooms.

The student benches are fixed giving no flexibility in the layout. Some students will have their backs to the teacher and the chalkboard making note-taking and observation of any experiments carried out by the teacher at the demonstration bench difficult. There is also very little space for the students to gather round the teacher's demonstration bench to watch experiments.

There is a fume cupboard in each laboratory next to the entrance doors. The fume cupboards are built of rendered block or brick with a glazed sliding sash window at the front for access and observation of experiments. Each fume cupboard is tiled internally and has a sink and an extract fan and light at high level. There is therefore no access to the fume cupboards from the preparation rooms and there is very little space for students to stand round the fume cupboard to observe experiments because of the layout of the benches and also because the side walls of the cupboard are solid thus blocking the view of any experiments.

Walls to the laboratories are tiled up to approximately 1.5 metres high and all benches are tiled on their top surfaces (at a secondary school visited in Sana'a, all of these worktop tiles had broken off leaving a rough surface).

The preparation rooms have access from each laboratory and have fixed benches on their long walls with double sinks to the bench adjacent to the laboratory.

All water and drainage pipes are buried in or are under the floor slab making access in case of leaks extremely difficult (although there are a number of floor outlets). There appears to be no fixed gas supply to either the laboratories or the preparation rooms and it is not clear therefore how experiments requiring heat are carried out.

10. 'Dry' Toilets

The existing design for 'dry' toilets for use at schools where there is not a dependable water supply has four toilets raised 1.8 metres above the ground and access is by steps or a ramp.

One version of the design has a separate disabled toilet which is wider than the other three. There are however some problems with this toilet as the ramp is too steep to allow self-propelled wheelchair access, there is very limited turning space for a wheelchair at the top of the ramp into the toilet, the toilet door is too narrow for a wheelchair and the actual toilet is the squatting type which a disabled student is unlikely to be able to use.

There are also other problems with the design of the toilets. The toilets are raised above a pit which has two openings for emptying. There are however no doors on these openings meaning that the pit is open creating most un-hygienic conditions and probably threats to the health of students! The structure of the toilets is also very heavy and expensive and the provision of squat pans is unnecessary.

Dry toilets of various types have been used extensively and successfully in many tropical countries. There are various types but most have underground pits or if the pits are above ground they are sealed. In most types the pit is ventilated to assist the breakdown of the waste and some have two pits so that one can be in use while the contents of the other pit are breaking down.

11. Furniture

Classroom design should start with the number of students to be accommodated and the size and layout of the furniture. These factors will dictate both the size and the proportions of the classroom.

The student desks that are at present being used in classrooms consist of bench-tops 120 cm long by approximately 40 cm wide with a fixed backless bench attached for seating. The overall size of the desks (for two students) is 120 x 90 cm and they must be uncomfortable for the students to sit at for long periods and therefore not conducive to work or concentration. They are also very inflexible in use and can in fact really only be used in one way: arranged in rows facing the teacher. If one of the aims of the project is to introduce more active, student-centred teaching methods and improve both teaching and learning then more flexibility in the way that the furniture can be arranged and used in the classroom is essential.

ANNEX 3: PROPOSALS FOR NEW STANDARD SECONDARY SCHOOL FACILITIES

The following proposals for teaching facilities for both urban and rural secondary schools are based upon the performance criteria described in Section 5. The existing curriculum and teaching methods and possible new teaching methods have also been taken into account together with standards for similar facilities in other countries.

A class size of 32 students has been taken as standard for the rural areas and a class size of 48 students has been taken as standard for the urban areas in order to reduce construction costs and the cost of providing teachers all of the room sizes indicated below relate to these figures.

The proposed structural module consists of structural bays 3.3 metres wide centre to centre and 7.2 metres deep centre to centre which will give a clear internal width of 7.0 metres. See drawing YN/01.

Proposals for General Classrooms for rural and urban schools are shown in drawings YN/02 – 07.

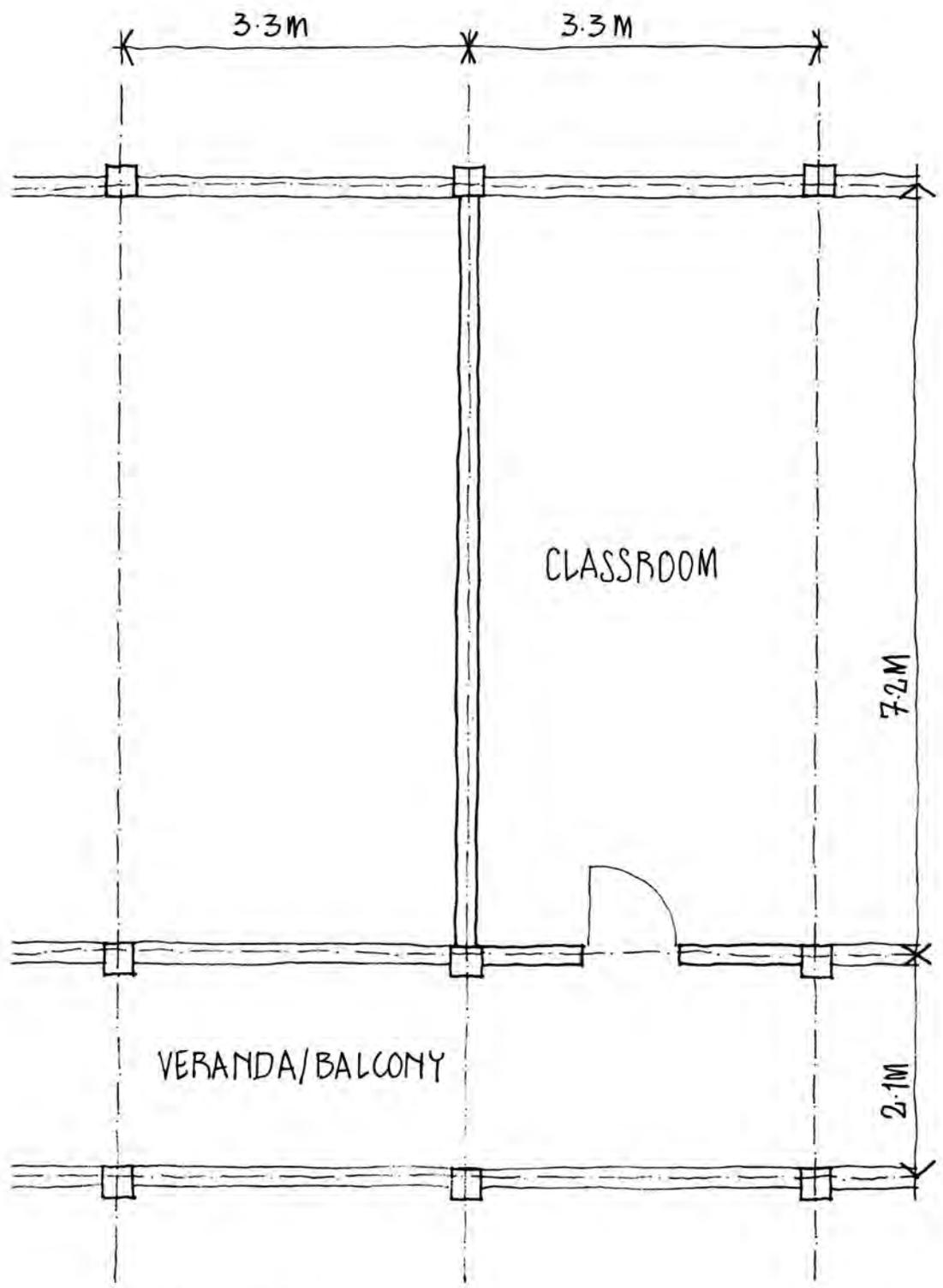
Proposals for Multipurpose Rooms for rural and urban schools are shown in drawings YN/08 – 13. The use of these rooms for teaching languages is shown in drawings YN/ 12 and 13.

Proposals for Science Laboratories for rural and urban schools are shown in drawings YN/14 – 19.

Proposals for Home Economics Rooms for rural and urban schools are shown in drawings YN/20 – 21.

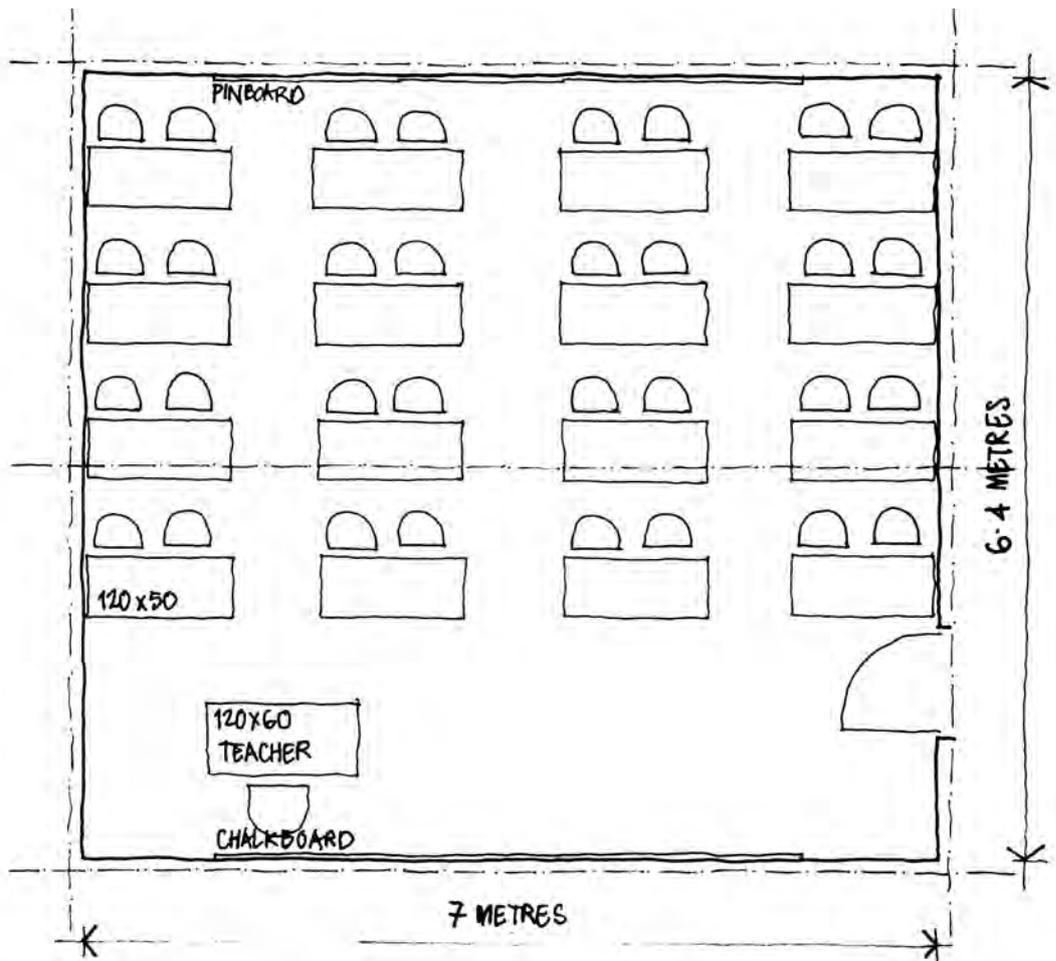
Proposals for IT Rooms for rural and urban schools are shown in drawings YN/22 – 23.

Proposals for Libraries for rural and urban schools are shown in drawings YN/24 – 25.



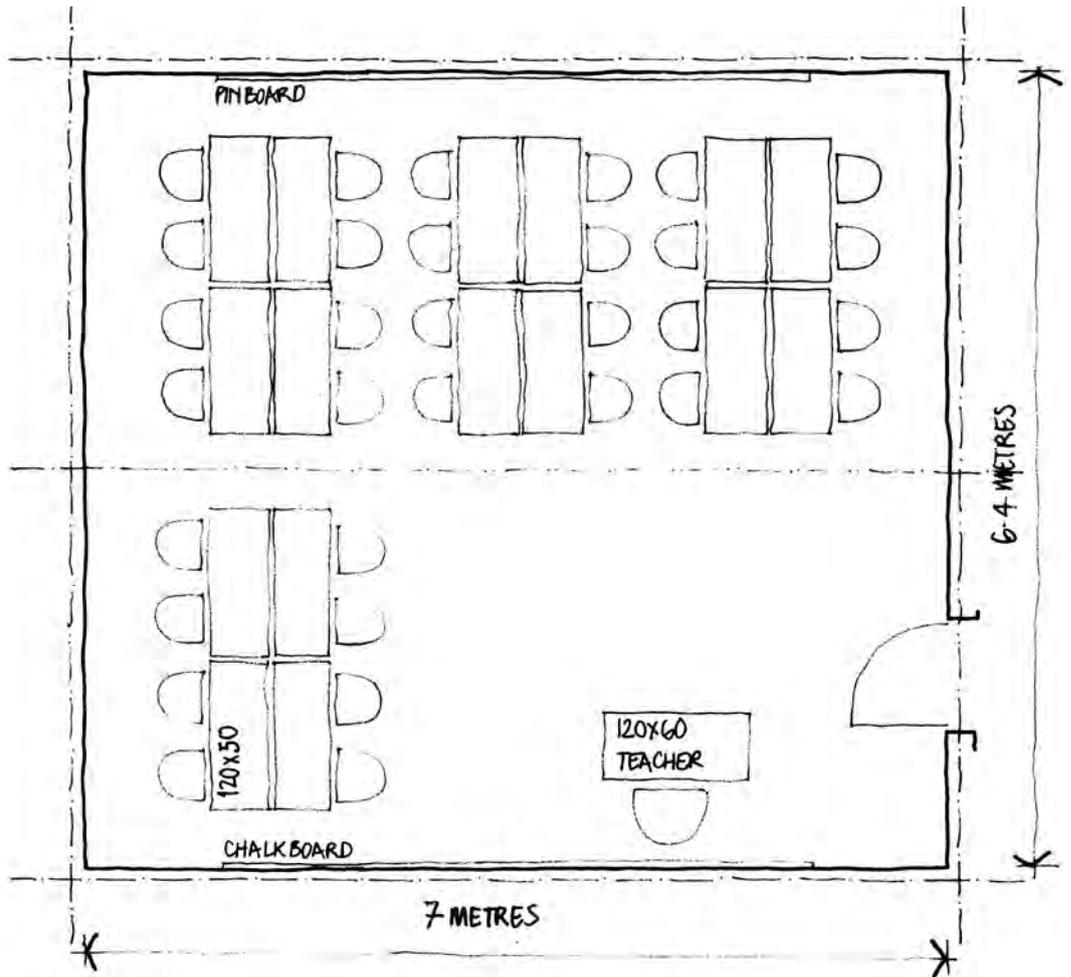
PROPOSED STRUCTURAL GRID

YN/01



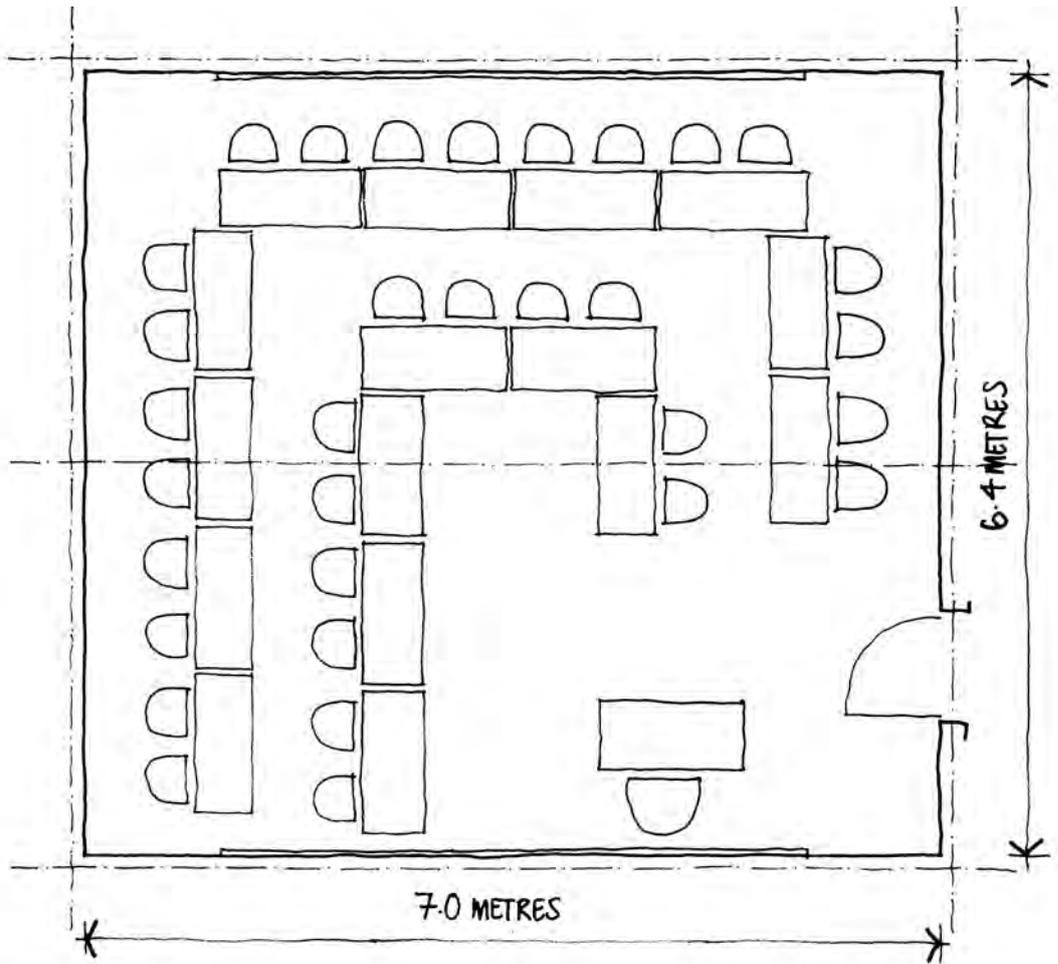
RURAL CLASSROOM - TRADITIONAL LAYOUT

YN/02



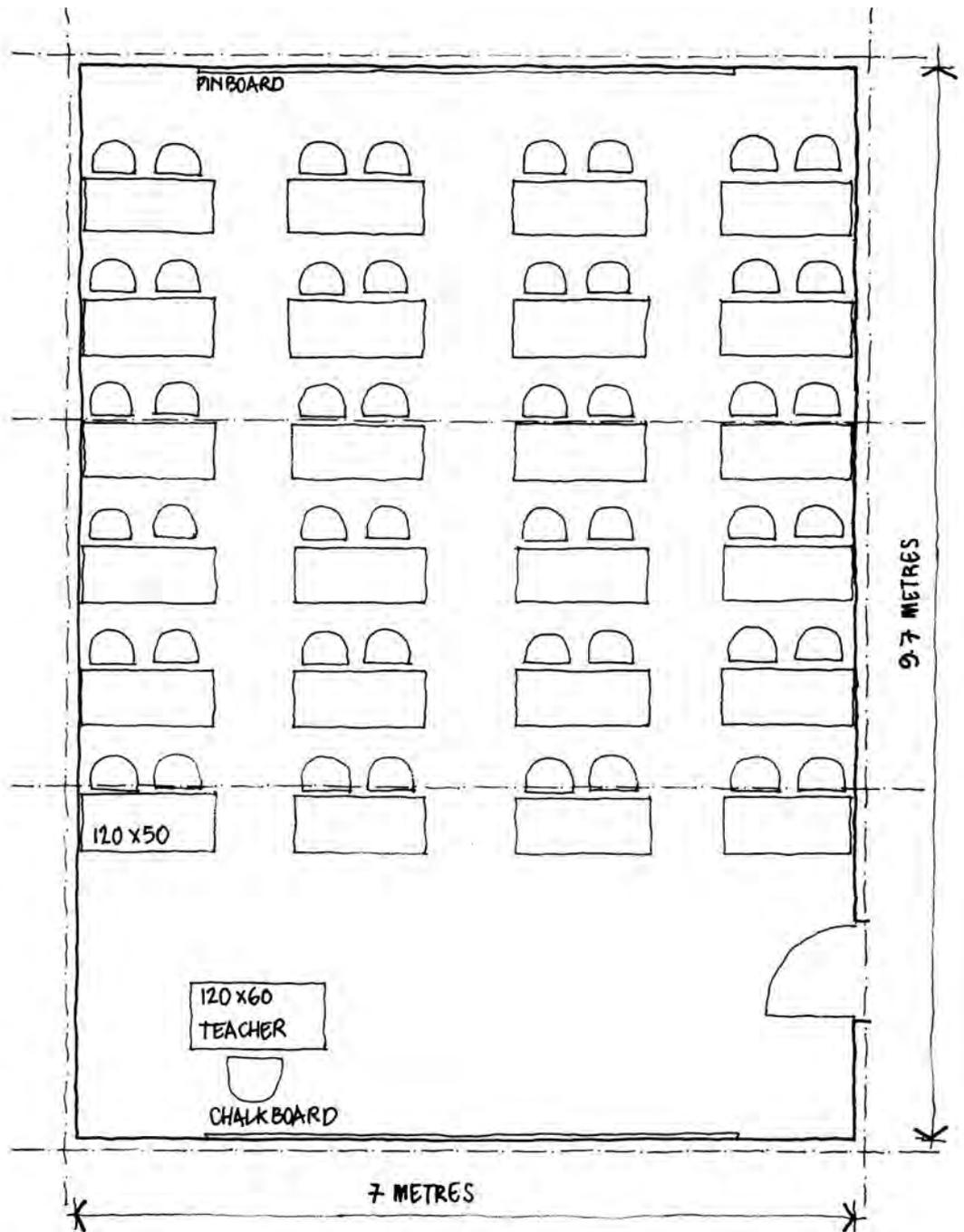
RURAL CLASSROOM - GROUP WORK

YN/03



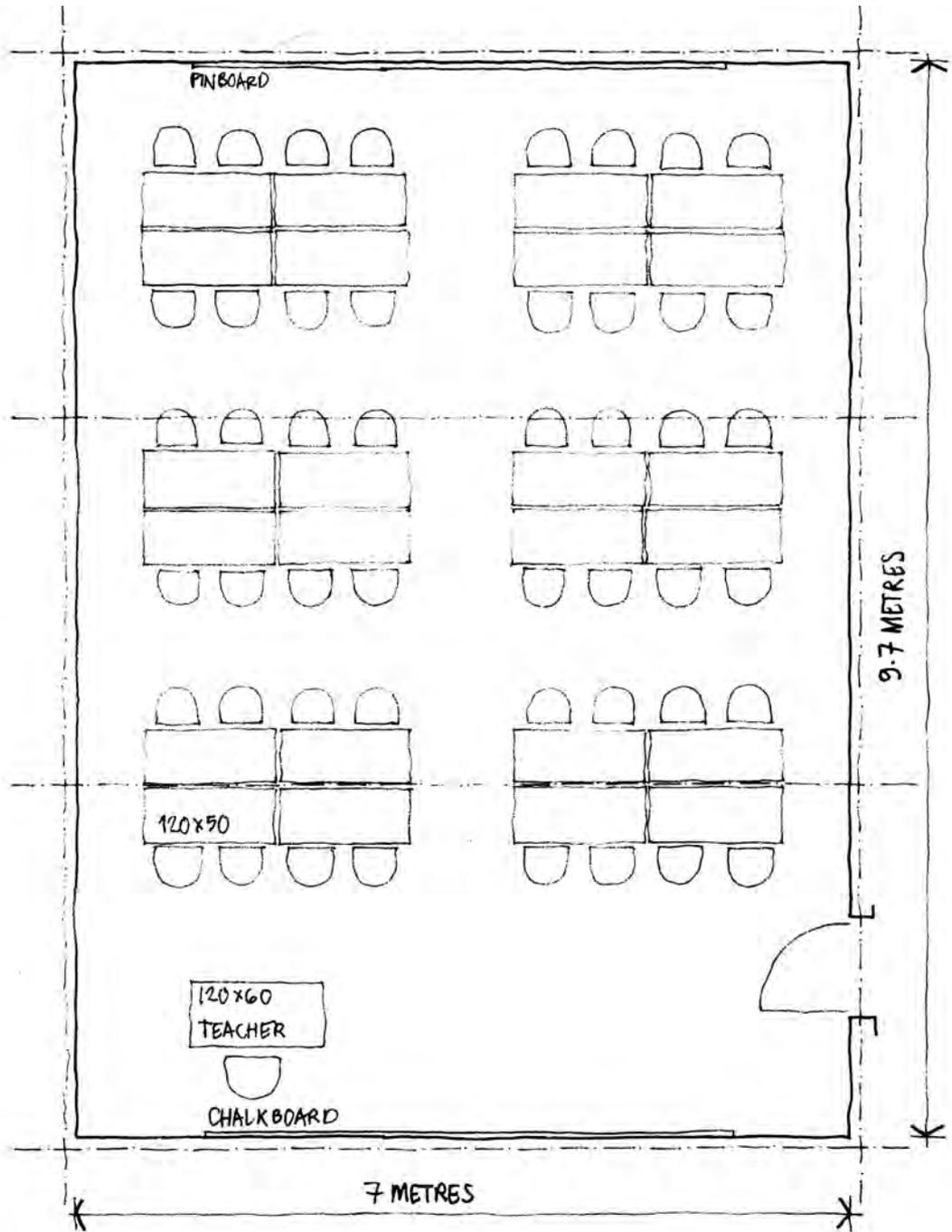
RURAL CLASSROOM - CLASS DISCUSSION

YN/04



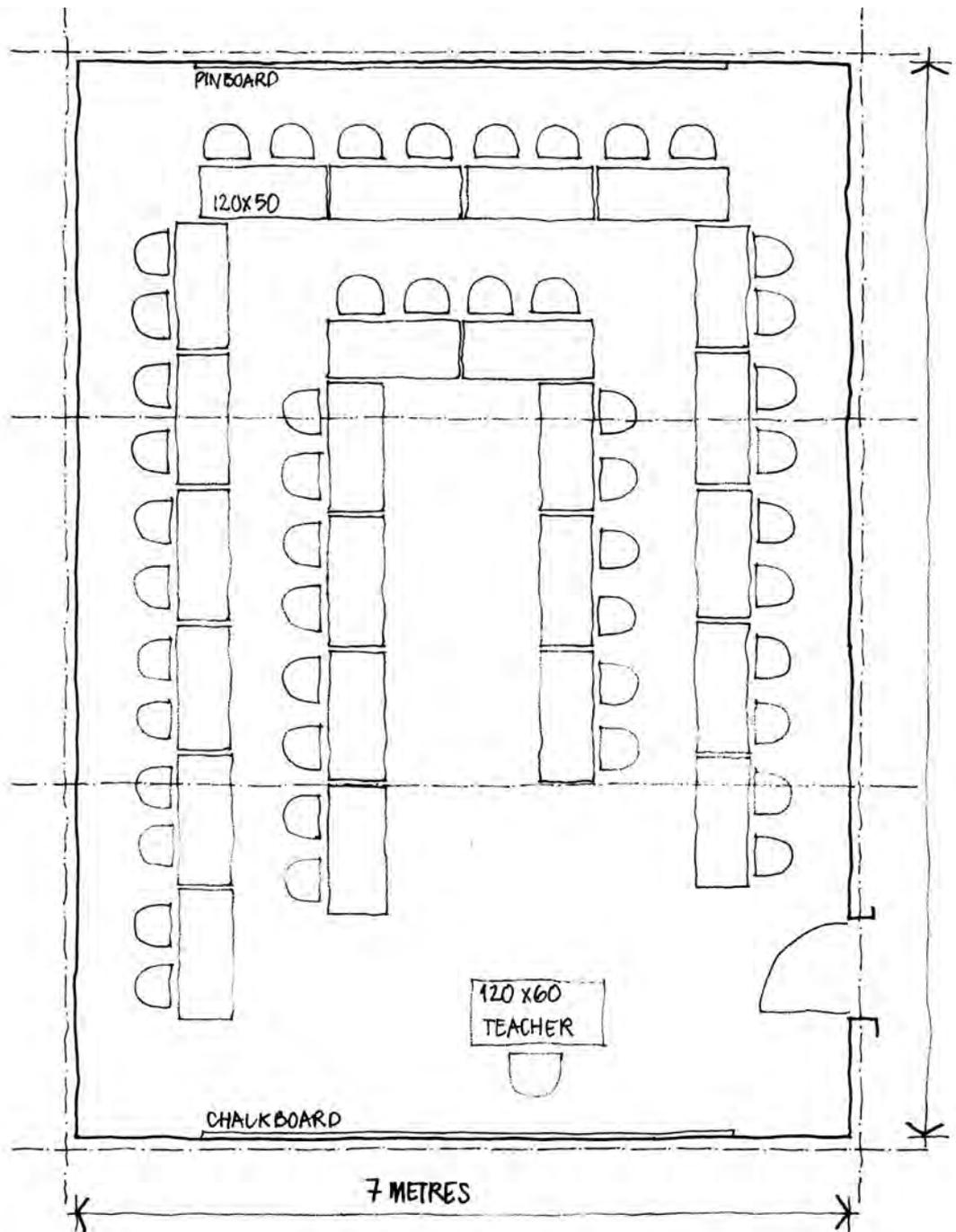
URBAN CLASSROOM - TRADITIONAL LAYOUT

YN/05



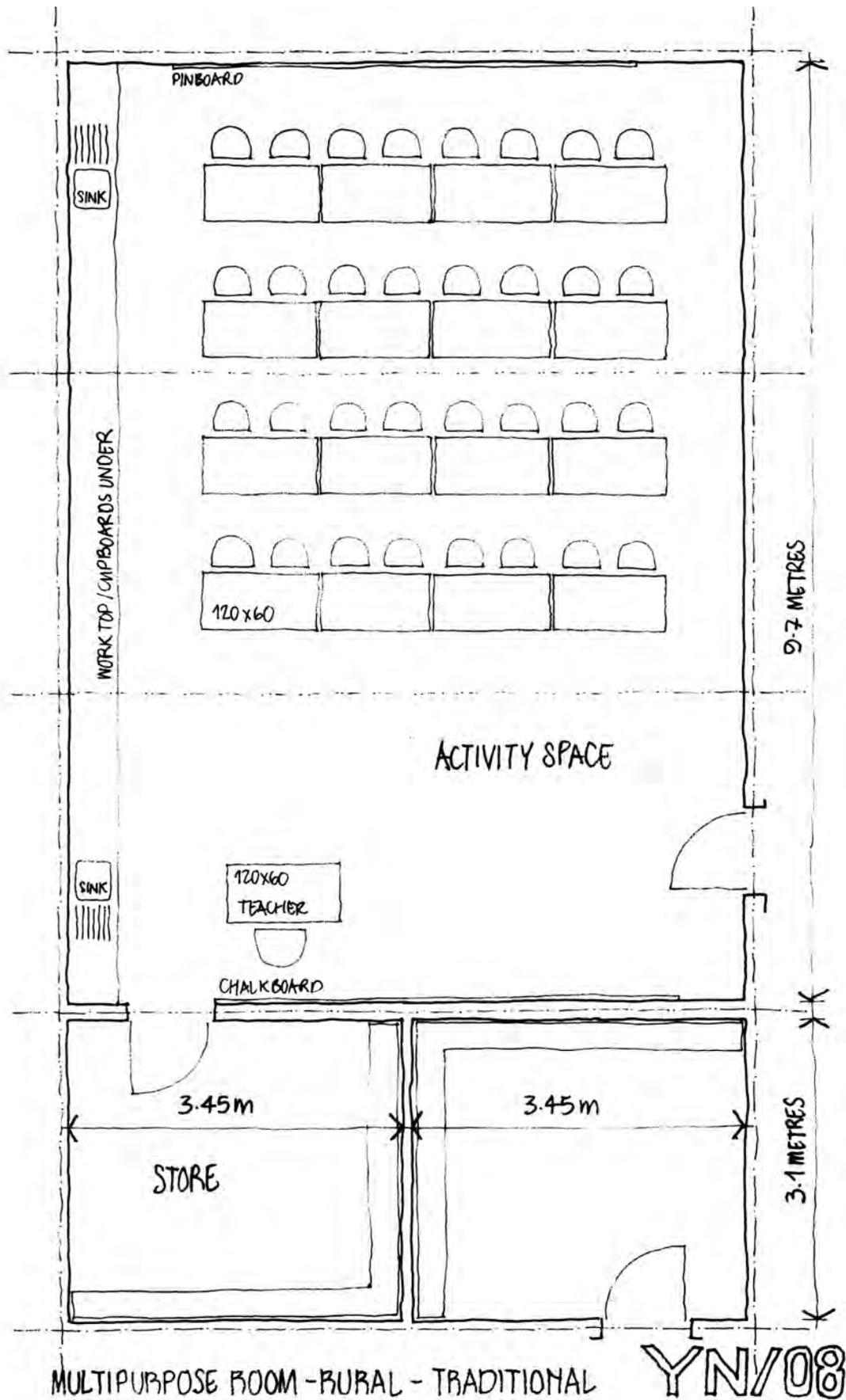
URBAN CLASSROOM - GROUP WORK

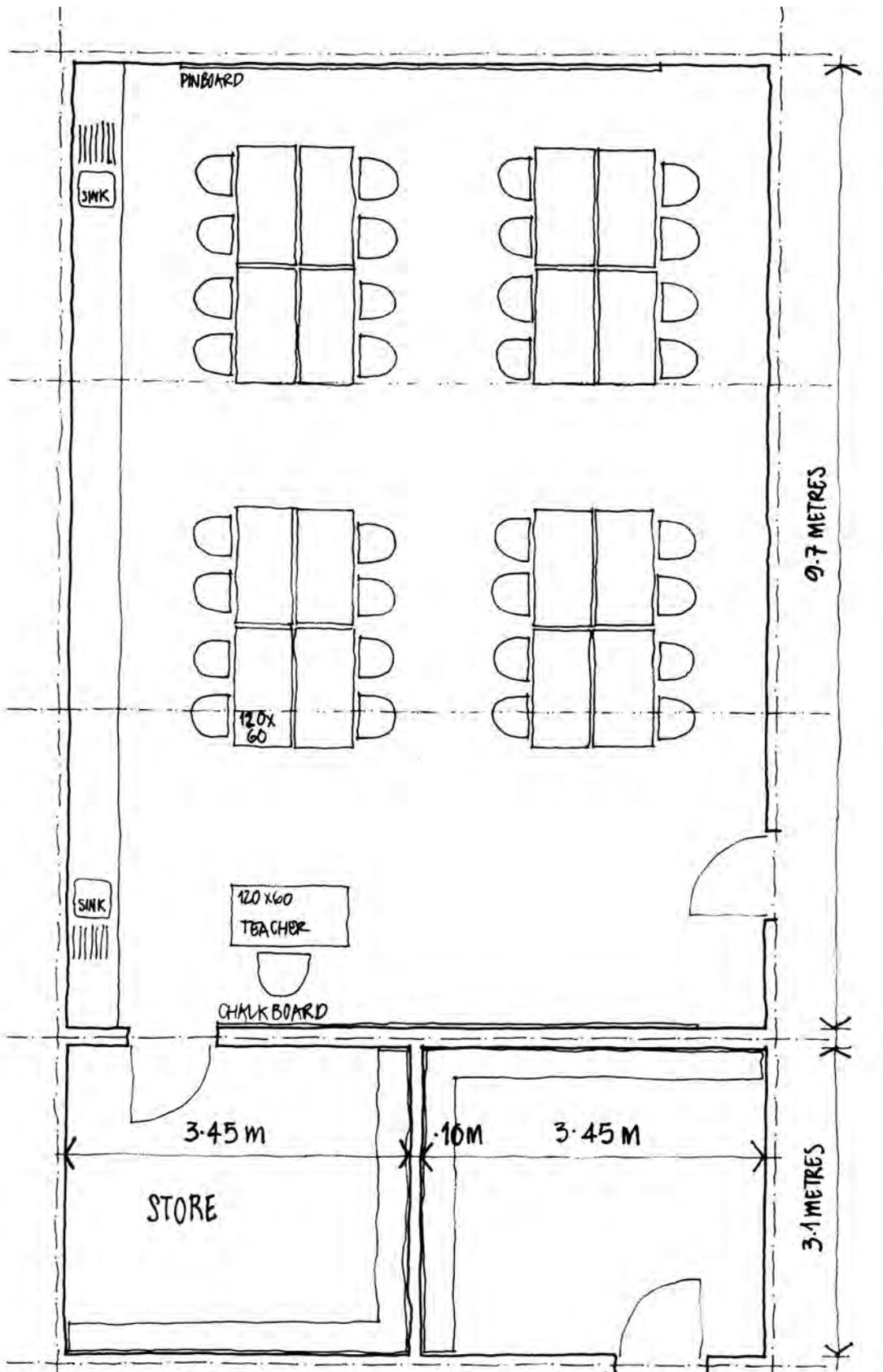
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URBAN CLASSROOM - CLASS DISCUSSION

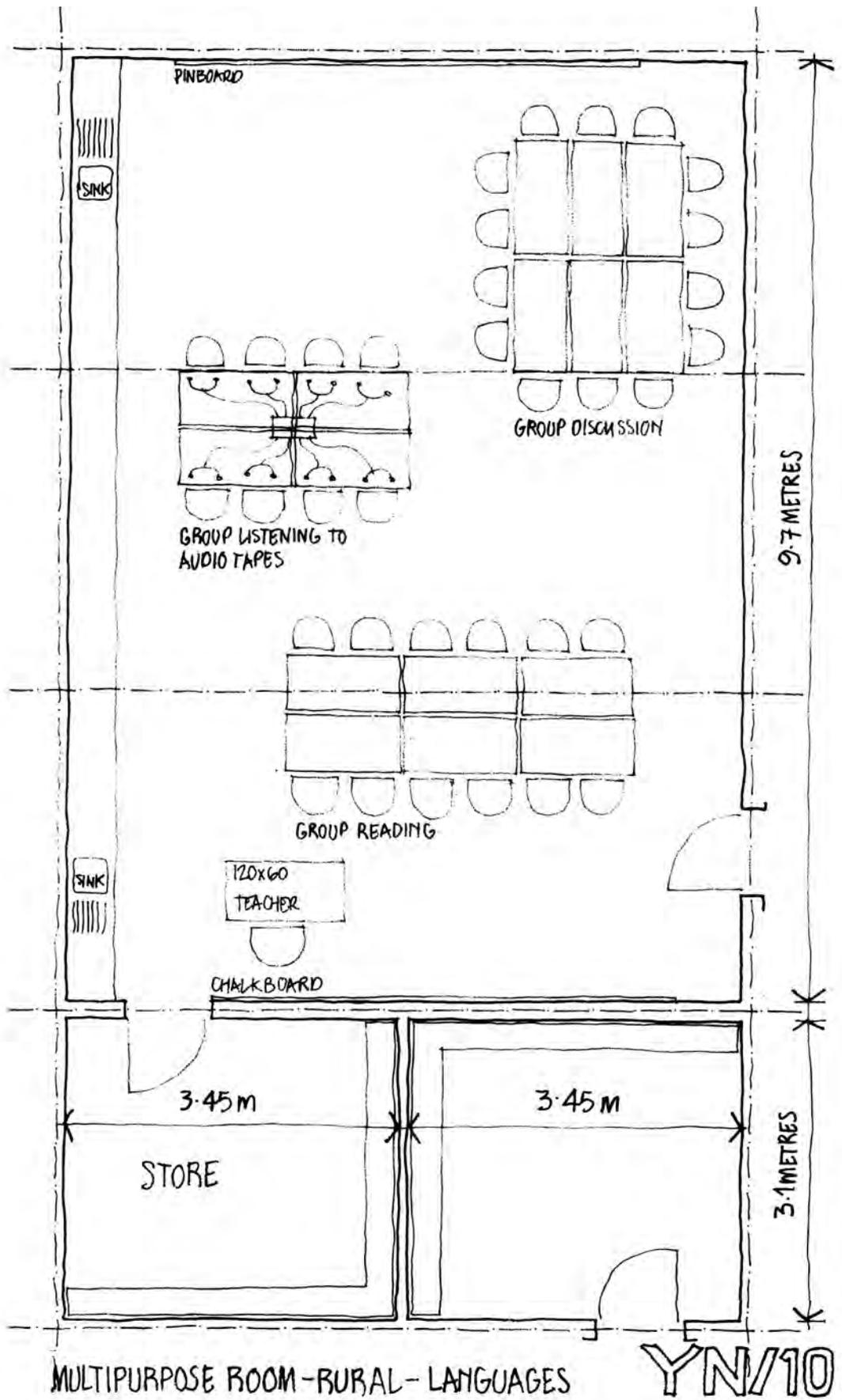
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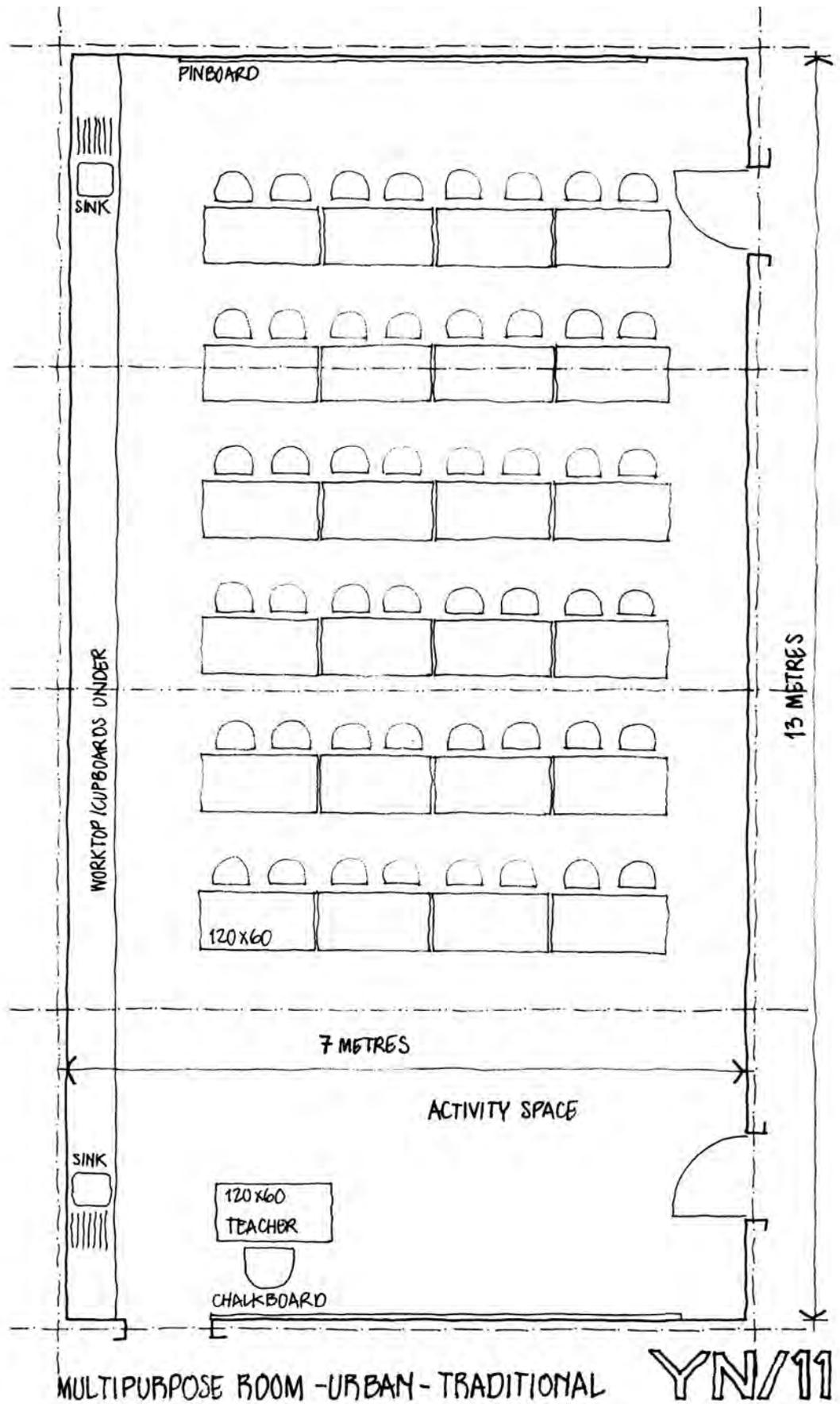


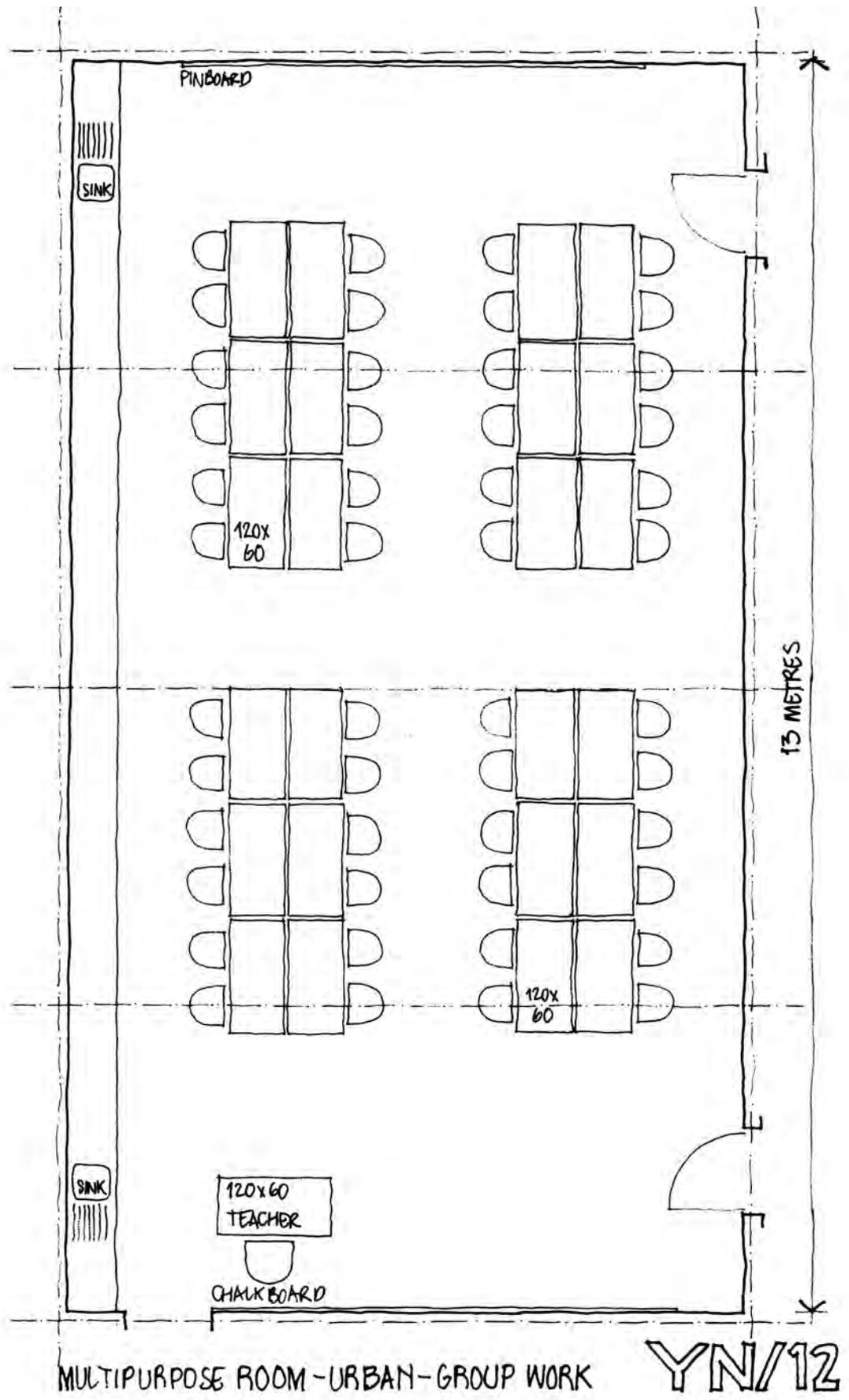


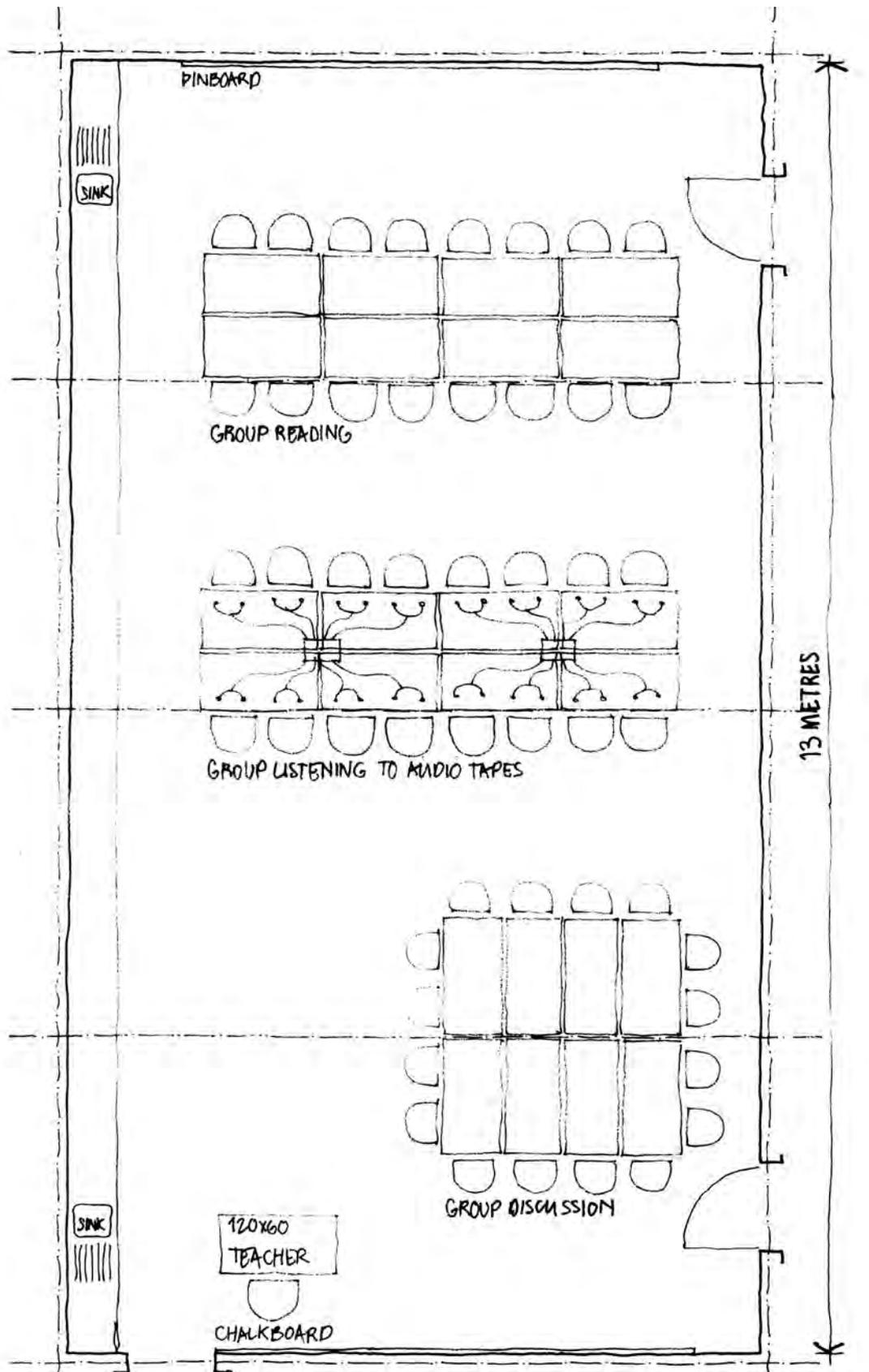
MULTIPURPOSE ROOM-RURAL-GROUP WORK

YN/09

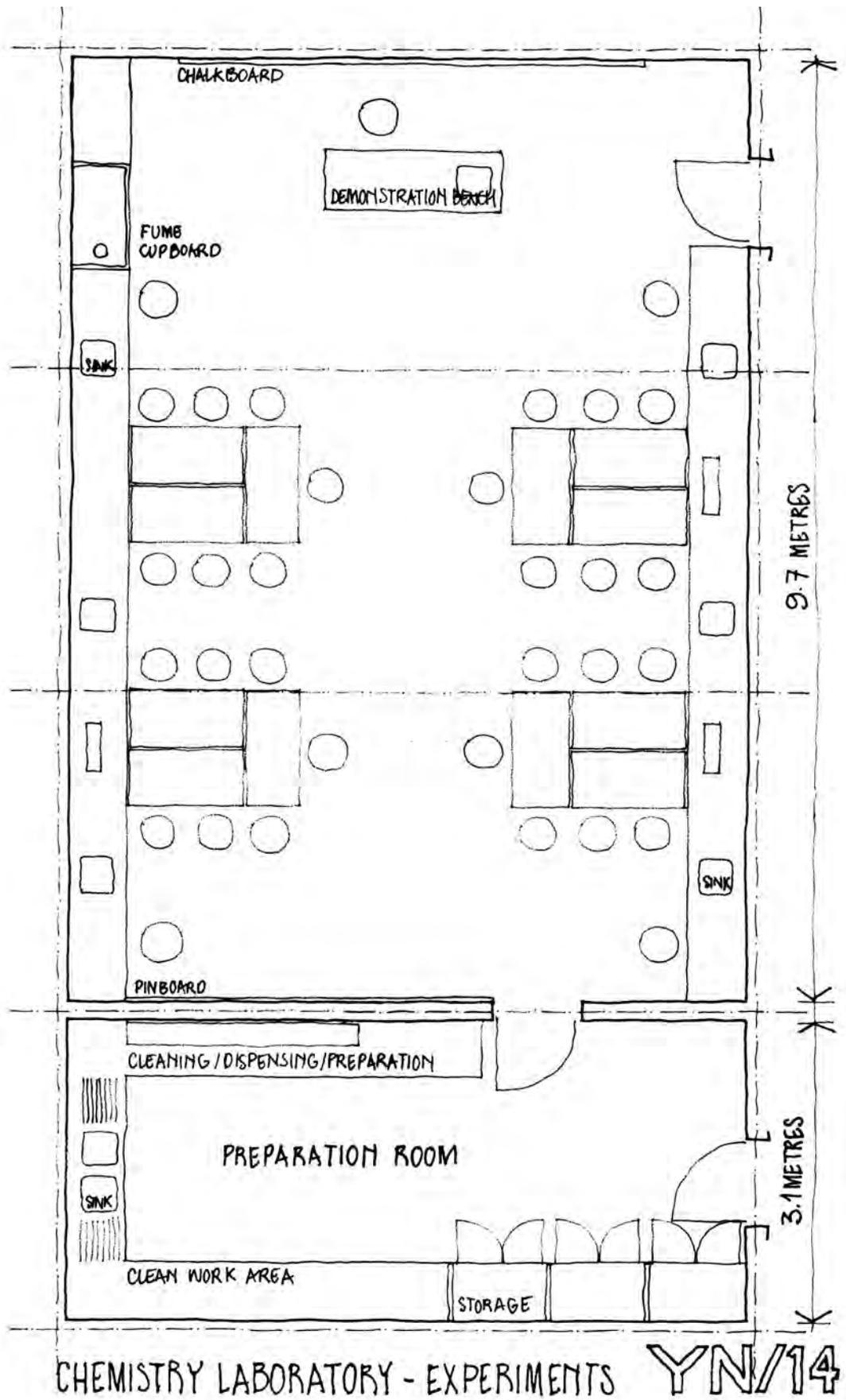


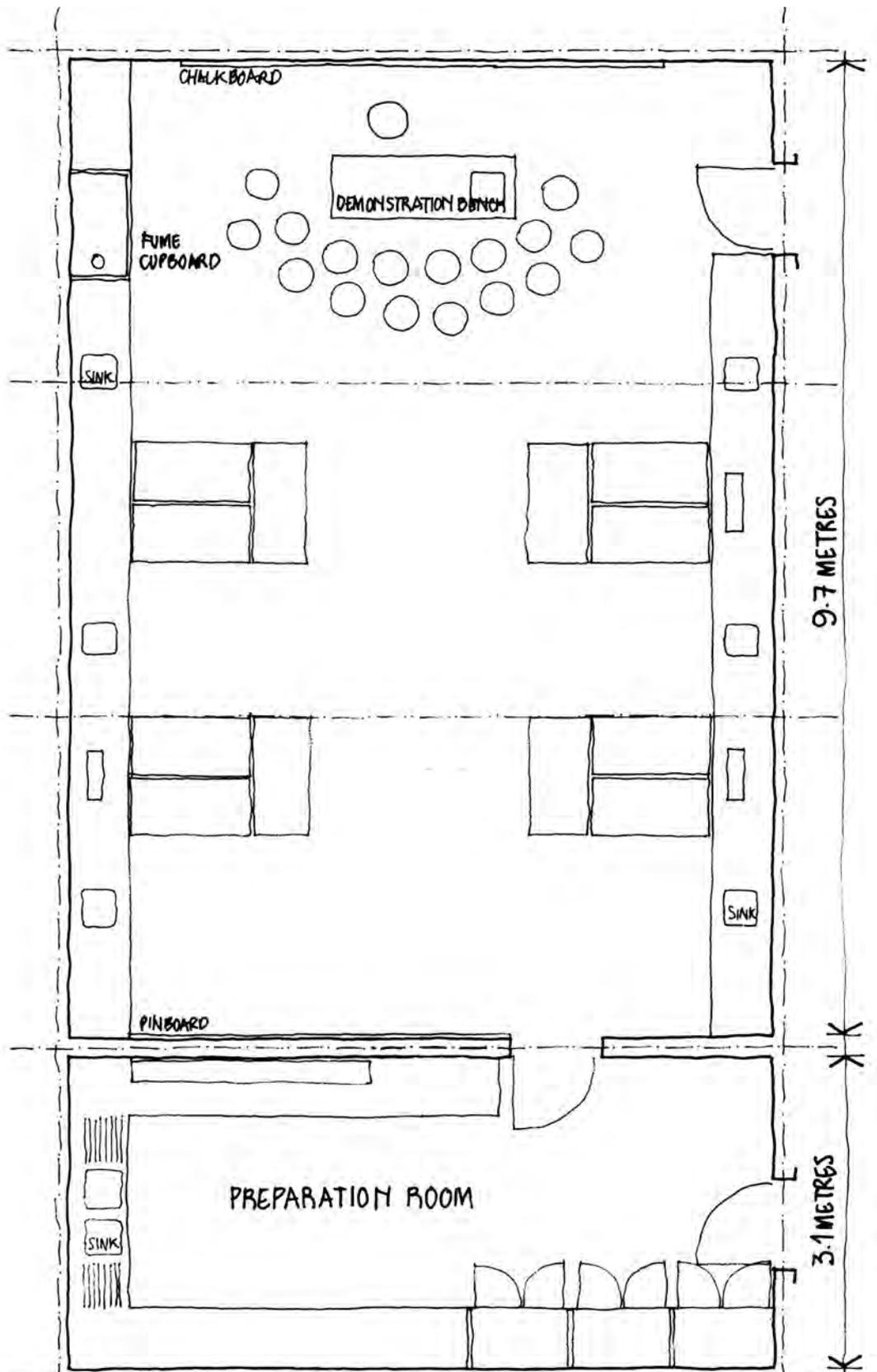




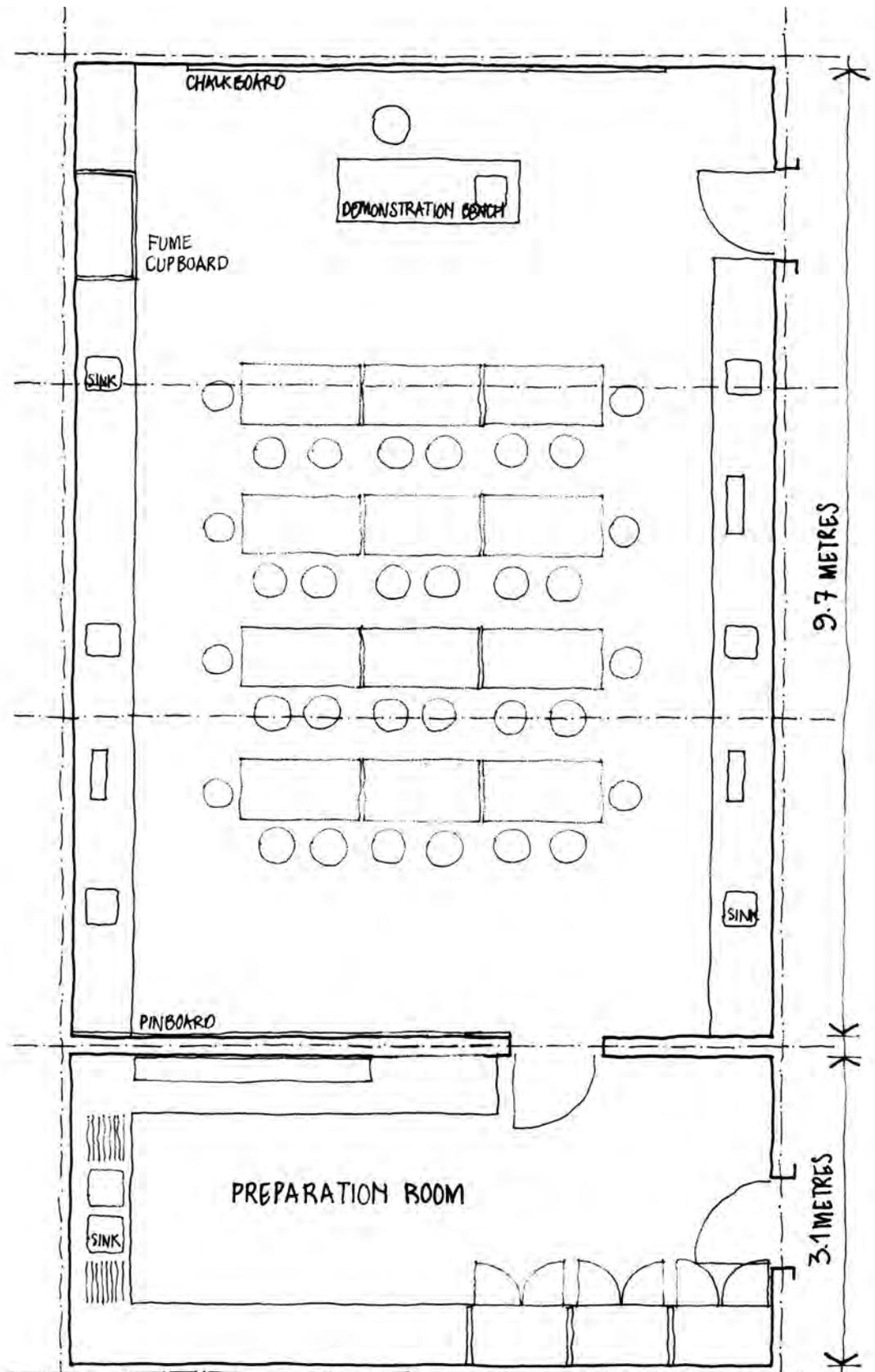


MULTIPURPOSE ROOM - URBAN - LANGUAGES YN/13

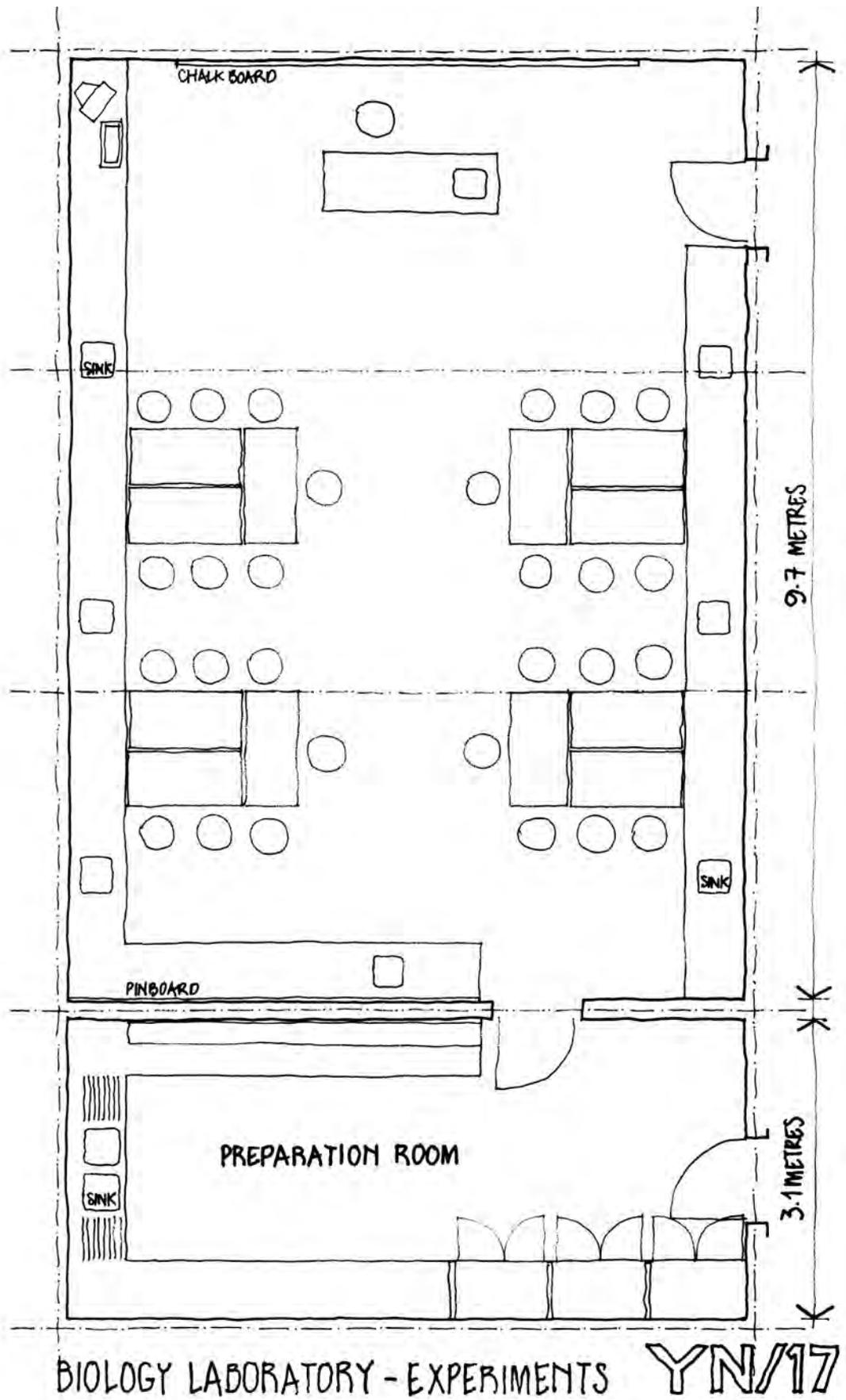


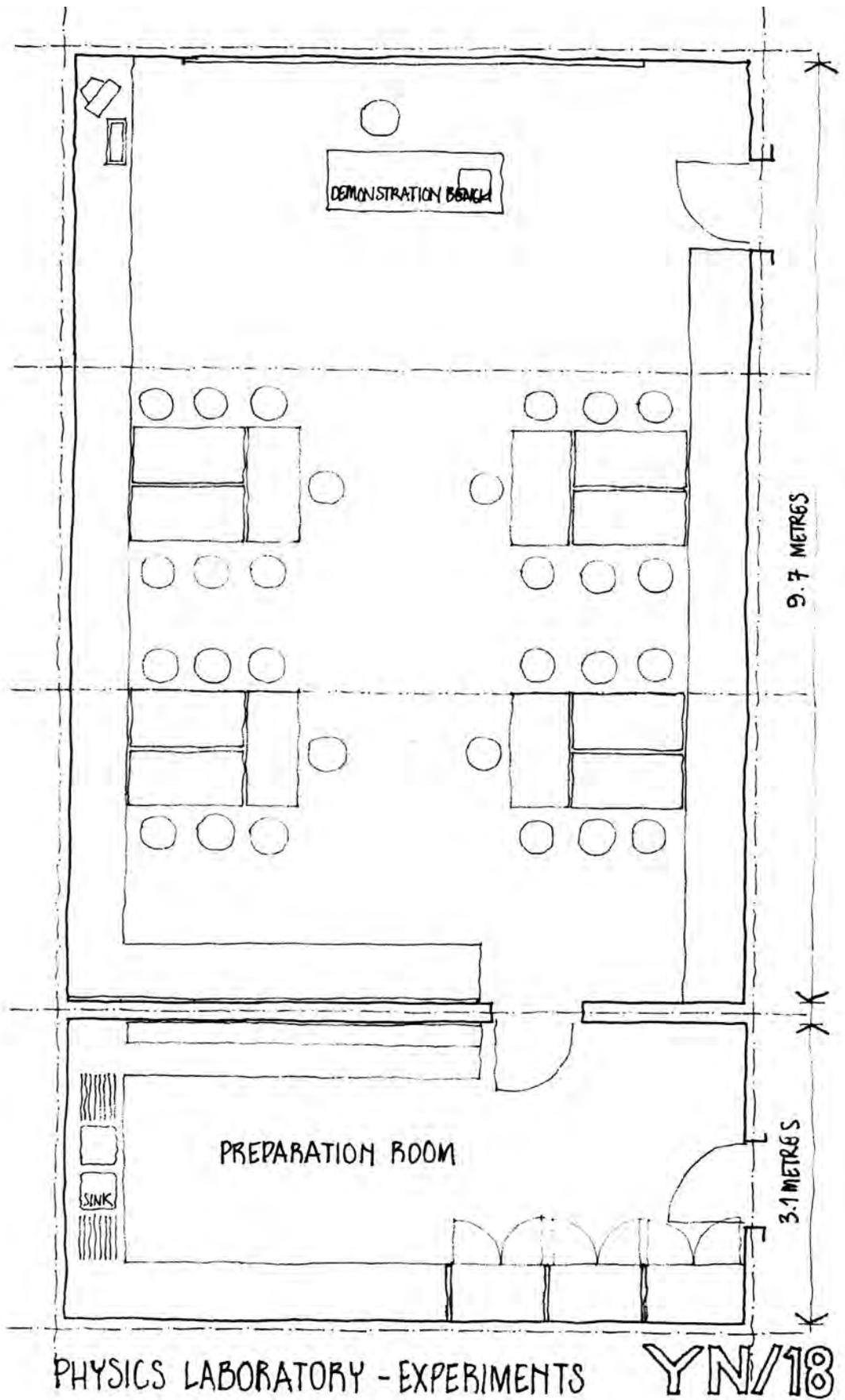


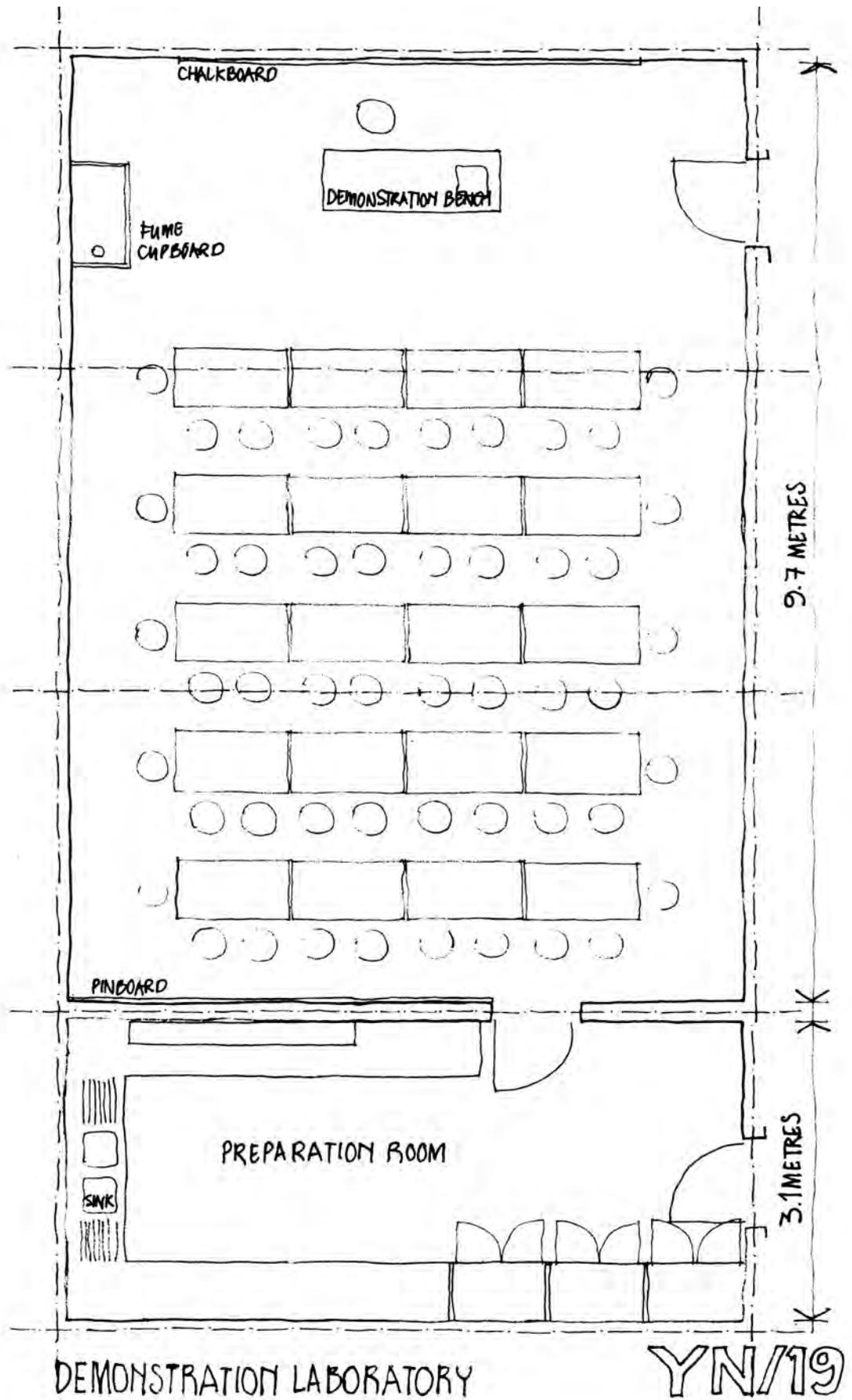
CHEMISTRY LABORATORY-DEMONSTRATIONS YN/15

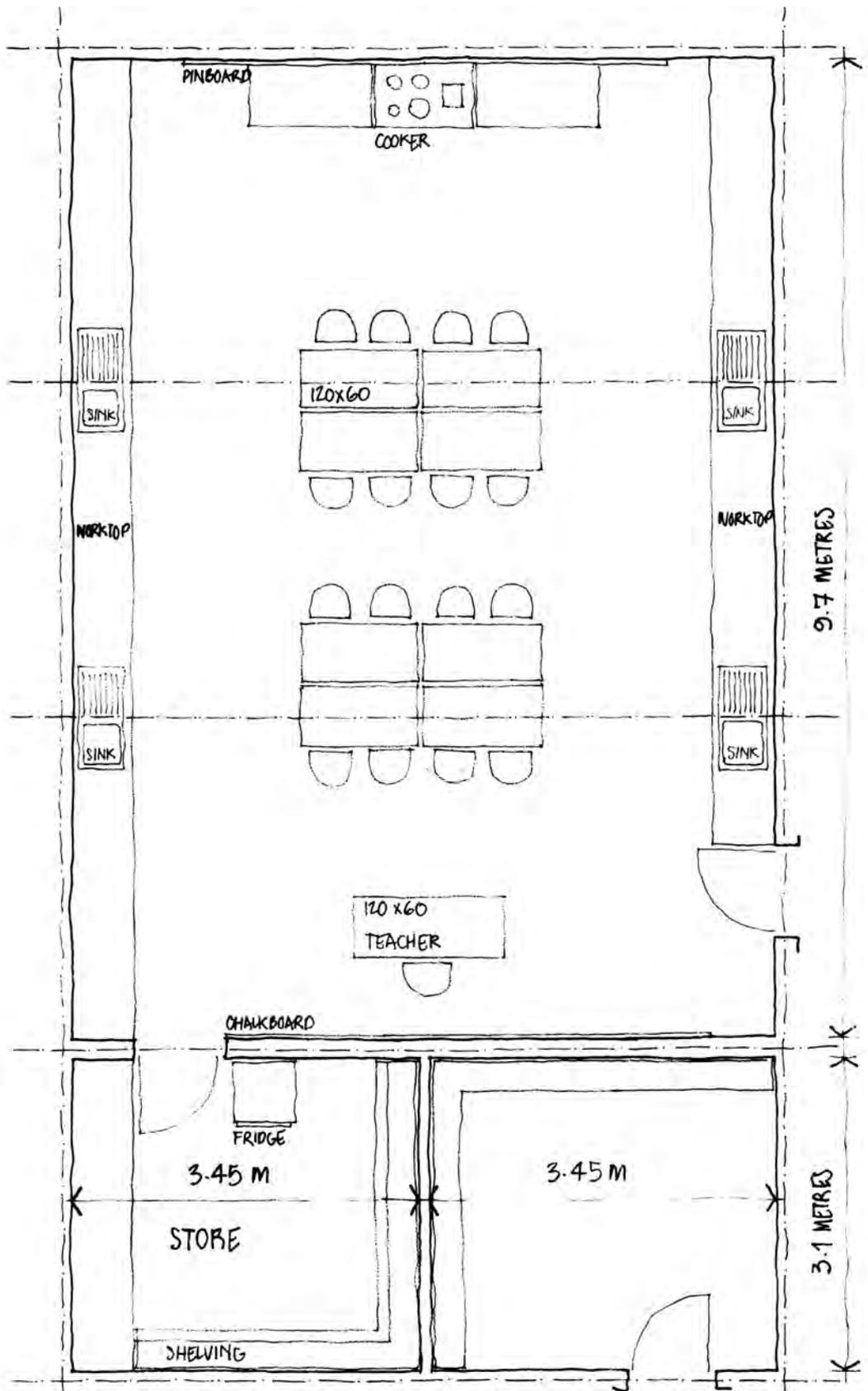


CHEMISTRY LABORATORY - NOTE TAKING YN/16



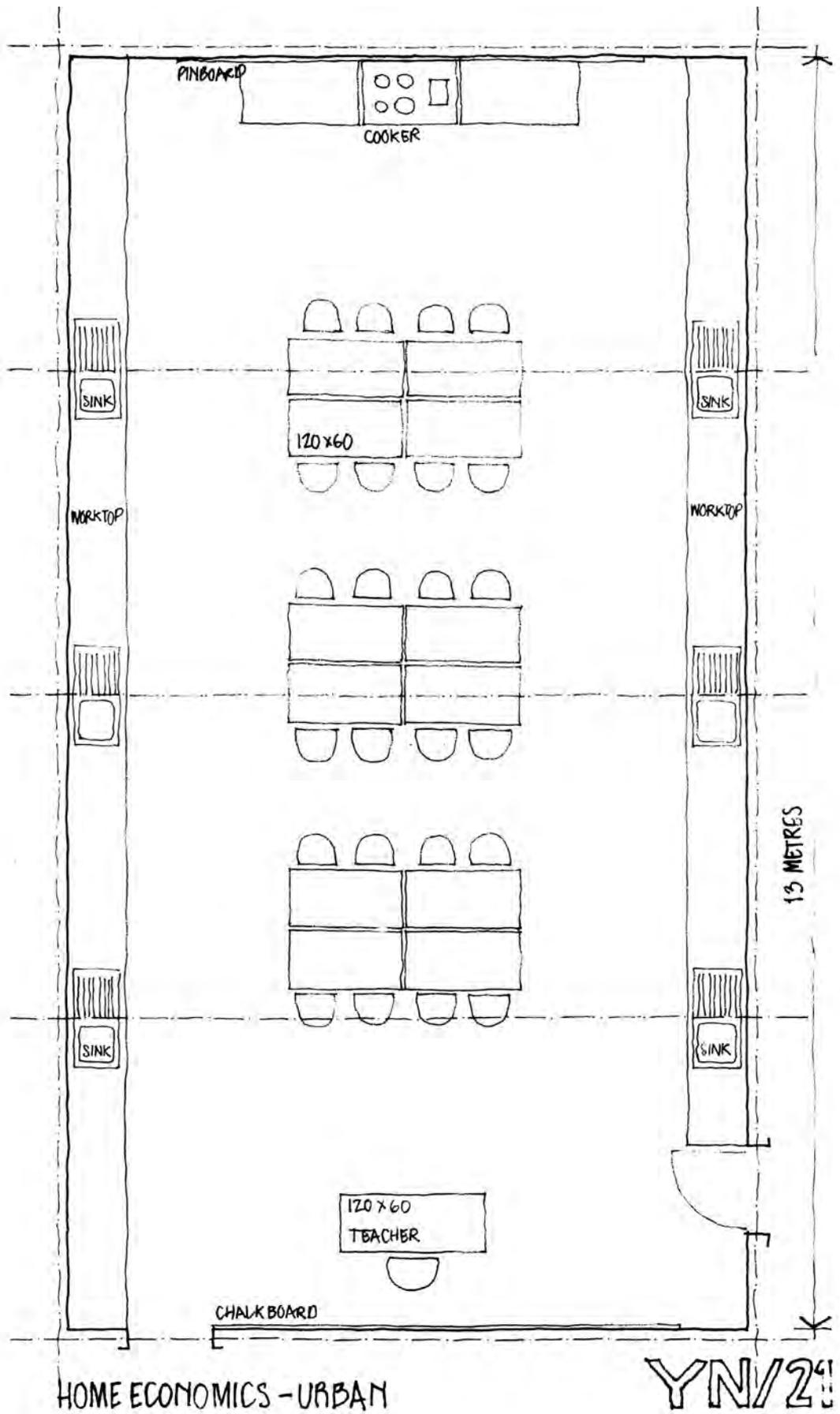


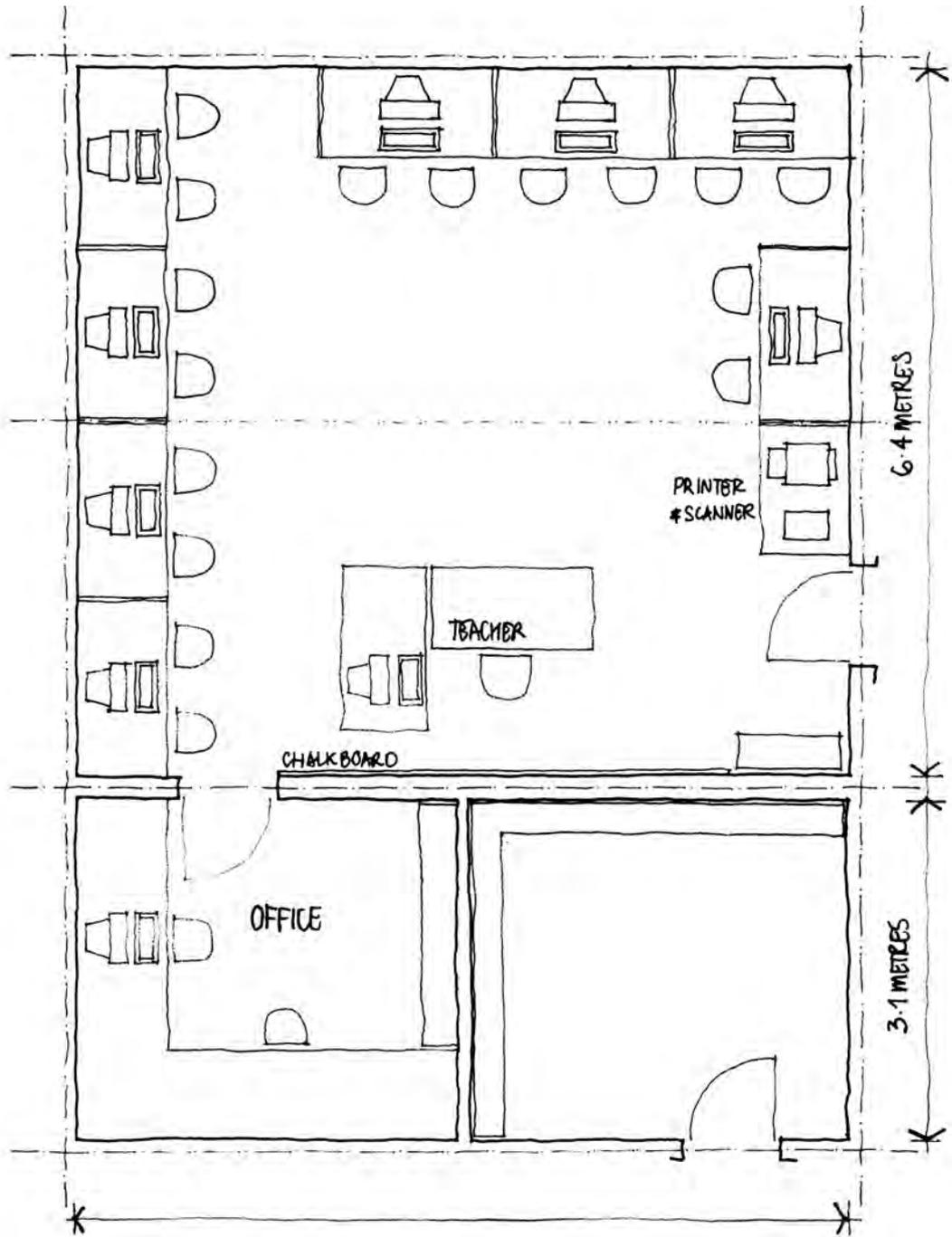




HOME ECONOMICS - RURAL

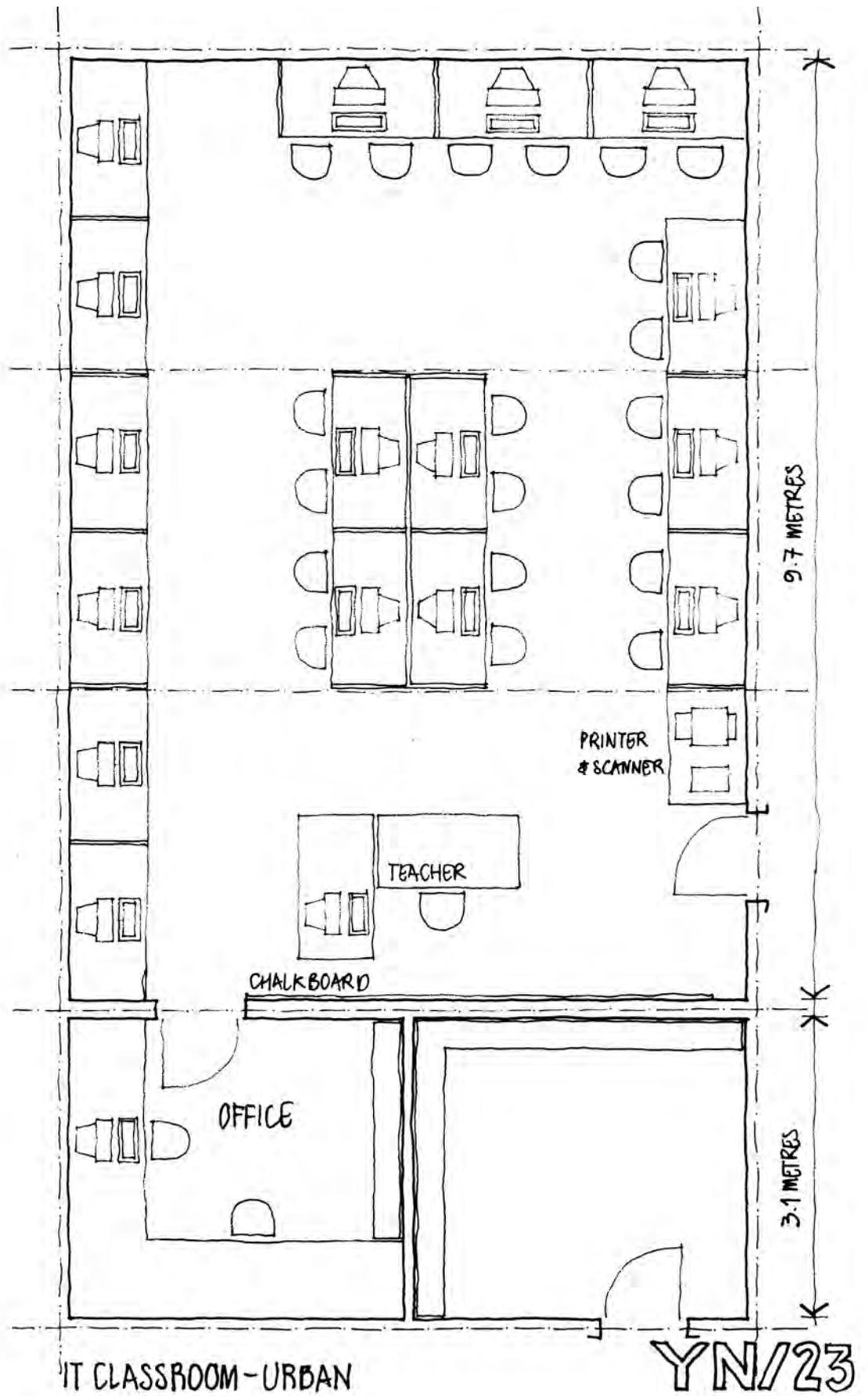
YN/20

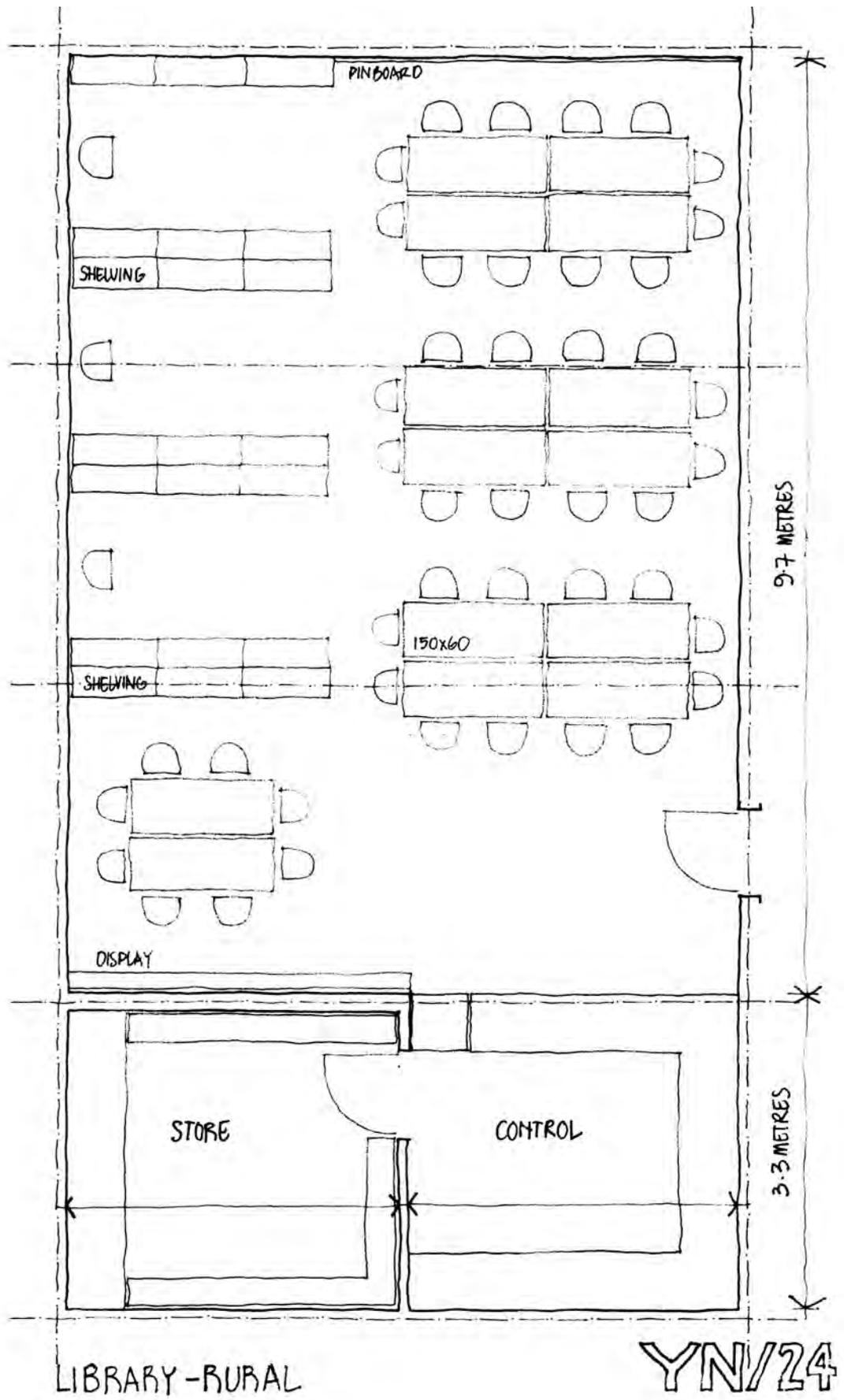


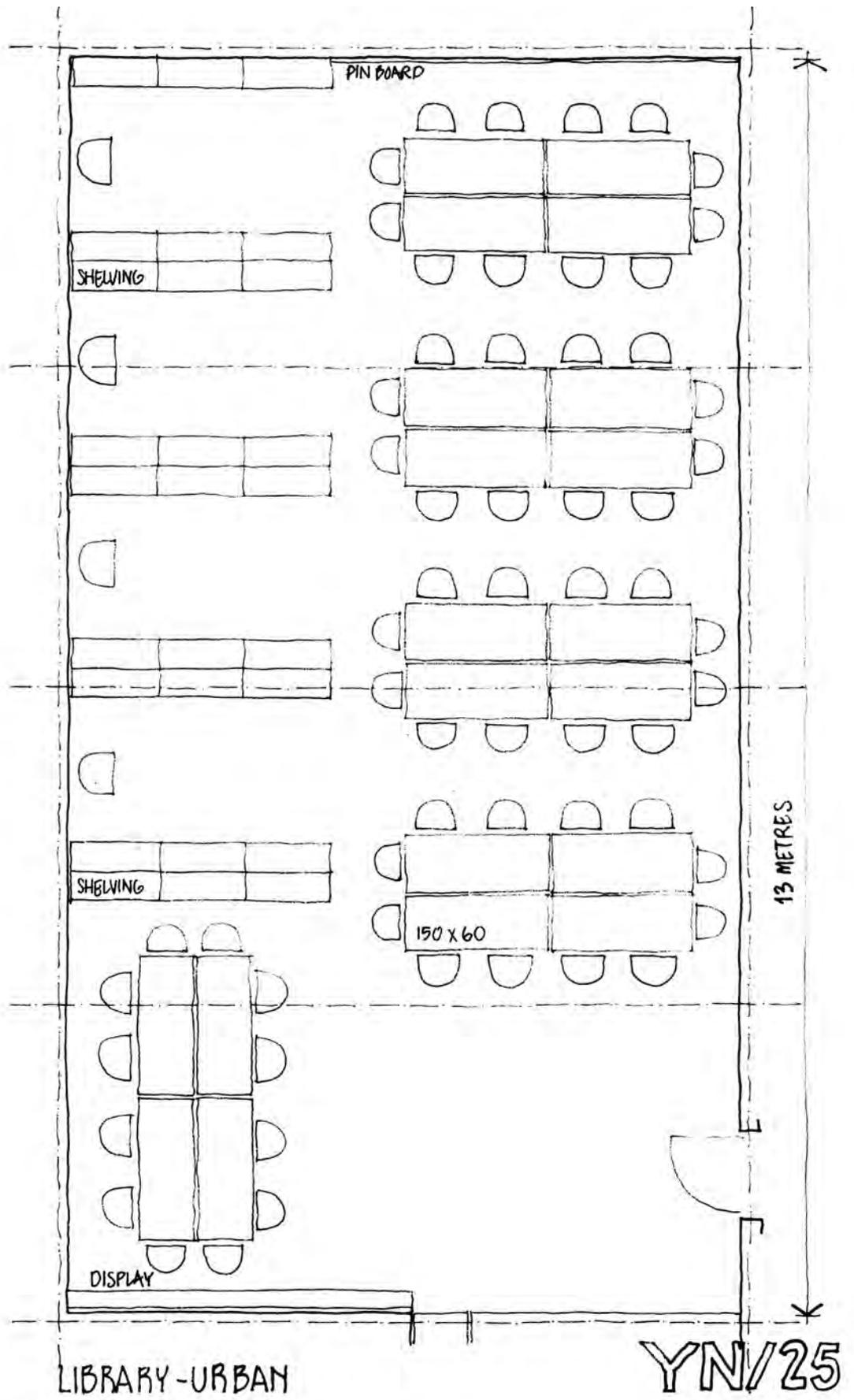


IT CLASSROOM - RURAL

YN/22







ANNEX 4: ASSET MANAGEMENT

4.1 General

Asset management is a way of ensuring the maximum economic use of built resources over a given period of time. In the context of education facilities in a developing country this would mean the most efficient use (and renovation if necessary) of existing facilities and the construction of new facilities only in locations where they are absolutely necessary using the most economic means of construction whether by contractors or local communities. It would also include a maintenance plan for existing and new facilities to ensure that they have a long life at the lowest cost.

The initial cost of a building should not be seen as the final cost. The total cost over the expected lifetime of a building will include the initial cost of the buildings, furniture and equipment, the cost of maintenance, the cost of any major repairs and re-modelling, the cost of maintaining and replacing furniture and equipment and the cost of demolishing the buildings and disposing of the unusable materials.

It can be seen therefore that the provision of new buildings even if totally funded initially by external donors can become a liability to governments if they do not have the funds to cover the recurrent costs over the life of the buildings. It may well be more economic to retain and renovate existing buildings and use them more efficiently as this will mean not providing additional buildings which will have to be maintained in the future. Planners need to address these issues before embarking on any large scale school building programme.

An asset management plan should therefore be prepared before any new school building programme or initiative is embarked upon. This plan will establish what school buildings already exist, where they are, what condition they are in, what repairs they require and how long they will last (*the asset register*) as part of a school mapping exercise. The educational planners will then set out their requirements and priorities in terms of standards and buildings and/or teaching spaces (*design standards*) and establish the demand for facilities and the locations where they will be required both at present and over a ten year period (*demand for facilities*). It will then have to be decided how these buildings will be provided, whether by renovation or extension of existing facilities or by new build (*effective use of resources*), what materials will be required, what resources are available in terms of materials and skills (*resource mapping*) and how the renovation or construction work will be carried out (*construction and management methods*). A maintenance plan should then be put in place to ensure that the assets are properly maintained and looked after and function as designed over the whole of their life cycle (*maintenance*). An important asset and one that is often overlooked or not considered, is school furniture and the provision, sizing and maintenance of school furniture should be carefully considered (*furniture*).

4.2 The Asset Register

As part of the school mapping exercise an asset register should be established that shows the location, condition and expected life of all education facilities within a governorate, district or sub-district.

The register should accurately locate all existing schools on a map and use the same serial numbers as used in the school mapping data to identify them.

The following information should be established for each school:

- The date of construction of all schools together with the numbers and types of all buildings i.e. classrooms, offices, stores, teachers' rooms, and staff housing.
- The type of construction of all buildings should be listed together with their size, condition, any repairs that are required and the expected life of the building after repair. Any repairs recently carried out or planned to be carried out under any current school renovation projects, should also be noted.
- The type, amount and general condition of any furniture and equipment should be listed. Any furniture or equipment recently supplied or scheduled for delivery in the current year should also be noted.
- The existence of services such as piped water and electricity supplies should be noted together with comments on whether and when they operate. The existence of wells and their condition i.e. whether full or empty, covered or open or provided with a pump and storage tank or other water supply should also be noted. Any new water supplies recently provided or planned to be provided in the current year should also be noted.
- The type (flush, latrine, pour-flush privy, VIP latrine, composting latrine, etc) and number of toilets on the site, their location and working order should be noted. Any toilets recently upgraded or built or planned to be upgraded or built in the current year should also be noted.

This register, once compiled, together with the school map will form one of the main educational planning tools and should be updated on an annual basis by the educational department.

4.3 Demand for facilities

The school mapping and data collection programme will also establish the numbers of school-age children in any particular district, the numbers of pupils at existing schools and thus the existing demand for school places. The educational planners should then prepare estimates of the numbers of school-age children over the next ten years using census or other population data in order to estimate the future demand for school places at all levels.

It will then be possible to establish how many new classrooms or schools will be required over the coming ten year period, when they will be required and in what location. These estimates should be checked and updated annually and the numbers of new facilities required adjusted as necessary.

4.4 Effective Use of Facilities

Having established what school places exist, the number of existing students and an estimate of the future demand for school places, the educational planners should look carefully at the use of the existing facilities before planning the construction of any new ones.

The construction of new schools or classrooms has implications for the education budget beyond the initial cost of construction. The more buildings there are, the more these buildings will cost to maintain or renovate in future and the more classrooms there are then the more teachers will be required to teach in them.

The existing resources should therefore be examined in detail to see if more efficient and effective use can be made of them and the number of new facilities to be built should be reduced to a minimum.

Measures that might be considered are the use of multi-shifts in schools to make the maximum use of the available facilities especially in urban areas; the use of clustering where several schools within walking distance share specialised facilities (laboratories, workshops, computer rooms, etc) thus reducing the overall need for these facilities and the use of distance learning including TV, radio and the internet to reduce the need for facilities.

4.5 Resource Mapping

Before designs for any new facilities are prepared, an assessment should be made of the resources available locally which will include the building materials, local traditions of design and construction and local building skills as all of these will (or should) affect the design and construction of any new facilities that might be required.

Whatever the design of the school buildings, it is important that they are simple to build using wherever possible locally available materials. This will not only save transport costs but should ensure that the materials and the techniques for using them are understood by local communities and builders.

If traditional or locally understood designs can be followed even with improvements then this will also assist local builders in constructing them.

The numbers and skills of local builders should also be investigated to ensure that there is sufficient local capacity to carry out any building or renovation programme. If new materials or techniques are being introduced then training programmes will have to be put in place.

The construction of educational facilities will require supervision and management but if local builders or communities are to carry out the construction then the amount of supervision and management required will be even greater. This should if at all possible be carried out by local civil works consultants with knowledge and understanding of local language, customs, construction techniques, etc and their numbers and capacity to do this should also be established.

4.6 Construction Methods

Any construction or renovation programme can be carried out in a variety of ways: by using large contractors to carry out a large construction programme; by using small contractors or local builders to carry out parts of a larger programme; or by using local communities to either build their own facilities or manage local artisans to construct their facilities. The way the buildings are constructed will have implications for the supervision and management of the construction programme.

If a large contractor is used there should be less need for professional supervision on a day-to-day basis but there will be less (or no) local ownership of the buildings and there will be the potential for corruption possibly on a large scale. Construction costs will probably be high, the use of local skills and the benefits to the local economy will be lower and there will still have to be some supervision and monitoring of progress, standards and payments.

If smaller contractors or local builders are used then there will have to be much more supervision (and supervision costs will therefore be higher) to ensure that standards are met, the construction programme is complied with and the funds are properly expended and there will still be the potential for corruption. There will probably be more use of local labour however and the construction costs should be lower. As pointed out above, it will be important to use local materials and techniques that will be familiar to the local builders.

If local communities are to construct the facilities or manage local artisans to do so there will have to be even more supervision and management than with small builders, probably on a day to day basis but there should be increased benefits in the form of more local employment, more local ownership of the facilities and less possibility for corruption if the funding is handled in a transparent manner.

4.7 Design Standards

Before any designs for school facilities can be prepared, appropriate national standards have to be established if these are not already in place.

Setting effective standards for buildings and furniture will require an interdisciplinary team where educationalists, architects and cost specialists work together to promote solutions that ensure an adequate quality of education and are yet functional and affordable.

When these standards are set, if new facilities are required the education department should commission architects (preferably local ones) to prepare designs for facilities that take into account national standards, local cultural norms, the climate, locally available materials and skills, local building codes, the construction method and the overall objectives of the programme which might include, as well as educational objectives, objectives such as poverty reduction, increasing local employment, improving construction skills, etc.

If it is necessary to renovate large numbers of existing educational facilities it is also essential that properly qualified and experienced civil works consultants are engaged to carry out surveys of the buildings and prepare proposals for renovating them in accordance with the educationalists' brief.

4.8 Maintenance

In order to obtain the maximum economic use of educational facilities throughout their life, it is essential that they are well maintained and a maintenance plan should be put in place at the time of construction.

However the buildings are constructed they will require maintenance and funding for cyclic, preventative maintenance should be built into the education budget annually.

The cost of maintaining buildings will vary with the construction materials and methods, climate, location etc but as a rule of thumb for simple buildings in developing countries, approximately 2% of the initial cost should be allocated for maintenance every year. Obviously the maintenance costs in the first few years will be low and will build up as the buildings get older.

The type and method of construction will both have implications for maintenance. If low-cost local materials are used such as mud-blocks and thatch, they will probably

have to be maintained or renovated at shorter intervals than more expensive, more durable materials such as concrete blocks and clay tiles or corrugated steel sheets.

Similarly, if communities or local artisans carry out the construction, the intervals between maintenance will probably be shorter than if competent contractors are used. A value judgement will have to be made therefore during the design of the project on what the priorities are. Is local involvement and ownership for instance, more important than long life and low maintenance?

In developing countries finding funding for maintenance can be very difficult and this budget, if it exists, is usually the first one to be cut in times of economic hardship. Involving local communities in the ownership and maintenance of educational facilities is therefore very important in ensuring that the buildings have a long and productive life. Community participation can take the form of raising funds to cover maintenance costs or the provision of labour and materials. One problem of community participation in maintenance is that it is often carried out by people unqualified in dealing with technical problems. There is a great need therefore for maintenance training and manuals.

If local communities are involved in the construction or renovation process this is likely to give them more interest in and ownership of the facilities and thus responsibility for maintaining them. If this is made explicit at the beginning of the process and accepted by the communities then training in maintenance should be built into the project together with the production of simple maintenance handbooks for use by the communities and/or schools. This can help reduce the cost of maintenance greatly.

4.9 School furniture

The most obvious link between the environment and learning is the need for a basic level of comfort so as to permit learners to concentrate on their studies. There is a need for thermal comfort, good lighting and not least physical comfort when sitting and writing or reading. Furniture therefore has a major role to play in ensuring the comfort of learners and thus enabling the learning process.

Furniture should be seen as a resource in the same way as buildings and should be sized correctly, fit for its purpose and be well made. Good quality furniture is expensive and should therefore be well maintained in order to prolong its useful life.

The amount and condition of furniture at individual schools should be checked during the school mapping process and a programme for the supply of furniture to those schools with insufficient or poor quality schools and new schools started as part of any education project or initiative.

The two most important aspects of furniture supply are the sizing and the type of furniture. In order to ensure comfort for all pupils, furniture should be supplied in a range of sizes to fit the whole school age population. A decision has then to be made as to how the furniture is to be made and of what materials.

Room size is a function of furniture size and final decisions on classroom sizes should not be made until the range of sizes of desks and chairs is decided.

ANNEX 5: CIVIL WORKS CONSULTANT’S TERMS OF REFERENCE

Technical Assistance:

Prepare Project Component on Physical Inputs to Improve Access to Secondary Girls’ Education in the Republic of Yemen

Reference: PHRD for the Preparation of the Girls’ Secondary Education Project (TF055138)

Background

Beginning in early 2005, with support from the World Bank, the Ministry developed its Secondary Education Development Strategy to address a number of challenges facing the sector. The Strategy identifies priority measures to be taken towards its stated objectives: expanding access with equity and equilibrium and improving completion rates of secondary education; improving the quality and relevance of secondary education; and improving the efficiency of secondary education at central, local and school levels. The strategy document was endorsed by the Cabinet in December 2006. The government’s recently approved Third Five-Year Plan includes measures for the education sector fully consistent with the Ministry’s strategy for secondary education.

Substantial work has already been accomplished. In 2004 and 2005, the GoY held a series of workshops to reveal the perceptions of stakeholders on the key issues and priorities related to secondary education. Relevant quantitative information has been compiled in databases. In addition, the following has been accomplished:

- Preparation of a background report on the current situation of secondary education in the country, a review of relevant international experience, and review of GoY’s educational development plan;
- Preparation of a strategic framework for the development of secondary education, and adaptation of the financial simulation AnPro Model (developed originally by UNESCO) for use in Yemen’s education sector;
- Preparation of a sector work paper, *“Issues and Options for Secondary Education in Yemen;”*
- Development of the Secondary Education Project Preparation Team (SEPPT); and,
- Finalization of the Secondary Education Strategy for the period 2007-2015.

The proposed development objective of the proposed Girls’ Secondary Education Project (GSEP) is to: “reduce the gender gap in secondary education while laying the basis for related improvements in the quality, relevance and efficiency of secondary schooling.” The government’s current strategy for secondary education addresses the need to increase access for girls and develop more diverse, relevant and cost effective curriculum options. In order to support the implementation of the proposed strategy, in particular with reference to the forthcoming preparation of the proposed Girls’ Secondary Education Project (GSEP), specific activities are required.

Current Situation

The Ministry of Education (MOE) has received a PHRD Grant from the Japanese Government through the World Bank towards the cost of the preparation of the Girls Secondary Education Project. The Ministry seeks consultants with international

experience in the areas of project preparation, education project management, and strategies to assist the Ministry in this process. The selected consultant will provide advice as to the appropriate and cost effective interventions in this area, the best institutional arrangement for supporting the interventions, and the roles of the MOE, governorates, and districts in supporting the proposed activities. The work of this component will complement on-going initiatives in basic education with selected interventions at the secondary level. Measures under consideration include new school construction, renovation, rehabilitation, and addition to existing buildings. The TA should also work closely with the TA to design girls' incentive mechanism to ensure that access-enhancing interventions and policies are most appropriate to encouraging girls' enrolment and retention in schools.

Objective

Assess current state of secondary school mapping, school design prototypes, and planning for physical inputs to enhance girls' enrolment in Yemen and provide the Ministry of Education with recommendations on priority interventions and preparation of project component at the secondary level.

Activity/Output	Estimated Duration/ No of days	Deliverable
Working directly with the Project Sector and other relevant groups, the Consultant will:		
1. a) Review all relevant documents and correspondence related to the specifics of basic and secondary education plans, projects, and results as they relate to school mapping and planning for school construction.	3	Literature review
1. b) Prepare a Tentative Work Plan based upon these Terms of Reference, the review of relevant documents, and correspondence with the Project Administration Unit (PAU).	2	Tentative Work Plan
2. Review the Tentative Work Plan upon arrival in Yemen with the counterpart team, Project and Maintenance Sector, the SEPPT, and the PAU and prepare Revised Work Plan based on these discussions.	1	Revised Work Plan
3. Assess the current state of the secondary school map. The assessment should determine usability for creating a project proposal for physical inputs for enhancing girls' enrolment.	5	Analysis of school map
4. Assess the current state of secondary school design prototypes or build on ideas for such prototypes. The resulting analysis should include cost effectiveness, opportunity, constraint, risk, success, and feasibility in relationship to potential changes to curriculum and programs and the attendant changes to school physical plants including laboratories, multipurpose rooms, libraries, ICT configurations.	10	Reports
5. Conduct workshops on current international best practice in construction, renovation, and addition in increasing girls' participation in secondary education. Workshops will be planned and delivered using a team approach and will be experiential, activity based, explorative in nature, and focussed on practical application of principles. Workshops should be delivered to MOE staff in the Technical Office and Project and Maintenance Sector.	10	Workshops, presentations, and/or seminars Package of resource materials including presentations, work sheets, etc.
6. Work with SEPPT, Project and Maintenance Sector, Technical Office, and PAU to prepare a set of specific recommendations for project design, including policy for effective use of existing classroom space (e.g., rotation, double shifting, public-private partnership, bussing, etc.), and specific interventions to be financed under the project including policy on new construction, rehabilitation, extension, maintenance, as well as criteria for selection of	14	Recommendations

school sites for these activities and linkages with existing work on-going with several agencies in basic education.		
7. Based on review and approval of recommendations, work with Technical Office, Project and Maintenance Sector and PAU to prepare a detailed implementation plan including specific schools and locations, cost, timelines, schedule, TA, monitoring and evaluation strategies, and processes to be followed.	10	Project plan
8. Develop a series of progress reports and a summary report containing recommendations for strategies to be utilized in the expansion and improvement of the managerial and operational capacity of the Sector for submission to the Ministry of Education.	5	An Interim Report and Final Report
TOTAL	60 days	

Summary of Deliverables

Deliverable	Suggested Timeframe
1. Literature review and Tentative Work Plan	April 1- April 7
2. Revised Work Plan reflecting input from the SEPPT, the TO, the Project and Maintenance Sector, and the PAU upon arrival	April 7-11
3. Assessment of the secondary school map.	April 7-28
4. Assessment of secondary prototypes	April 7-28
5. Interim Report due prior to the Secondary Education Dialogue mission (early May 2007). The Consultant is required to make a presentation to the Govt. and Bank team on preliminary outcomes of the study.	May 3
6. Conduct workshops	April 28-May 16
7. Recommendations	May 16-31
8. Detailed implementation plan	June 1-15
9. Final Consultant Report due prior to Project Preparation mission (early July 2007). The consultant is required to undertake a joint presentation with the Govt. to the World Bank team on outcomes of the study and proposed component design.	June 30

Working Arrangements

The Consultant will be assigned a counterpart individual/team that will act as day-to-day liaison for the consultancy and will provide services such as data gathering, interpretation, review of materials, etc.

The Consultant will be provided with suitable working arrangements by the Ministry of Education including workspace, local telephone, and access to printing and photocopying. The Consultant will be expected to work in the MOE offices within the regular working hours of 8:00-3:00 Saturday to Wednesday. Meetings, conferences, workshops, etc and the requirement to produce work within a specific time period may require work or attendance outside of the worksite. The Consultant is responsible for providing his/her own portable computer, mobile phone, and internet access. Transportation and translation are the responsibility of the Consultant, although the Ministry may provide transportation to specific events. Secretarial support will be provided by the PAU.

Reporting

The work will be performed in collaboration with the staff of the Project and Maintenance Sector (PMS). Day to day liaison and monitoring will be done by the PMS counterpart individual or team. The PAU PHRD Technical Coordinator will be responsible for supervising the consultancy. The Consultant will report through the PAU to the SEPPT.

The deliverables identified above will be delivered to the PAU PHRD Technical Coordinator for approval and distribution. The Interim and Final Reports must receive initial approval from the SEPPT.

Qualifications

Educational Background

The Consultant will possess at least a degree in architecture or an equivalent combination of credentials, knowledge, skills and abilities related to construction, building, and project management in the education area.

Professional Experience

- At least 10 years experience in construction in education in developing countries
- Relevant experience with development project involvement and management will have been at a school system, ministry of education and/or national/international levels
- Extensive experience in drafting/preparing project materials for international agencies and governments, especially experience with World Bank-financed projects would be a plus.
- Understanding and appreciation of the issues in the education sector in Yemen or other countries in the region

Language Requirements

The Consultant will possess excellent written and verbal skills in English. Preferred candidates will be bilingual in Arabic and English.

Duration and Terms of the Contract

The expected start date for this consultancy is April 2007. The level of effort will be for 60 working days over a duration of three months, linked closely to the World Bank-financed Girls Secondary Education Project processing schedule. The actual start date will be determined by the availability of the Consultant and local conditions such as school or national holidays, or other circumstances.