THE PEOPLE'S REPUBLIC OF BANGLADESH
REPORT ON PRELIMINARY SURVEY
FOR
CONSTRUCTION PROJECT
OF
TELEVISION STUDIO

JULY 1977

JAPAN INTERNATIONAL COOPERATION AGENCY

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CHAPTER 1: SUMMARY OF SURVEY

1-1 Details of Auditorium Construction Planning

This auditorium had been designed as public television studio, and the building itself was completed about 9 years ago. Since then, from October 30, 1974 to January 28, 1975. Mr. Yukio Watanabe, a member of Nippon Hoso Kyokai, was dispatched as a specialist for the Japan International Corporation Agency and made a basic survey. As a result, the technical instruction report was compiled. However, as a considerable time had elapsed without any subsequent development, this survey team's work came into being.

Upon survey of the local circumstances based on Mr. Watanabe's report, the commission of this survey team was to make a basic design and, to the extent possible, complete the data necessary for execution of the design.

1-2 Organization and Schedule of the Survey Team

The survey team was composed of 1 member of the Ministry of Posts & Telecommunication, 3 members of the Nippon Hoso Kyokai, and 1 member of the Japan International Corporation Agency; it was this five member team which carried out the survey in the three weeks period from March 24 to April 13, 1977.

Details are as follows:

Organization of the Survey Team

Leader	Heiji Kagechika	Deputy Director, Broadcast Engineering Division, Radio Regulatory Bureau, Ministry of Posts & Telecommunications (summary of all surveys)
Member	Akihisa Asano	Senior Engineer, NHK Technical Headquarters (for construction)
Member	Koshiro Hibino	Senior Engineer, Studio Facilities Group NHK Technical Headquarters (for stage decoration)
Member	Teruji Yamamoto	Senior Research Engineer, NHK Technical Research Laboratories (for sound)
Member	Yoshihisa Kondo	Social Development Corporation Department, Japan International Corporation Agency (business coodination)

Survey Itinerary

March 24 (Th.)	Depart Tokyo, Arrive Bangkok
March 25 (Fri.)	Depart Bangkok, Arrive Dacca Consultation at Japan Embassy and Japan International Corporation Agency Office
Marcy 26 (Sat.)	Surveying Bangladesh Television Installation
March 27 (Sun.)	Surveying Bangladesh Television Installation
March 28 (Mon.)	Conference with BTV concerning the detailed planning
March 29 (Tue.)	Conference with BTV concerning the detailed planning
March 30 (Wed.)	"
March 31 (Th.)	"
April 1 (Fri.)	Investigation of extension of building
April 2 (Sat.)	"
April 3 (Sun.)	Actual survey of buildings in the city
April 4 (Man.)	Making drawings of buildings and installations Visiting Ministry of Information and Broadcasting, and Planning Committee
April 5 (Tue.)	Conference on extension planning Making the actual measurement for sound

April 6 (Wed.)	Conference on stage facilities
April 7 (Th.)	Drawing preparation
April 8 (Fri.)	Conference on memorandum planning
April 9 (Sat.)	Conference on memorandum planning
	Actual survey for sound and air-conditioning
April 10 (Sun.)	Actual survey of buildings in the city
April 11 (Mon.)	Memorandum Exchange
April 12 (Tue.)	Visiting the embassy; consultation, leave Dacca,
	Arrive Bangkok
April 13 (Wed.)	Leave Bangkok, Arrive Tokyo

1-3 Organization of BTV (Bangladesh Television Broadcasting) and This Survey Main Respondents

The organization of BTV is as shown in Table 1-1. For this construction planning, the planning committee responsible for over-all national economic planning has been participating in addition to the Ministry of Information and Broadcasting. Main respondents from BTV for this survey are shown in Table 1-2. A memorandum summarizing this survey has been exchanged with Mr. Amir-Uz-Zamam Khan, Director General of BTV.

Table 1-1 BTV's Organization Chart (as of April 1st, 1977)

President

Prime Minister

Minister of State of Information & Broadcasting (Mr. Akbar Kabir)

Secretary, Ministry of Information & Broadcasting (Mr. Colam Mostafa)

Bangladesh Television	Radio Bangladesh	Other Dept.

Director General Bangladesh TV
(Mr. Amir-uz-zaman Khan)

Chief Engineer (Mr. A.M.M.Aabad)	Director Programmes (Mr. Salimuddin Ahmed)	Director Administration (Mr. Abu Naim Ahmed)	Chief News Editor (Mr. Humayun Chy)	Chief Accounts Officer (Mr. Wahidul Hossain)	TV. Station

Engineering Manager (Project)-1
(Mr. S.M. Nousher Ali)

Engineering Manager (Project)-2
(Mr. M.A. Wahed)

Dacca TV Station

General Manager
(Mr. Mustafa Monwar)

Programme Manager-1
(Miss. Khaleda Fahmi)

Programme Manager-2
(Mr. A.A. Mamoon)

Engineering Manager
(Mr. Abu Taher)

News Editor
(Mr. Mushtaq Ahmed)

Administrative Officer
(A.B. Nafizur Rahman)

Accounts Officer
(Mr. Serajul Hog Miah)

Table 1-2 Main Respondents for This Survey Team

Name of Staff	Present Position	Part to be in charge of the Auditorium
Mr. A.M.M. Aabad	Chief Engineer	Video, Audio and related Technical Facilities
Mr. Salimuddin Ahmed	Director Programmes	Programme Planning
Mr. Mustafa Monwar	General Manager	Stage and Lighting facilities
Mr. S.M. Nousher Ali	Engineering Manager	Manager of the Auditorium
Mr. K.G. Rabbany, M.D.	Consociates International Ltd.	Architecture Adviser
Mr. Munir Ahmed	Architect	Architect.

Table 2-1 Various Facts of Building *1

	Floor Space	Total Space *2	No. of Floors	Construction
Existing part	990 m^2	1,400 m^2	3 floors	Reinforced concrete
Additional construction part	720 m^2	1,700 m^2	3 floors partially 5 floors	- ditto -
Total	1,710 m^2	3,100 m^2		

*1: Space only related to hall.

*2: No draught space included.

CHAPTER 2: SUMMARY OF CONSTRUCTION PLANNING

The basic design previously planned was based on the existing building. However, for the present survey BTV issued requirements regarding uses and auditorium facilities not to be restricted by the existing building. As a result of examination, the basic design of stage facilities, sound facilities and air conditioning equipment have finally been completed by additional construction. The purpose of use and a summary of construction planning for the auditorium are as follows:

2-1 Purpose of Use of the Auditorium

2-1-1 Main performances

National events, conferences (excluding international conferences), dramas (TV dramas and group dramas), audience participation programs, national music, dancing, and rental purpose etc.

2-1-2 Subordinate purposes

Movies (provides a room to accommodate a projector), and the production of normal television programs.

2-2 Construction Relations

Hanging decorations of the stage set cannot be moved up and down because the stage area of the existing building is low and narrow. Therefore, the depth of the stage has been increased and a side stage established, which has a draught equivalent to five floors.

With television broadcasting in mind, the sub-control room has been located so that the stage is easily visible. The locations of accessory rooms have been changed. Various facts of the building are indicated in Table 2-1.

2-3 Stage Facilities

The thick curtain, sleeve curtain, baton and cyclorama have been arranged so that the progress of drama can be smooth and functional. As for lighting, its possible use in television lighting has been kept in mind. For stage lighting itself, more effective use of flood light spot light and horizont light are contemplated.

2-4 Acoustic Relations

As acoustics are a most important element in an auditorium, the design has been made considering the acoustic absorption due to the shape of the room, interior materials and seats so that time of reverberation etc. can be appropriate. The loudspeaker facilities were examined for output, quantities and location taking into consideration acoustic volume and tone quality in the seating area. For sound shielding, noises from the air-conditioning room and airplanes were chiefly considered (upon completion of the new airport, an air lane would be directly above the auditorium).

2-5 Air conditioning Facilities

The air conditioning has been designed to make various adjustments possible by division into several systems in accordance with the

usage of each room. As for noise removal, examination was made for acoustic absorption, silencers and anti-vibration devices. At present, the air conditioning equipment of BTV is making too much noise; it would be improved, however, if appropriate measures were taken in accordance with the present noise countermoves.

2-6 Other Facilities

Examinations have been made for broadcasting facilities, electrical installations, security installations and communication facilities, etc.

SECTION NO. 3: BASIC CONSTRUCTION PLAN

3-1 Restrictions due to existing structures

The basis of this plan is to create the most functional theater possible which will fulfill the previously proposed use objectives within the restrictions of the existing building i.e. without building a new hall but by adding the necessary facilities to the building, which was originally planned as a TV studio for audience participation programs.

These conditions were agreed upon by the survey group and BTV from the beginning of our discussions. Seen from this technical point of view, the first problem is whether the structural strength of the existing building can support the additional installation of the various necessary facilities. When this building was first designed, Bangladesh was a part of Pakistan. The structural calculations and part of the drawings were lost in the confusion of the war.

Furthermore, for various reasons the original designer had been replaced by another architect and relations with the former have been discontinued. As a result, there is nothing to do but check the existing structural drawings with a professional in structural dynamics, and taking time to gather information regarding original planning, superimposed load, earthquake and other external force design values. However, such time was not available during the survey. Fortunately, as the team leader of the present consultant

was the professional engineer for structural planning, his opinions were tentatively adopted for solving problems in this area in order to facilitate planning (for example: assumed live-load on the roof was approximately 500kg/m^2). In the actual design steps to be put into effect, rechecking of detailed structure could be necessary. As a result, reinforcement of part of the building and amendment of part of the plans may or may not become necesary.

3-2 Extension of scenery space

General dramas and entertainment shows are among the main purposes of use. For these large scale plays, the previous design was not sufficient in stage area or height, and an orchestra pit of adequate size could not be accommodated. These facts were the greatest reason for not having continued the construction work. This time, various plans have been studied in order to solve these problems completely. In the end, the orchestra pit has been enlarged by moving the proscenium back to G line, and almost all of the rest of the stage has been left as an acting area. Also, the existing external wall, including pillars and beams, located at the rear part of the stage has been removed completely, and an expansion plant to provide scenery space, i.e., the rear part of the stage, was adopted.

In Japan, this kind of planning is impossible due to the incorporation of bearing walls, pillars and beams as part of the main anti-earthquake structure. In Dacca, however, the possibility of earth-quake is nil and the pillars and beams of the wall have no

relation to the rigid frame (an opinion from the above mentioned consultant). Regardless of the absence of earthquakes in the past, there are some fears of them in the future, but all buildings (including the existing part of the BTV broadcasting center building) have been built on the assumption that there would be no earthquakes. Given that this factor became clear as the result of a supplementary survey, it was decided that this kind of planning was possible in the present case.

The height of the existing part is equivalent to three floors. However, as sufficient height is required for back drops or set panels, the height of additional construction for the rear part of the stage is approximately 45 feet of grid height plus enough additional height for the operational space. In other words, the height is equivalent to approximately five floors.

3-3 Construction planning for the front half of the stage

In a normal theatre, sufficient height is required to make possible full use of flies over the entire stage; in other words, the planning of a height equivalent to five floors has not only been required for the rear half (the scenery space) but also for the acting area.

In this hall however, a large scale reconstruction of the existing building would be required to do this. Given that it would constitute an increased financial burden to BTV and that the absolute necessity of providing files in the acting area is relatively small compared with that in the scenery spare, it

was decided that this reconstruction was not necessary; also, hanging of teasers can make possible a certain amount of flying.

3-4 Adoption of proscenium theatre style

The world wide tendency in recent theatre planning has been toward open theatre styles, especially for small theatres or studios for audience participation TV programs. On this point, however, the intention of BTV is as follows: "There have been no full-scale theatres in Bangladesh. As this hall is to be the first, a proscenium theatre based on the most orthodox forms is desirable."

Certainly even in western countries and Japan, the open style theatre was built following the proscenium style which came first. The pattern of proscenium style theatres has now become comparatively standardized all over the world, and its operational effectiveness has been proved. On the contrary, the open theatre style still has many experimental elements, and has not been proved as the standard style to be recommended as the only theatre in the nation in this case. For these two reasons, planning of this hall in accordance with the standard proscenium style was appropriate.

3-5 Dimensions of proscenium

In the case of a proscenium theater, the suitable dimensions of the proscenium depend on the plays to be staged. The scale of the stage and the auditorium will be settled as a function of the

dimensions of the proscenium. In the case of this hall, the structural scale has already been settled. Therefore, the reverse operation naturally has to be considered. By taking these factors into consideration, the width of the proscenium has been set at 44 feet. From the sight lines of the audience, sitting at both sides of the first row, a plan to narrow the proscenium width and to increase the width of the wing curtain space is to be considered. However, as this hall is the only one in the country, yet having multiple purposes, many shows requiring widening of the proscenium can be anticipated. The effective width of the proscenium can be increased when required by established practical means. From this way of thinking, as large a proscenium width as possible has been provided, given the installation space for column speakers and the storage space necessary when the traveling curtains are pulled aside. For the height of the proscenium, it has been set at 20 feet, without taking into consideration flying in the acting area.

3-6 Regarding stage depth dimensions

It is standard that stage depth be equal to the width of the proscenium. With this stage in particular, as change of scenery is limitted to the scenery space alone, it is desirable to have sufficient area in this space by extension to the extent possible.

The entrance to the building located behind the stage building can be moved to another side of the power supply building, thus eliminating an obstacle to the projected stage expansion, standard dimensions of the stage have been obtained by increasing the depth of the extension as much as possible.

3-7 Height of cyclorama

The height of the cylorama has been set at 30 feet. Generally, higher figures were recommended, but as a straight line stage, i.e. a stage style having many masking border cutains suspended over the acting area, must be adopted in this case, effective use would not be available even if the height of the cyclorama alone were increased.

3-8 Layout of fly-galleries

The fly galleries are commonly established at both sides and the rear of the stage running along the surrounding wall of flies. They are used in the four following ways:

1) Operation of ropes, control of counterweights
2) Auxiliary lighting
3) For stage effects such as falling snow or petals
4) Provisions against collision between suspended border lights, curtains, and set panels.

With this stage, as there are no flies in the front half, all rope operations for suspension systems are to be operated from a position against the side wall of the side stage.

Therfore, the fly gallery has been established at both sides and in the rear only on the third floor part.

As for the 4th and 5th floors, the side fly galleries have been omitted as unnecessary, and consequently the scale of flies is naturally reduced.

3-9 Extension of side stage

In the previous design, no side stage was planned at stage right while a only certain amount of space was provided at stage left.

Because of this, the usual scene change function could not be expected, and it would prove troublesome for audience participation TV programs as well as the usual plays. Therefore, preparations have been made for the expansion of the required area. The height of the side stage in relation to the height of the proscenium has, as a rule, been set at two floors. In this case, however, the ceiling height of the part adjacent to the acting area at stage right has been restricted to ten feet since removal of the beam of the main rigid frame of the existing building seems to be unfavorable. Even in the acting area, the use of a wagon for scene changes is quite frequent, so tha restriction to that height was regrettable, but compromise was unavoidable. Movement to the stage left, however, allows selection of sufficient height.

3-10 Orchestra pit

One of BTV's main desires was to accommodate 40 members, and this was the second factor in the expansion of the stage. In the previous design, it was difficult to accommodate the approximately 25 members of the BTV folk-music orchestra. However, at present it has been improved to accommodate more than 35 members. Allowance was made for these members by thinking of the usual european musical instruments, and reconsideration may be necessary given that there may be many large size instruments like the koto or special percussion instrument among the ordinary folk instruments.

The orchestra pit floor was to be of the type rising out of the pit, converting it to audience seats and apron stage use where necessary. This has now become one of the common practices in the design of multipurpose theaters. However, as the underground water level of the site is high, and the general level of the machine industry in Bangladesh is not developed enough, it has been considered that the daily maintenance of a mechanism which rised out of the pit and is constructed in the cellar may create considerable burdens.

Therefore, BTV has expressed the desire to select a means for the time being where platforms could be stacked, as required, by manpower; consequently, the plan of installing a mechanism rising out of the pit has been postponed. As it is a very useful installation however, it is naturally necessary to take minimum

considerations so that it could be added in the future.

3-11 Side apron

Side aprons are to be constructed on both the left and right sides of the stage, combining the level of the apron with the floor of the fourth row of audience seats at an almost horizontal level. The side door at the stage right side wall is constructed so that performers can make sudden appearances. The creation of this side apron complies with the wishes of BTV to embrace the front section of the audience seats by extending the acting area, and at the same time it can be used as a pathway for trucking of TV cameras during programs open to the public; this intention was shown in the previous plan.

3-12 Form of seating section

The auditorium has already been constructed in accordance with the previous plan for roofing structure, external walls, stepped floor, and dugouts for audience entrance and exits. The previous design has considerable individual traits. There are many good points to be appraised but not without a feeling that there are also some problems. These are shown below:

1) The grade of the floor is steep
2) Seen from the plane, the left and right sides of the auditorium are not symmetrical, but form a deflected trapezoid by angling out the left side.
3) Each row is a complete straight seat arrangement

4) Seat arrangement is adopted from the continental seating (continuous row) system

5) Entrance/exits are concentrated in a total of 4 places, two of which are dugout style.

The consideration and treatment of these points are described in the following items.

3-13 Floor grade of auditorium

The grade of the stepped floor of the auditorium is steep, which means that the stage can be easily seen and direct sound from the stage can be heard well. In a large theatre, the drop from the farthest seats to the stage is apt to become great, but in this case there is no such fear as the scale of the hall is small. And, as continental seating has been adopted for this hall, the greater distance between rows has proved advantageous to seeing and hearing.

The fact that the stage can be seen easily means, that the floor of the stage up to the part close to the audience can be seen well. The orchestra pit section can be used as an apron stage in order to increase rapport between performers and the audience, and in cases where it is desirable to add elements of the open theatre to the current hall it is advantageous. In TV programs open to the public, audience reaction can easily be caught by TV cameras. The purpose of the previous plan seems to have aimed at these points.

3-14 Row arrangement

The most regrettable part of the previous plan for the auditorium is the straight alignment of each row. In other words, the principle of positioning seats facing the stage in a centripetal arc has been completely ignored. In Japan, this major rule has not been stressed in the traditional Kabuki theatre, but in western countries this rule for the design of theatres has been scrupulously observed. The reason for this comes from the effect it has on the psychology of the audience.

First of all, members of the audience are always unconsciously influenced by other members of the audience. In order that the reaction of groups of people seated alongside one may be perceived, seats must be positioned in such a way that neighboring groups are within the field of vision of each other.

Secondly, audiences sitting in a straight line are apt to have a somewhat cool and critical attitude toward the performers; in other words, this form can make difficult the creation of the sense of rapport which is brought about by arc seating which embraces the performers.

Thirdly, the straight line gives rise to groups of seats which face directly on the ends of the stage, and a sense of indifference and estrangement is created between the members of the audience in those sections and the performers.

As there are such substantial defects in the straight line alignment, this has been amended by the additional placement of

light weight concrete triangles in the side seat section to allow bending of the straight line. However, as this causes the load on the floor to increase, this has been applied only to the side seat section on the left side of the auditorium where the third defect is especially pronounced. Furthermore for all seats, defects 1 and 2 have also been marginally improved by this application.

3-15 Continental seating

This seat arrangement has not been legally approved in Japan where, for the purpose of evacuation in case of an emergency, the establishment of lengthwise aisles having a given width has been required. In Europe and America, however, there are many countries which permit the continental style, and it is thought to be equally advantageous in terms of evacuation. This is for the following reasons:

In this seat arrangement, the distance between each row is about 4 feet. There is enough space in front of the knees of seated spectators to allow someone to pass through when crossing in front of them. (1 foot wider than that in Japan). Furthermore, the entirety of each row can be converted into a cross-way aisle having sufficient width if everyone stands and the seats are lifted, yet more people can be accommodated than with the cross aisle system. As this seems to be reasonable, the previous design has been followed. For locations of entrance/exits, the ideal continental seating system is to establish

side corridors, and as many entrance/exits as possible are to be made between these side corridors and the auditorium. However, in this hall these are concentrated into four places; nevertheless, they should be sufficient for evacuation and comply in substance even with Japanese law.

3-16 Alteration of left dugout

The dugout style entrance/exits of the previous plan might have been an unavoidable device due to the lack of side corridors. This time, however, the left dugout has been abolished, and the number of seats have been increased in its place. To compensate for the loss of the dugout entrance/exit, a side corridor has been constructed in the extension space, and the audience may enter and exit by a doorway leading onto this corridor. By this alteration, the seating capacity becomes about 500 without including the auxiliary seats.

3-17 Alteration of seat style

In the design, a seat type which had no legs was adopted, the seat being installed on the leading edge of the stepped floor. This type of seat can be seen in athletic stadiums, but no general theatres have used such seats, and no manufacturer's catalogue lists such products. The cost of special order products is high, and as no special merits can be seen, normal theatre seats have been employed. For this purpose, however, it has been necessary to amend the location of the steps in the existing floor.

3-18 Movable seats and auxiliary seats

In TV programs open to the public, where the audience participates, performers or TV cameras must frequently go into the audience. In general, this means that the sense of familiarity between performers and the audience can be increased, that dynamic variation is given to camera angles, and audience reaction may be caught from close-up. For these purposes, there is the above mentioned side apron combined with the fourth row of movable seats.

Furthermore, movable seats have been set so that a lengthwise aisle through the audience can be set up a little off-center to stage right.

Apart from that, a crossway path for TM cameras has been set up at the rear most part of the auditorium; about 60 auxiliary seats can be provided here and in the orchestra pit when necessary.

3-19 New establishment of rooms for various spotlights

As described later, rooms for the various spotlights necessary in the usual proscenium theatre have been planned. However, plans for access to and from some of these rooms have not been completed yet.

3-20 The interior finish of the auditorium

The building code of this country is not perfectly established yet. There is as yet no law in effect corresponding to Japanese regulations on interior design. Therefore, no restriction exists from this view point. However, taking into consideration

that Japanese laws concerning interior design have been improved through the valuable yet unhappy experience of fire in theaters, use of non-flammable material for a versatile hall is an absolutely fundamental policy.

However, people in this country seem to prefer natural materials as the Japanese do. Therefore, poured concrete, laid bricks, or stone work seem to be techniques that meet the people's taste in this country. They also like the feel of simply varnished, but not painted, plain wood (most folk-art articles are of this kind). A bright and clear interior design giving consideration to these things is a desire of BTV. For that purpose, even inflammables such as wood, might possibly be used in part as accent to the design.

As mentioned later, care in view of acoustics is also important, and the lighting design for the auditorium should not be overlooked, either.

In the figures which appear at the back of this section, an example of a design employing these in a coordinated fashion is shown.

3-21 Addition of attached support rooms

A 3-storied addition which is 1 span wide and 5 spans long will be constructed at the left side of the auditorium in which the following rooms will be provided.

(1) Subcontrol room (reasons described later)

(2) Air conditioning equipment room (reasons described later)

(3) Canteen and kitchen

(4) Technical storage and lighting equipment storage

(5) Office and others

(3), (4), and (5) are insufficient at present, but will be satisfactory following this addition. Existing facilities for stage set manufacturing rooms and dressing rooms will also be used for this auditorium. Originally, this block was to be added between the auditorium and the broadcasting center itself for easy access between the two parts. However, as this would involve the complete sacrifice of the light garden in front of the main entrance, the present location was selected at BTV's request.

3-22 Basic space allocation plan

The decisions made based on an overall judgement regarding the above-mentioned problems are shown in Figures 3-1 - 3-7, and the area of each room corresponding to these judgements is shown in Table 3-1.

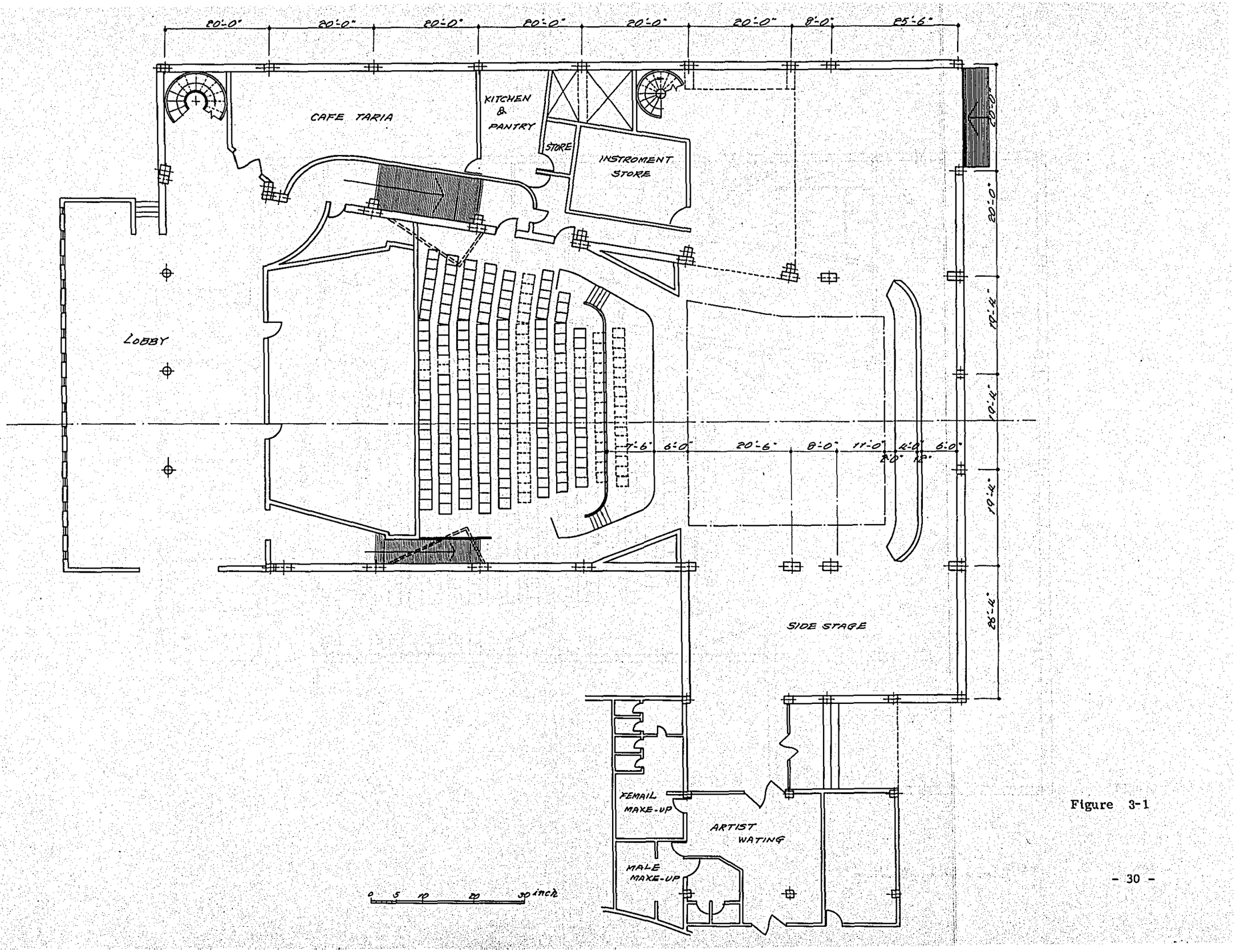
3-23 Rough estimate of the construction costs

We do not have enough materials available to estimate the construction costs on the spot. However, it is suggested from past examples that it would be approximately 800,000,000, which includes electric, plumbing and air-conditioning facilities but does not include stage lighting and scenery suspension systems,

the P.A. system, broadcasting facilities or audience seats, this estimate is based on undertaking the same construction in Japan.

Table 3-1 Schedule of Approximate Area of Multi-Purpose Broadcasting Hall for BTV

Ground Floor	Stage (incl. side stages.)	690 m^2
	Auditorium (incl. apron and orchestra pit)	540 "
	Lobby	300 "
	Canteen (incl. Kitchen)	120 "
	Instrument Store	40 "
	Common Space (incl. W. C.)	260 "
First Floor	Sub Control Room (incl. rack room)	110 "
	Office	120 "
	Lighting Room (incl. projection Room)	80 "
	Common Space	110 "
Second Floor above	Air Conditioning Machine Room	390 "
	Lighting Room (incl. ceiling spot lights and others)	60 "
	Fly Gallery	180 "
	Common Space	100 "
Total		3,100 m2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20'-0"
20'-0"
20'-0"
20'-0"
20'-0"
8'-0"
25'-6"
CAFE TARIA
KITCHEN & PANTRY
STORE
INSTROMENT STORE
LOBBY
20'-0"
19'-4"
19'-4"
28'-4"
7'-6"
6'-0"
20'-6"
8'-0"
11'-0"
4'-0"
2'-0"
6'-0"
SIDE STAGE
FEMAIL MAXE-UP
ARTIST WATING
MALE MAXE-UP
0 5 10 20 30 inch

Figure 3-1

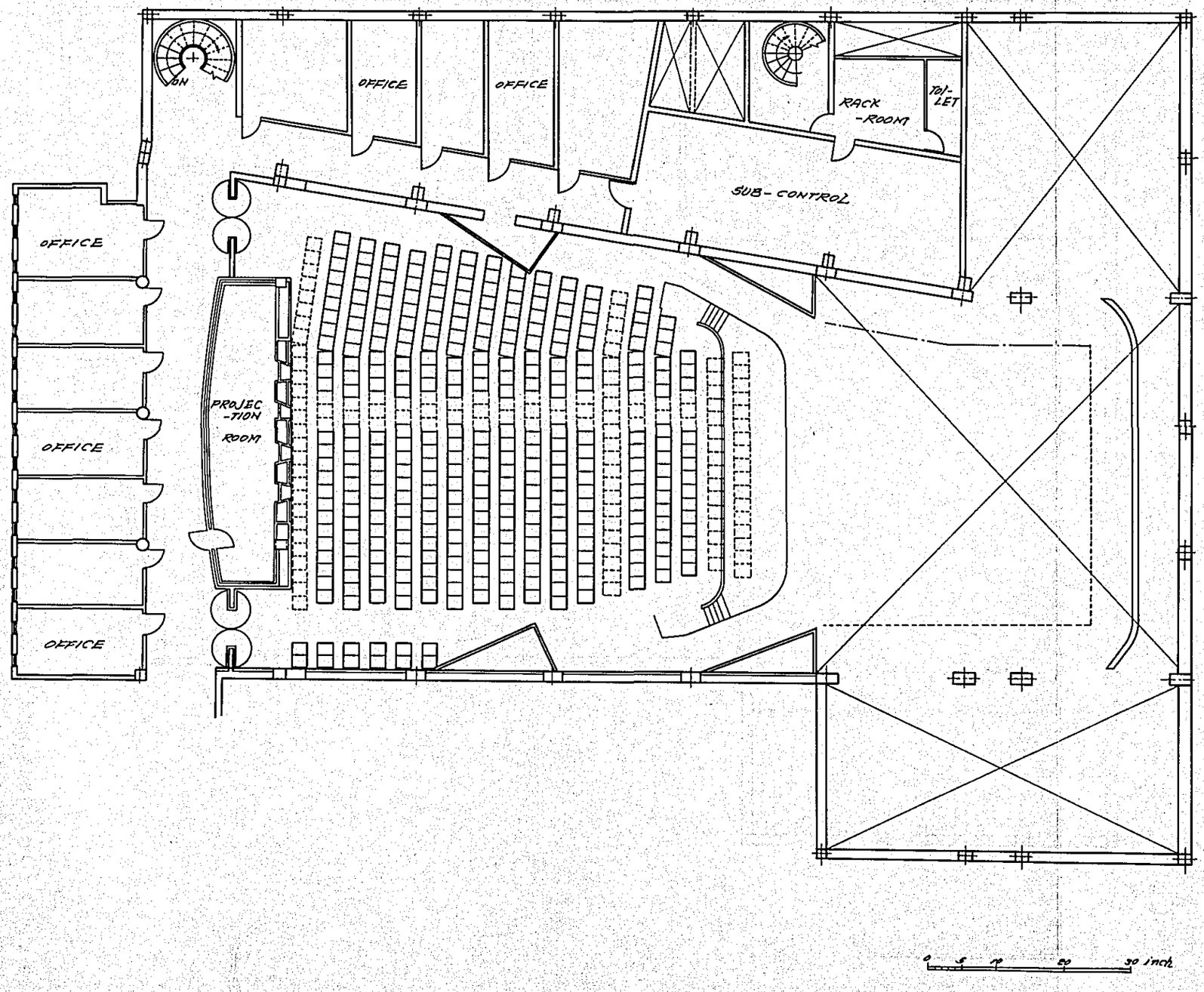
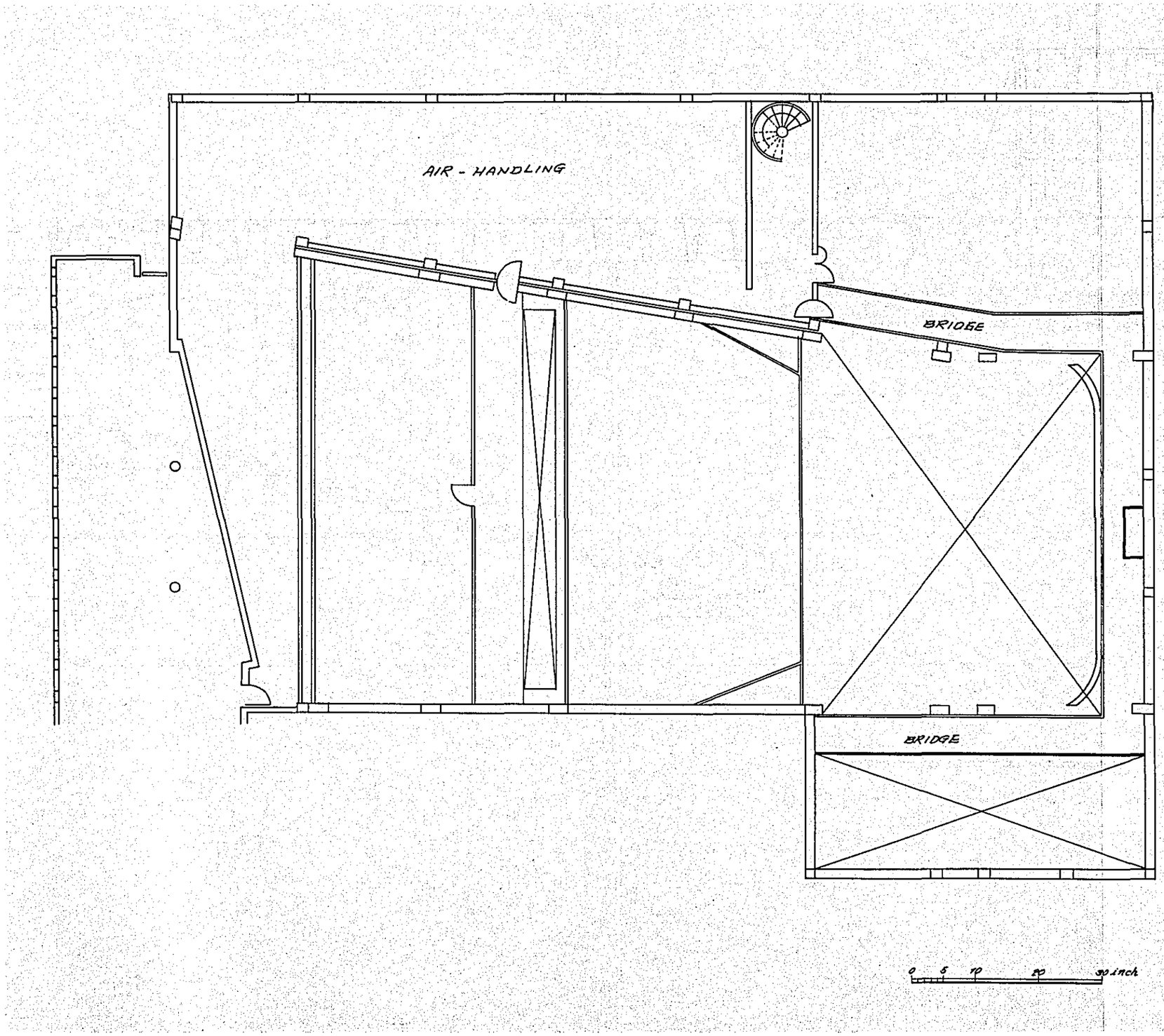

OFFICE
OFFICE
RACK -ROOM
TOI- LET
SUB- CONTROL
OFFICE
PROJEC -TION ROOM
OFFICE
OFFICE
0 5 10 20 30 inch

Figure 3-2



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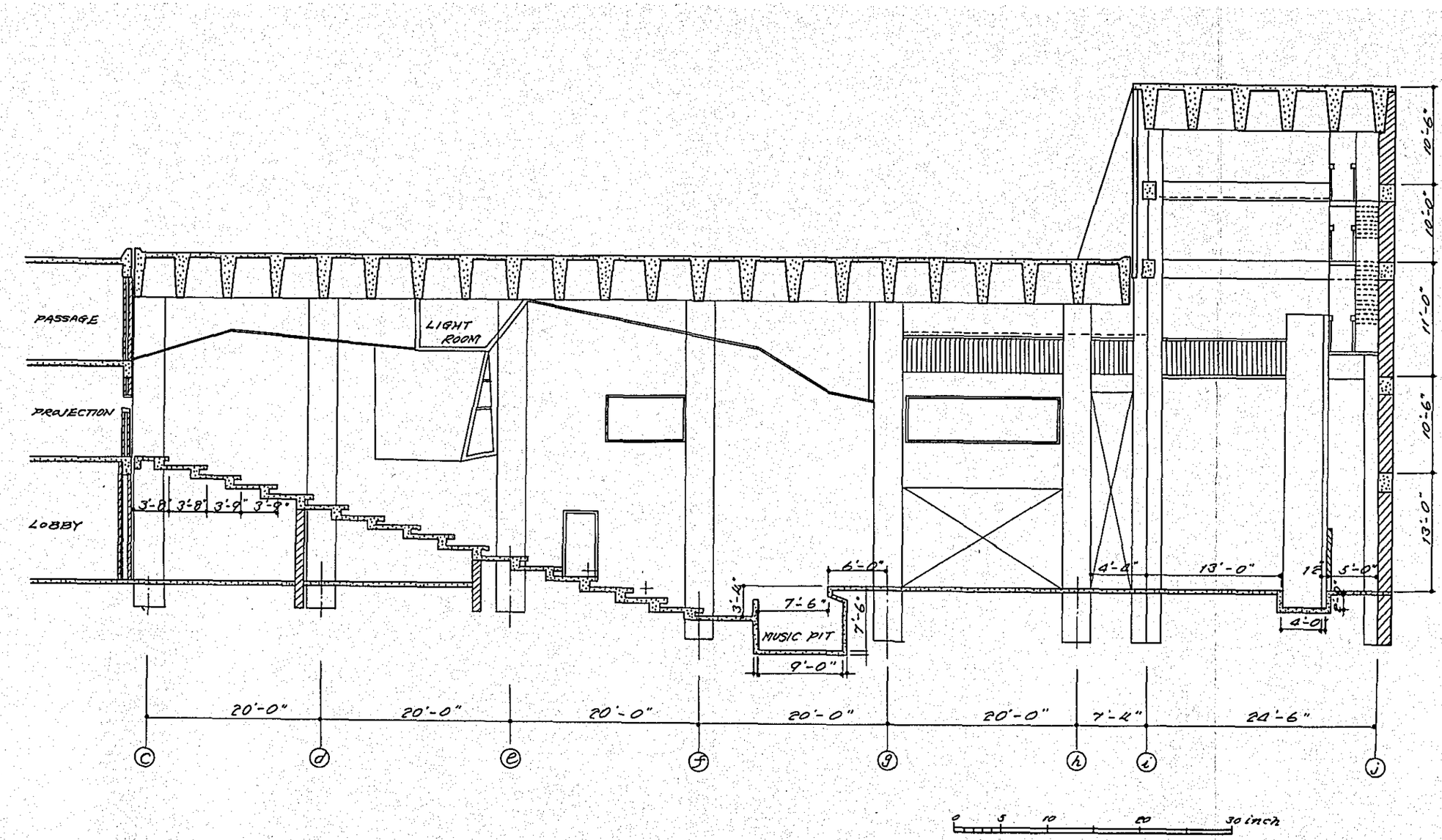
PASSAGE
PROJECTION
LOBBY
LIGHT ROOM
3'-8"
3'-8"
3'-9"
3'-9"
3'-4"
7'-6"
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MUSIC PIT
9'-0"
6'-0"
4'-4"
13'-0"
5'-0"
4'-0"
10'-6"
10'-0"
11'-0"
10'-6"
13'-0"
20'-0"
20'-0"
20'-0"
20'-0"
20'-0"
7'-4"
24'-6"
ⓒ
ⓓ
ⓔ
ⓕ
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0
5
10
20
30 inch

Figure 3-4

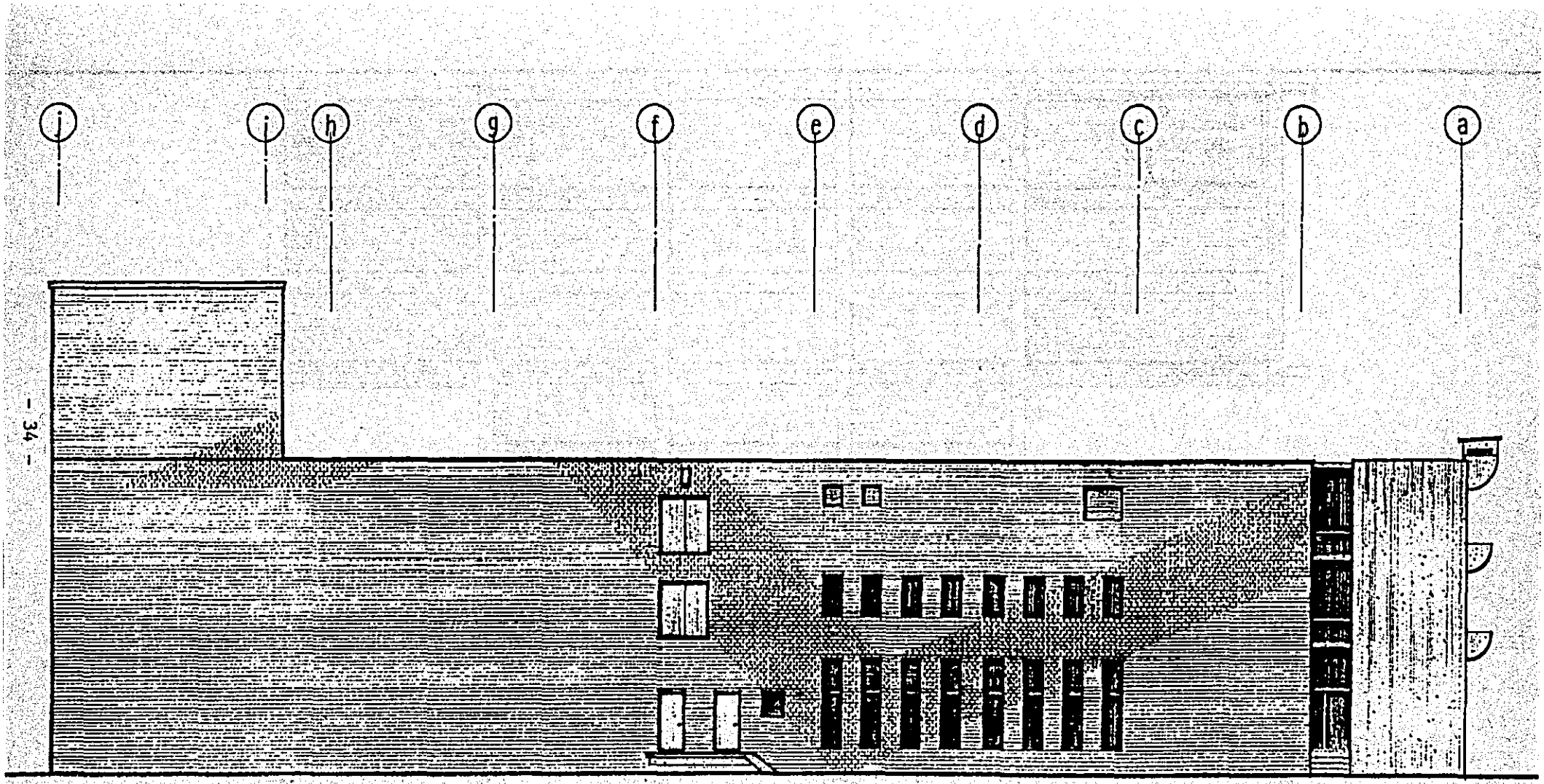


Figure 3-5 NORTH ELEVATION

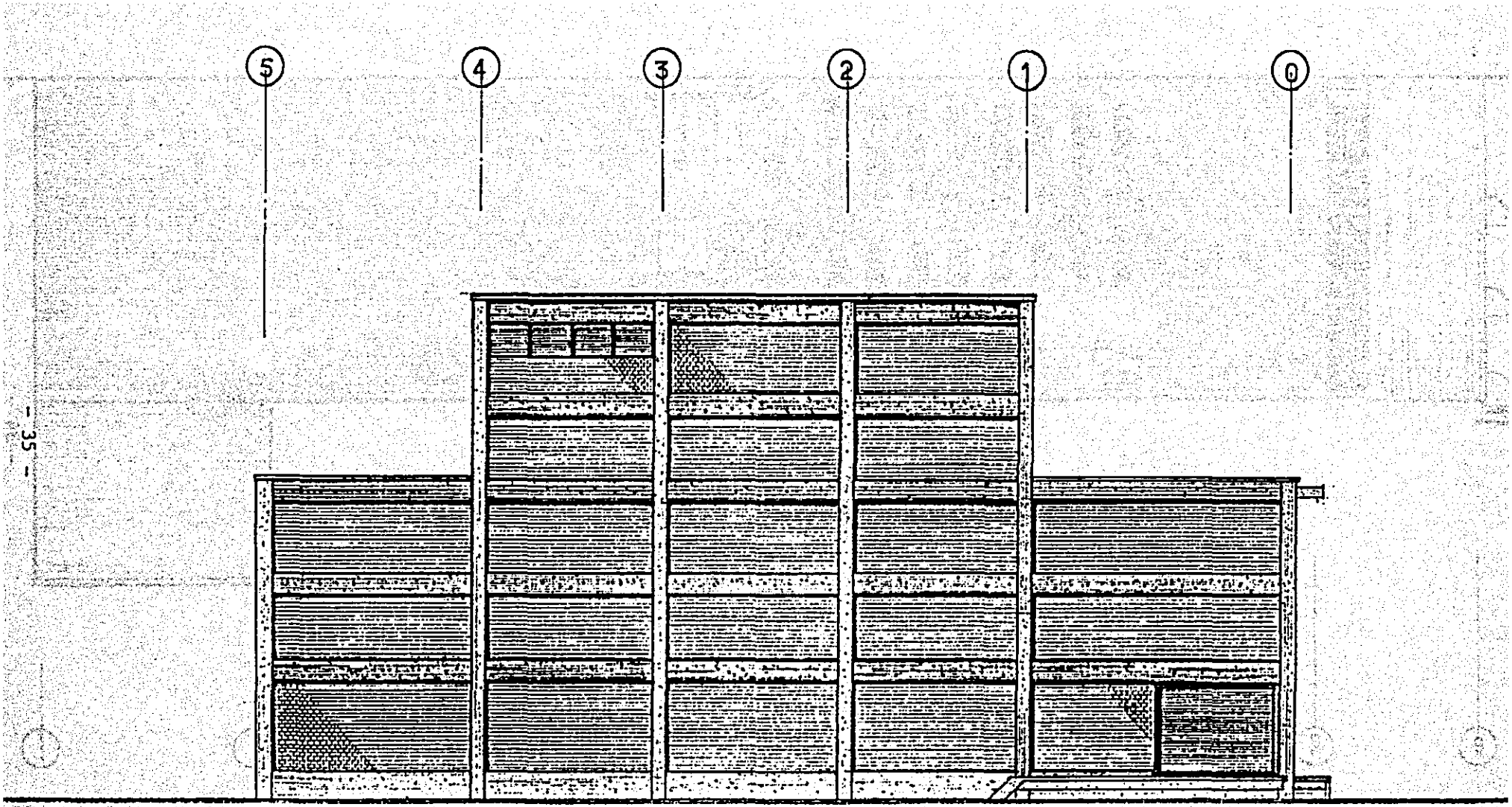


Figure 3-6 EAST ELEVATION

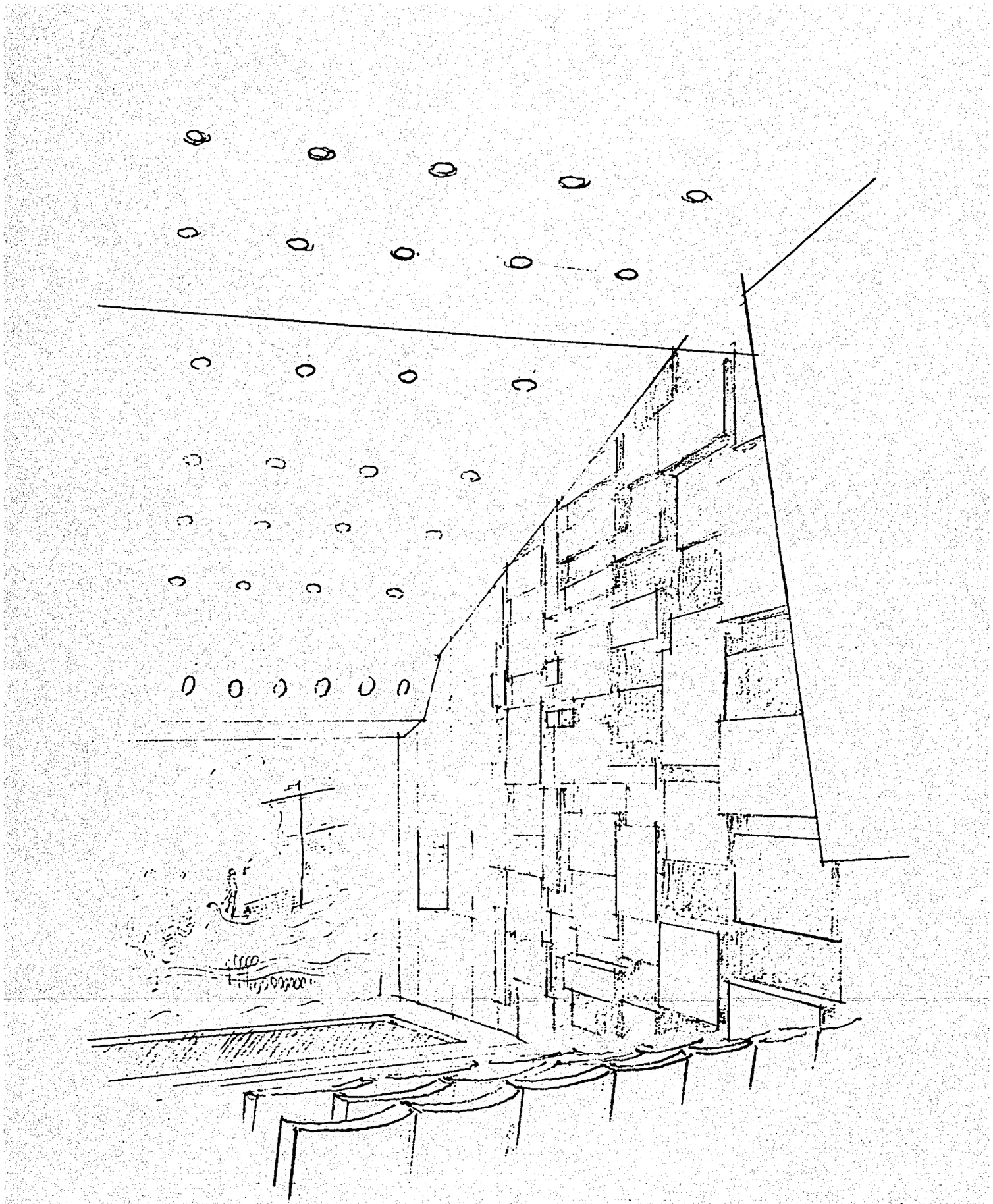


Figure 3-7 INTERIOR VIEW of AUDITORIUM

CHAPTER 4: STAGE FACILITIES

In the present situation, where the building had been completed for use as a TV studio, the BTV had a sesire to provide the building with the function of a multi-purpose hall. As a result of energetic discussion on the technical problems that had proposed in original basic plan, agreements have been reached that stage and facilities as a theatrical system would be extended.

4-1 Lighting for Stage

4-1-1 Foot Lights

Are the ones that are laid out in a row on the floor in the very front of the stage and are used to light the feet side of the players. It would have been ideal if the foot lights were embedded in the floor but will, in consideration of the size of stage, be made removable and portable (to be stored in separate room). A total of seven (7) lighting fixtures, each consists of twelve (12) bulbs of 60W, will be furnished.

4-1-2 Base Lights

As they are called, are the ones to provide even lighting over player and stage setting from above the acting area. This lighting alone is sufficient for such programs as lectures, meetings, etc. These lights are hung on flying

duct (boarders) and can be manipulated by hand to change the lighting direction (the change of direction of lighting fixtures). The flying duct (boarders) are arranged in an even spacing of 2-3 meters. One border consists of twelve (12) lines, each fitted with thirty-three (33) bulbs of 200W. So that a luminosity of approximately 800-1,000 lux can be provided throughout the stage in total.

4-1-3 Suspension lights

Are used as an auxiliary light source, when candle and other lights are used on stage, to light players, etc., and will also provide, as spot lights, a high light on a particular player, setting, etc. The lighting fixtures used will be eight (8) units of 1 kW fixtures fitted in one line and a total of twelve (12) lines will be furnished to provide the desired luminosity of 1,500-2,000 lux.

4-1-4 Cyclorama

Every scene has it's own other background. Providing a cyclorama made of cloth at the back of stage makes it possible to create an effective background suitable for the nature of the program by use of lighting technique. A total of fifty-six (56) lighting fixtures of 800 W each will be installed above and below.

4-1-5 Other lighting of auditorium

On the ceiling will be installed fortyeight (48) 200 W general auditorium lights. Luminosity of 100 lux is considered as an objective. As for TV Scene, eighteen (18) lighting fixtures of 500 W will be furnished on the ceiling to provide lighting over approximately two-third (2/3) of the seats and 500-800 lux of luminosity is considered as an objective.

4-1-6 Ceiling spot lights

Are the ones that provide lighting at the periphery of the proscenium and are installed inside the ceiling. It is preferable to install them so they provide lighting at the stage front (in front of proscenium) at an angle of 30-40 degrees. Eighteen (18) light fixtures fitted with tri-color changers will be furnished and remote control from wall surface of the right of stage will be possible.

4-1-7 Front and side spot light rooms

These are to provide lighting from both sides of auditorium to the near of the proscenium. The locations where they will be located will be on the auditorium side walls on both left and right sides of the stage approximately 10 meters from the proscenium and at a horizontal angle of 20-25 degrees to the stage. The lighting fixtures used will be ones not generating noise audible by the audience and the capacity will be 1 kW each. Six (6) units will be installed on each wall.

4-1-8 Lighting control room (sub-control room)

Had been, in the original plan, considered to be located adjacent to the side stage on the left side of the stage. With this location, however, there was the drawback that performers etc. would have had difficulties in taking their cues. Therefore, it has been determined that the lighting control room would be moved to the first floor, in the extension work section, so that the stage could be well observed. In this room will be used the spot lights in the ceiling. The reason for this was that, it would be necessary to keep whole room dark so as to provide better monitoring conditions, in the case of color programs, by providing lighting only with main control console.

4-1-9 Lighting control system

The number of lighting control units will be approximately fifty (50) units, half the number of the load circuit of 110 lines, and they will be connected by main circuit patching method. The units used will be, in consideration of interchangeability, the same ones as are presently used in both A and B TV studios.

Installed at stage wide in the sub control room will be the main control console, preset fader board and patching board, and installed in the rack room will be the main switch board and dimmer unit rack.

The above schemes are shown in Figures 4-1 - 4-8 and Tables 4-1 - 4-3.

4-2 Art Facilities

It is required that the art facilities used on stage should have an organic relationship with dramatic presentations and performance. That is, the art facilities as a whole must be subject such contents of programs as player's movements, lighting variations, etc.

Table 4-1 Specification of Lighting Load Circuit

Fl - 6	3 kW	24 circuits
Sl - 8	"	24 "
Ceiling Spot Light	"	6 "
Side and Front Spot Light	"	4 "
Upper Cyclorama Light	6 kW	12 "
Lower Cyclorama Light	3 kW	12 "
Floor Concents	"	14 "
Auditorium (TV)	6 kW	2 "
Auditorium (for general lighting)	"	2 "
Center Spot Lights	3 kW	2 "
Cat-walk Lights	"	5 "
Ceiling Spot Lights (for effects)	"	1 "
		(108 circuits)

Electric Power Source Capacity: 250 kVA

Table 4-2 Number of Dimmer Unit

Dimmer Unit		(Specified value)	Patching Method (actual value)
F1 - 6 Battens	3 kW	24 units	8 units
S1 - 8 "	"	24 "	12 "
Ceiling Spot Lights	"	6 "	6 "
Side and Front Spot Lights	"	4 "	4 "
Upper (UH) Lights	6 kW	12 "	6 "
Lower (LH) Lights	3 kW	12 "	6 "
Floor Lights	"	6 "	4 "
House Lights	6 kW	4 "	4 "
Sub-total		92 units	50 units
	(3 kW : 76 units, 6 kW : 16 units)		

Table 4-3 Number of Lighting Facilities

Lighting Facilities			
F1 - 6 Battens	200 W	198 lamps	(incorporated in 6 borders) with filter holders, color filters are mounted (with spares); total 2 ea. (per 1 lamp)
S1 - 8 Battens	1,000 W	96 sets	with filter holder, color filters are mounted (with spares).
Ceiling Spot Lights	1,000 W	18 sets	with color-changer (incorporated in control console) (color filter)
Front Side Spot Lights	1,000 W	12 sets	Same as above
Upper Cyclorama Lights	1,000 W	56 sets	with filter holder, color filters are mounted (with spares)
Lower Cyclorama Lights	500 W	56 sets	Same as above
Tower Spot Lights	1,000 W	18 sets	Same as above (Traveling type, 3 sets/frame)
Special Effect Lights	1 lot		
Accessories	1 lot		
Ceiling Lights for TV	500 W	18 sets	

4-2-1 Curtains

That separate the audience space from the stage are hung from the upper part of the proscenium and a total of three (3) of them will be installed: namely No.1 (draw curtain); No. 2 (drop curtain); and No. 3 (gathering curtain). The No. 1 curtain is to be pulled open at its center by hand. Lifting/lowering of No. 2 and 3 curtains are performed electrically.

4-2-2 Other hanging decorations

There are two means of lifting/lowering hanging decorations: that is, manually or electrically. The manual method will be employed for lifting/lowering art battens (electric method for the curtains) so that speed variation can be provided. The number of the battens will be eight (8) units for pipe battens, eight (8) units for side curtains and two (2) units for straight lines.

The cylorama will be a fixed one, and will be nine (9) meters high and sixteen (16) meters wide. As the art facilities for the new line stage have a close relationship with the building, their arrangement and quantity will be subject to change in accordance with the changes that may occur with building structure execution designs that will be carried out.

4-2-3 Operation of hanging decorations

There are two types of rope operations, manual and electric, for lifting/lowering hanging decorations. Art battens that are hung backgrounds, etc. are generally manually operated because they are comparatively light in weight and because of the requirements for varying the speed of their lifting/lowering following the change of scenes. A manual operation for lifting/lowering art settings from the wall surface of the right side stage well be employed. The above schemes are shown in Figures 4-9 - 4-10 and in Tables 4-4 - 4-6.

4-3 Safety Precautions

There are few statutory limitations in force for theaters, etc. in Bangladesh. However, it will be necessary to provide sufficient safety precautions such as securing durability of limit switches for controlling lifting/lowering of hanging decorations, prevention of faults in the electric roll up machines, and prevention of lighting equipment from falling down, etc., on the lighting and art facilities as a whole.

Table 4-4 Lighting and Art Hanger Equipment (for Reference)

1.	Trimming Curtain	Lifted & Lowered by Manual Control	Counter-Weight System	
2.	Draw Curtain	Operating & Closing by Motor Driven System	(0.75 kW)	Operating & Closing Speed 25 m/min
3.	Drop Curtain	Lifted & Lowered by Motorized Winch System	(0.75 kW)	
4.	Contour Curtain	Lifted & Lowered by Motorized Winding System	(1.5 kW)	Lifting & Lowering Speed 25 m/min
5-1	Lighting Batten (Spot)	"	(0.75 kW)	" 5 m/min
5-2	"	"	(")	"
6.	Pipe Batten	Lifted & Lowered by Manual Control	Counter-Weight System	
7-1	Lighting Batten (Flood)	Lifted & Lowered by Motorized Winding System	(0.75 kW)	5 m/min
7-2	" (Flood)	"	(")	"
8.	Border Curtan	Lifted & Lowered by Manual Control	Counter-Weight System	
9-1	Lighting Batten (Spot)	Lifted & Lowered by Motorized Winding System	(0.75 kW)	5 m/min
9-2	" (Spot)	"	(")	"
10.	Pipe Batten	Lifted & Lowered by Manual Control	Counter-Weight System	
11.	"	"	"	
12-1	Lighting Batten (Flood)	Lifted & Lowered by Motorized Winding System	(0.75 kW)	5 m/min
12-2	" (Flood)	"	"	"
13.	Pipe Batten	Lifted & Lowered by Manual Control	Counter-Weight System	

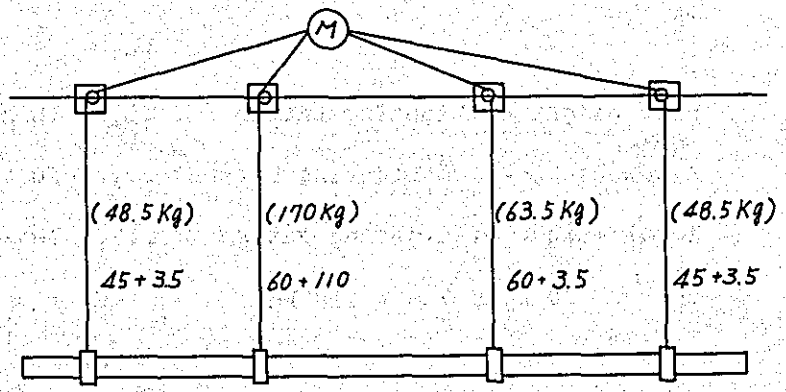
Table 4-4 (Cont'd)

14-1	Lighting Batten (Spot)	Lifted & Lowered by Motorized Winding System	(0.75 kW)	5 m/min
14-2	" (Spot)	"	(")	"
15.	Border Curtain	Lifted & Lowered by Manual Control	Counter-Weight System	
16-1	Lighting Batten (Flood)	Lifted & Lowered by Motorized Winding System	(0.75 kW)	5 m/min
6-2	" (Flood)	"	(")	"
17.	Pipe Batten	Lifted & Lowered by Manual Control	Counter-Weight System	
18.	"	"	"	
19-1	Lighting Batten (Spot)	Lifted & Lowered by Motorized Winding System	(0.75 kW)	5 m/min
19-2	" (Spot)	"	(")	"
20.	Pipe Batten	Lifted & Lowered by Manual Control	Counter-Weight System	
21-1	Cyclorama Light Batten	Lifted & Lowered by Motorized Winding System	(0.4 kW)	5 m/min
21-2	"	"	(")	"
21-3	"	"	(")	"
22.	Back Curtain	Lifted & Lowered by Manual Control	Counter-Weight System	
23.	Side Curtain	Curtain Rail System	Opening & Closing by Manual Operation	
24	"	"	"	

Table 4-5 Schedule of Load on Electrically Powered Hanger Equipments: for Reference

The load applied on grid are:

Machine ..... 75 kg Distribution Box.. 5 kg Multi-core cable.. 20 kg Wiring material .. 10 kg	Machine Section	110 kg	(Schedule of load on curtain is shown on a separats sheet) (Schedule of load on ceiling is shown in separats sheet)
Hanger Block ..... 3 kg Switch Wire ..... 0.5 kg	Both Section	3.5 kg	



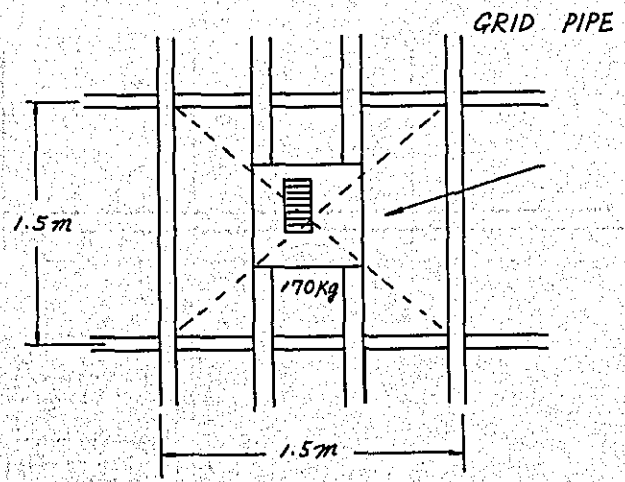
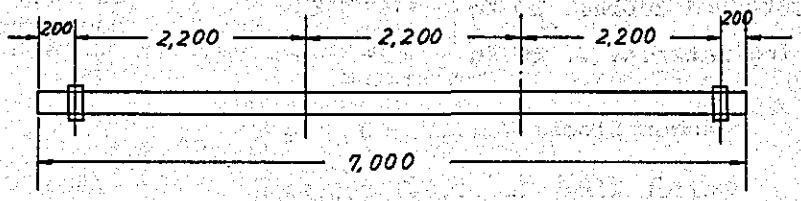


Table 4-6 Schedule of Load on Lighting (Border Light): for Reference

Calculation method of weight for 7 meter Batten



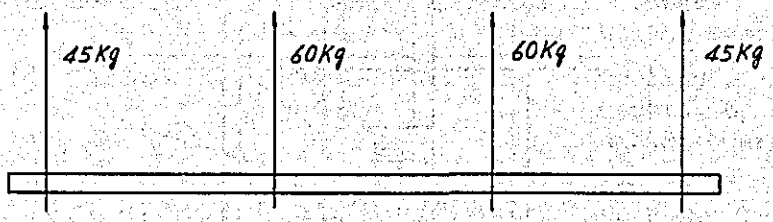
Dead Weight of Lighting Batten ..... 10 kg/lm

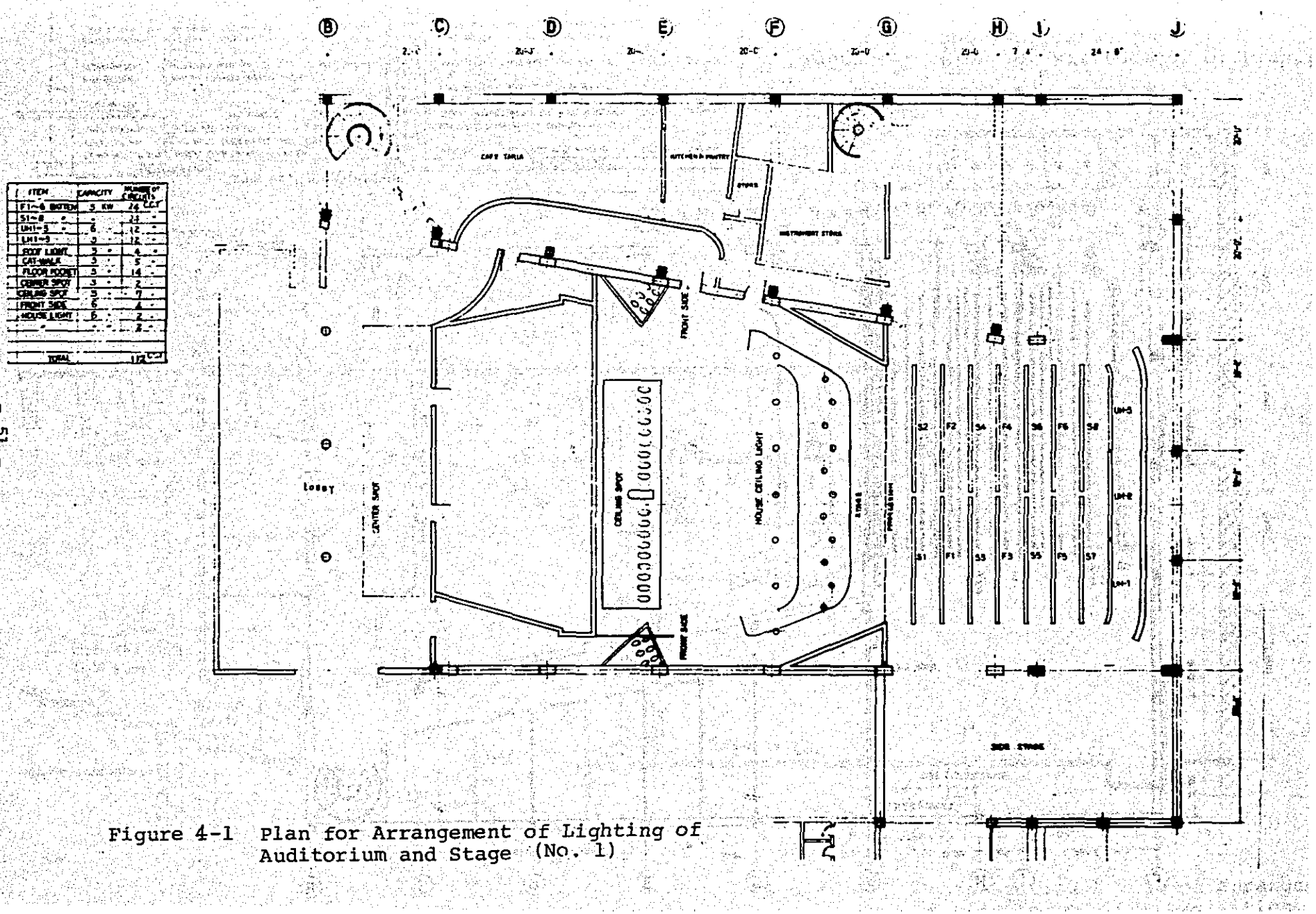
Allowable Load on Lighting Batten ..... 20 kg/lm

Total Weight of Lighting Batten ..... 30 kg/lm

30 kg x 7 m = 210 kg

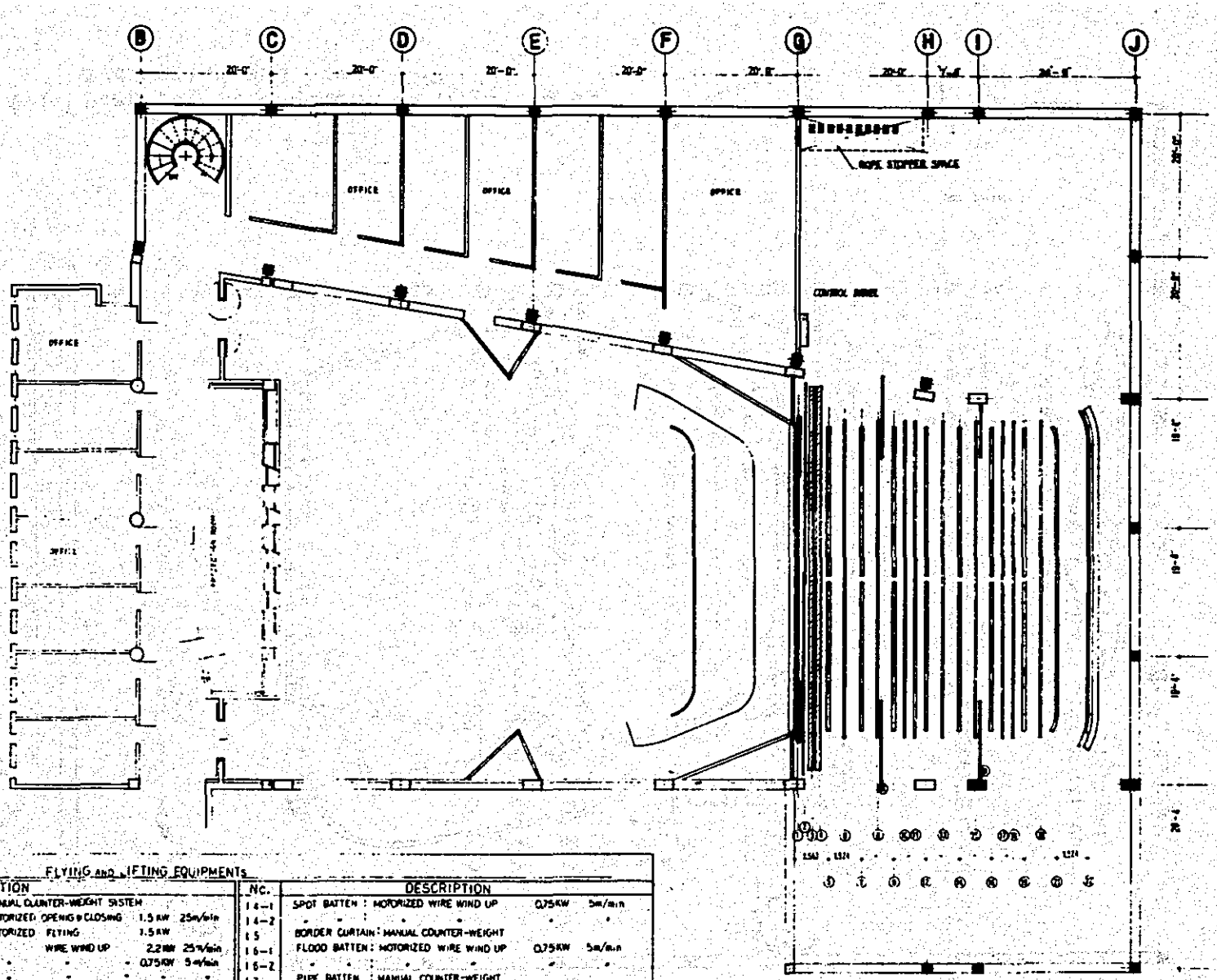
Load Distribution on Batten Suspension Wire:





ITEM	CAPACITY	NUMBER OF CIRCUITS
F1~6 BATTEN	5 kW	24 C.C.T
S1~8 "	"	24 "
LH1~3 "	6 "	12 "
LH1~3 "	3 "	12 "
ROOF LIGHT	3 "	4 "
CAT-WALK	3 "	5 "
FLOOR POCKET	3 "	14 "
CORNER SPOT	3 "	2 "
CEILING SPOT	3 "	7 "
FRONT SIDE	6 "	4 "
HOUSE LIGHT	6 "	2 "
"	"	2 "
TOTAL		112 C.C.T

Figure 4-1 Plan for Arrangement of Lighting of Auditorium and Stage (No. 1)



FLYING AND LIFTING EQUIPMENTS

NO.	DESCRIPTION			
1	TRIMMING CURTAIN	: MANUAL COUNTER-WEIGHT SYSTEM		
2	DRAW CURTAIN	: MOTORIZED OPENING & CLOSING	1.5 KW	25m/min
3	DROP CURTAIN	: MOTORIZED FLYING	1.5 KW	
4	CONTOUR CURTAIN	WIRE WIND UP	2.2 KW	25m/min
5-1	SPOT BATTEN	" " "	0.75KW	5m/min
5-2	" "	" " "	"	"
6	PIPE BATTEN	: MANUAL COUNTER-WEIGHT SYSTEM		
7-1	FLOOD BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min
7-2	" "	" " "	"	"
8	BORDER CURTAIN	: MANUAL COUNTER-WEIGHT		
9-1	SPOT BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min
9-2	" "	" " "	"	"
10	PIPE BATTEN	: MANUAL COUNTER-WEIGHT		
11	" "	" " "		
12-1	FLOOD BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min

NO.	DESCRIPTION			
14-1	SPOT BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min
14-2	" "	" " "	"	"
15	BORDER CURTAIN	: MANUAL COUNTER-WEIGHT		
16-1	FLOOD BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min
16-2	" "	" " "	"	"
17	PIPE BATTEN	: MANUAL COUNTER-WEIGHT		
18	" "	" " "		
19-1	SPOT BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min
19-2	" "	" " "	"	"
20	PIPE BATTEN	: MANUAL COUNTER-WEIGHT		
21-1	UPPER HORIZON BATTEN	: MOTORIZED WIRE WIND UP	0.75KW	5m/min
21-2	" "	" " "	"	"
21-3	" "	" " "	"	"
22	BACK CURTAIN	: MANUAL COUNTER-WEIGHT		
23	SIDE CURTAIN	: RAIL SYSTEM		

Figure 4-2 Plan for Arrangement of Lighting and Facilities (No. 2)

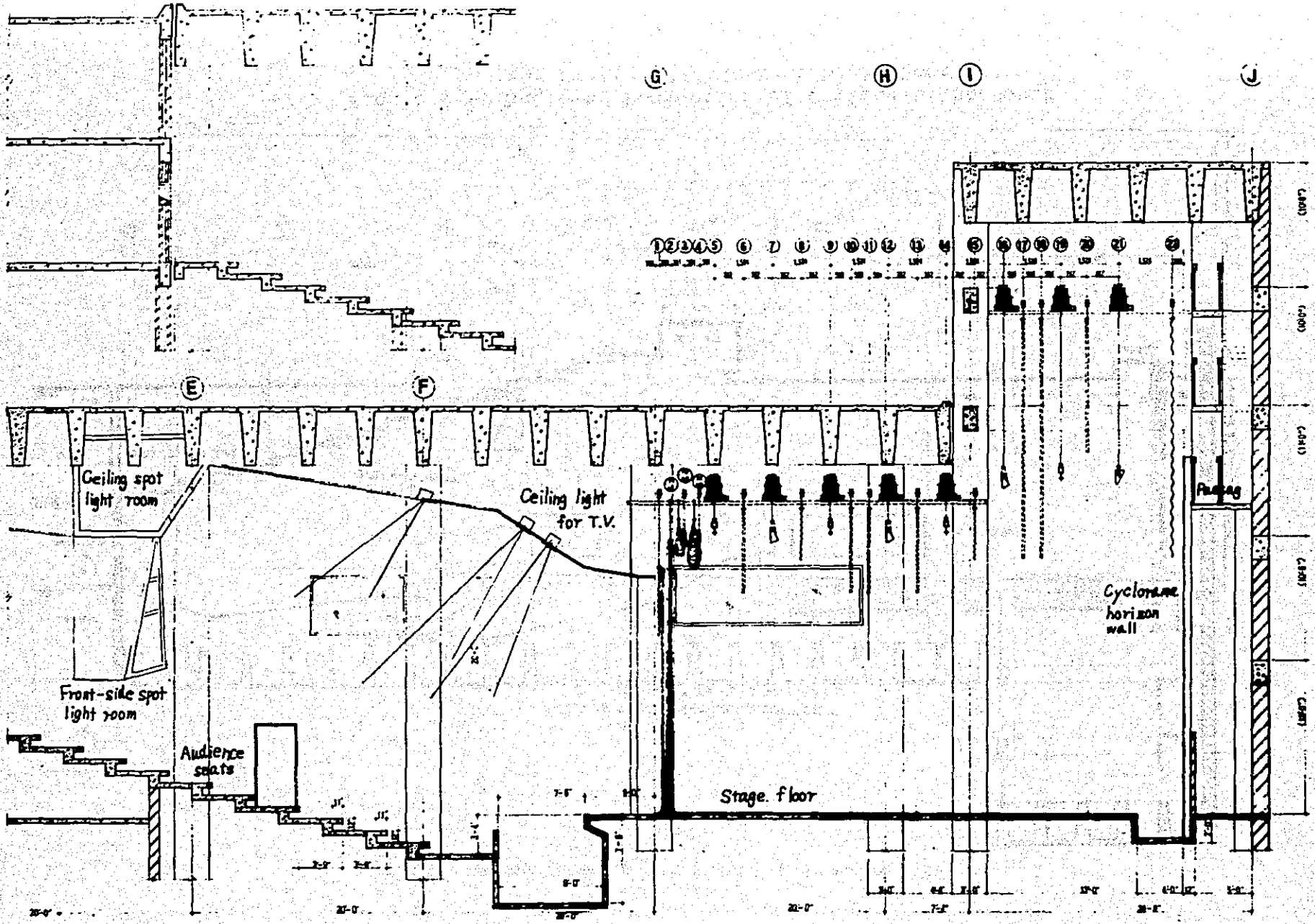


Figure 4-3 Cross-Sectional View of Arrangement of Lighting and Art Facilities

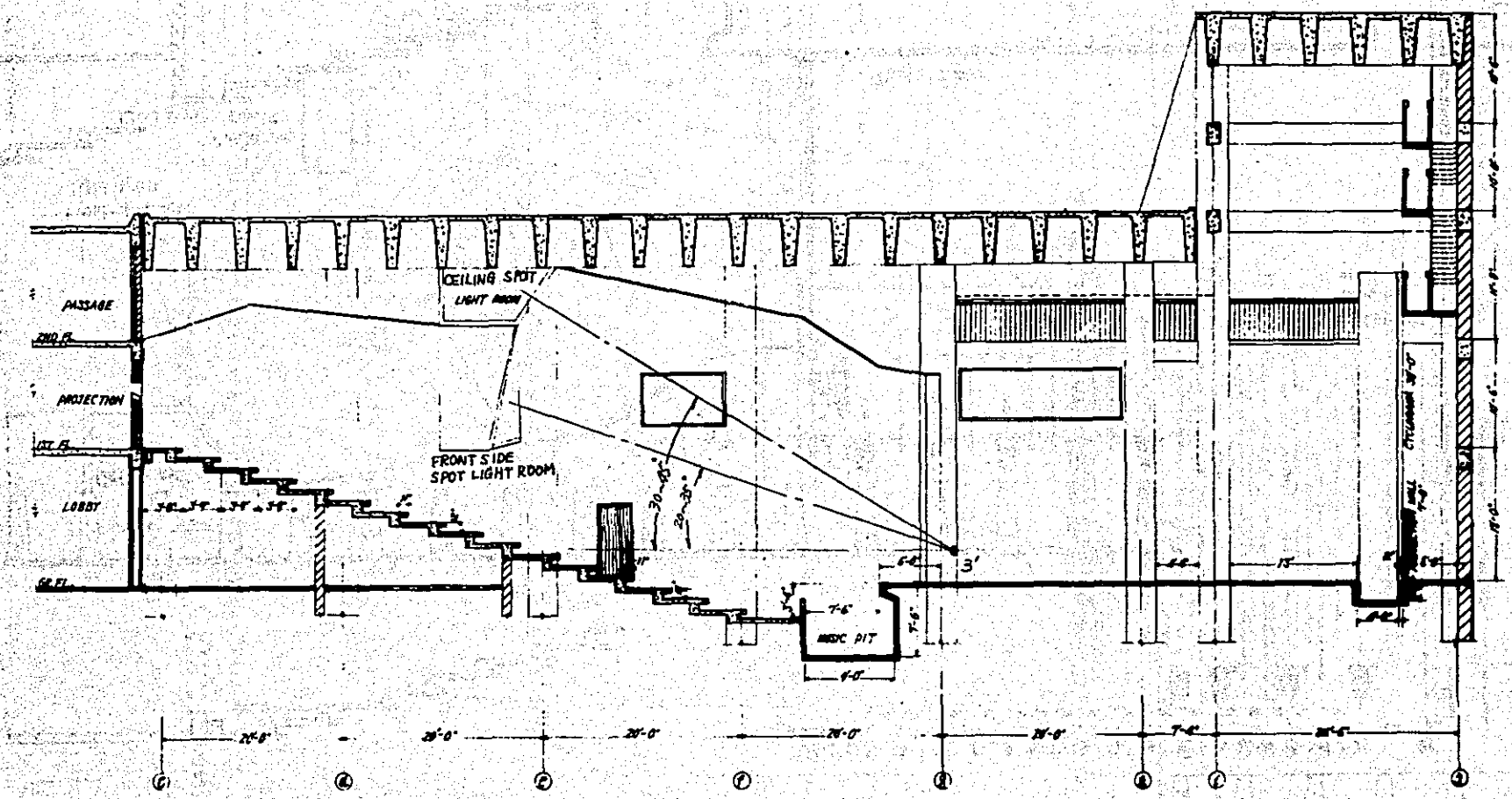


Figure 4-4 Angle of Projection of Ceiling Light Booths and Front and Side Spot Light Booths

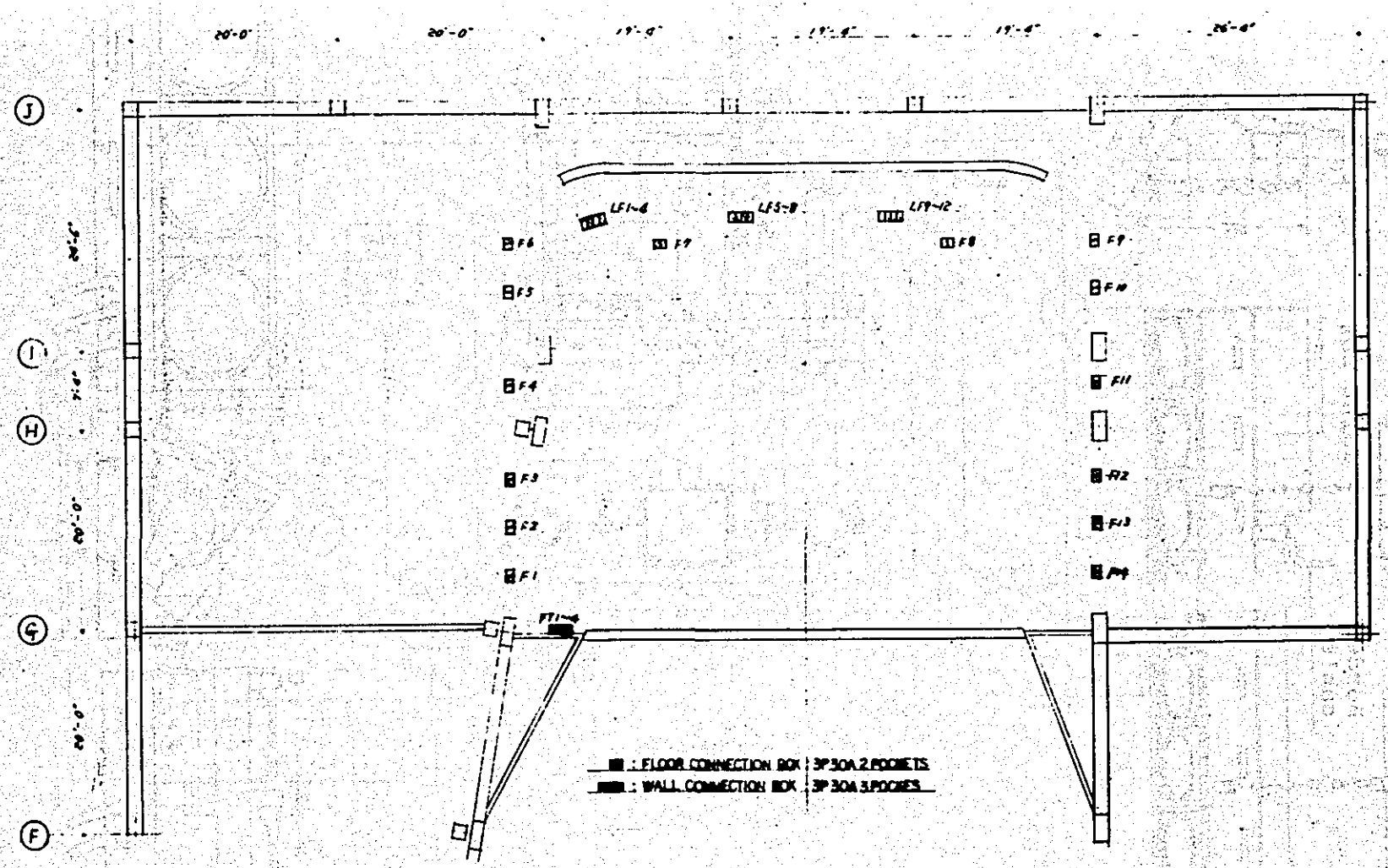


Figure 4-5 Scheme of Floor Inlet Boxes on Stage

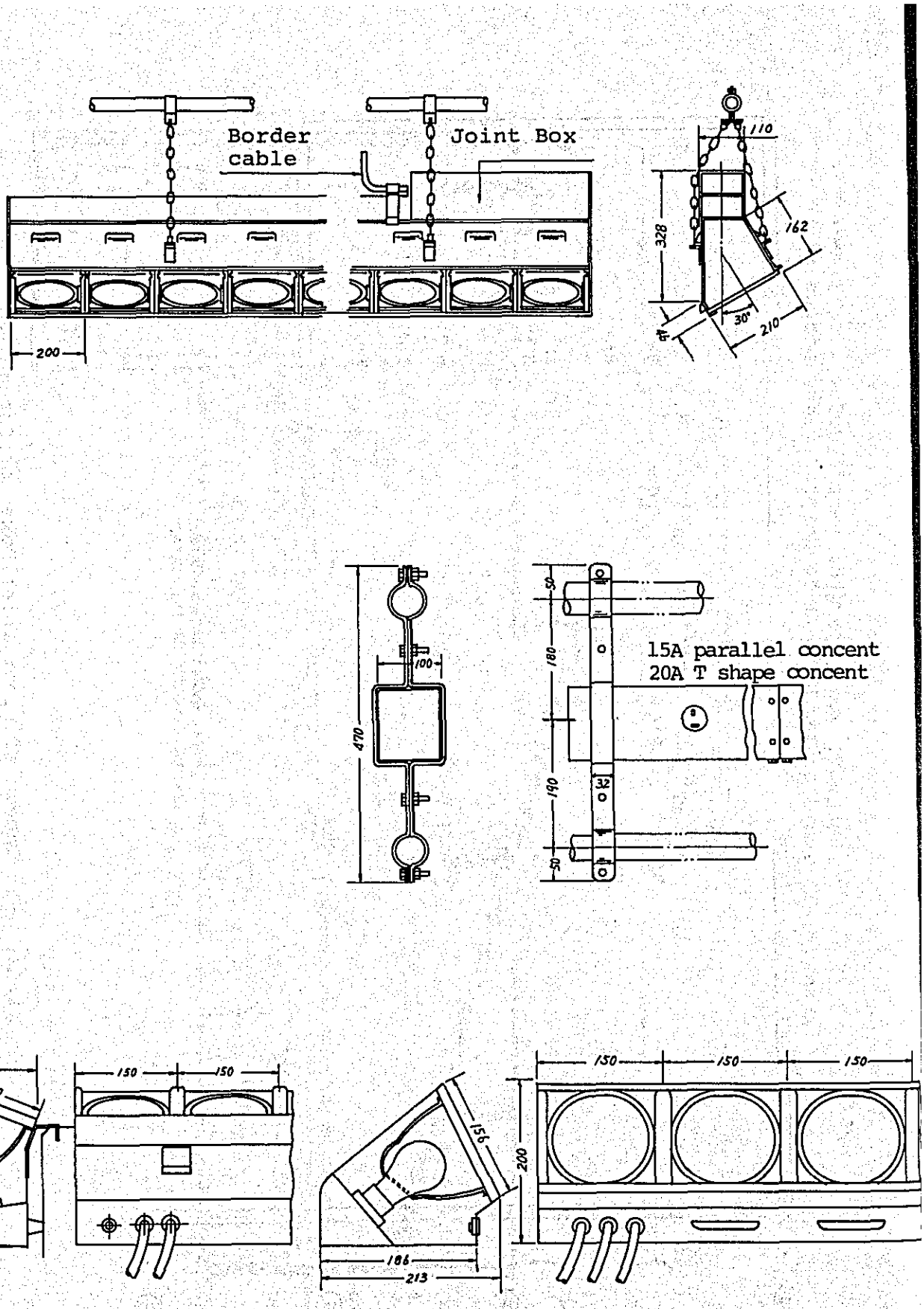


Figure 4-6 Lighting Fixtures

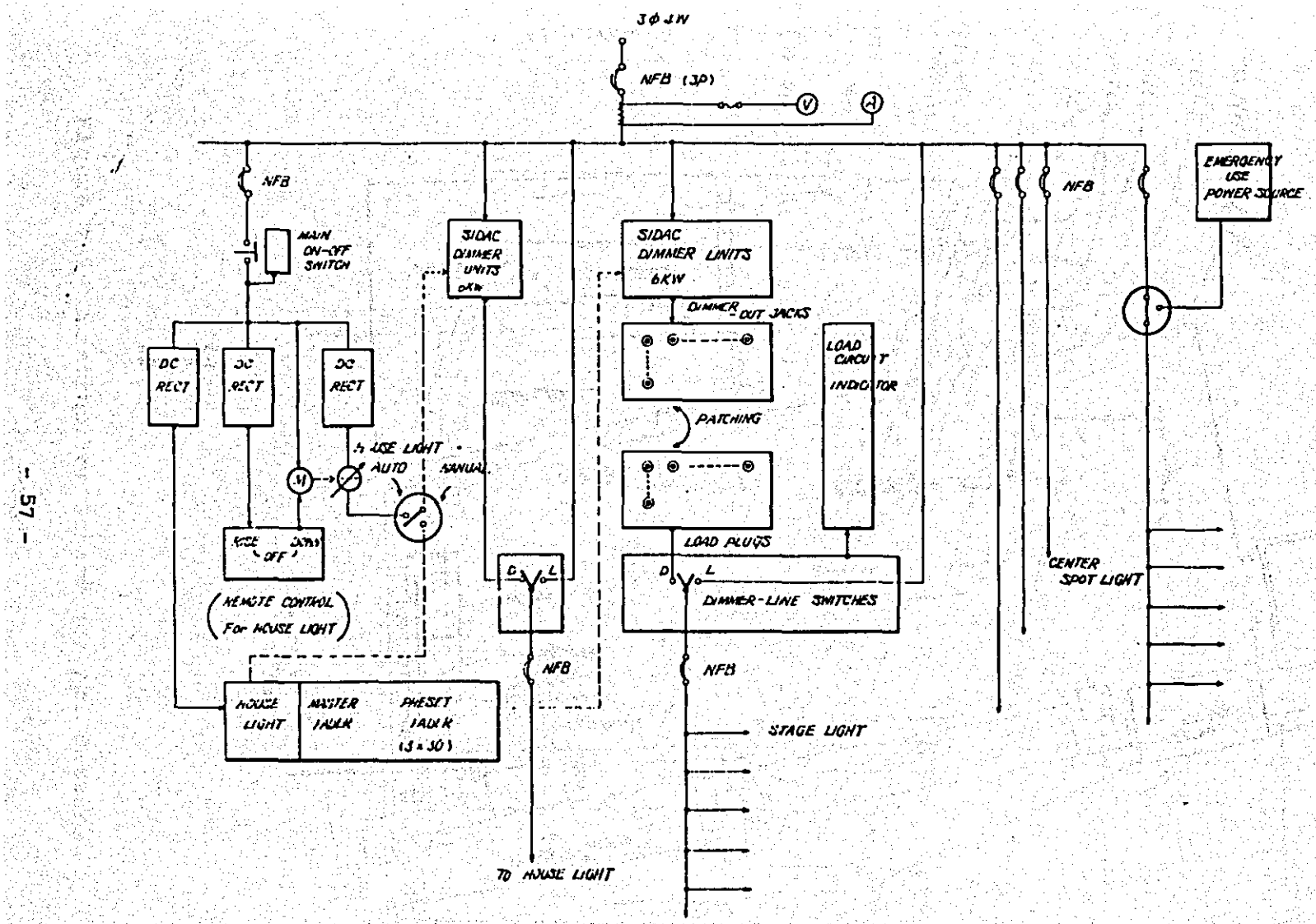


Figure 4-7 Schematic for Lighting Fixtures

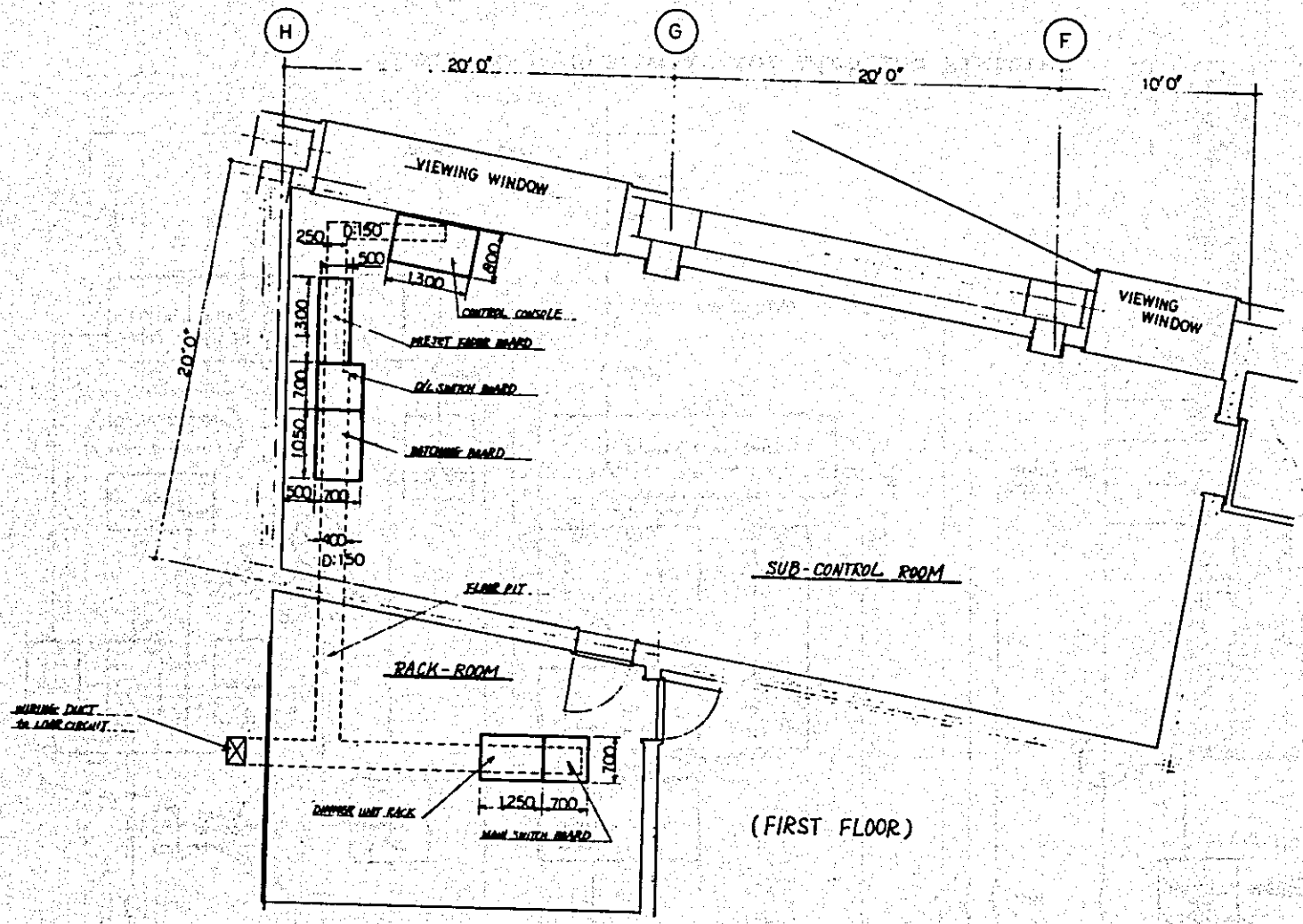


Figure 4-8 Schematic of Arrangement of Lighting Control Operations (sub control room)

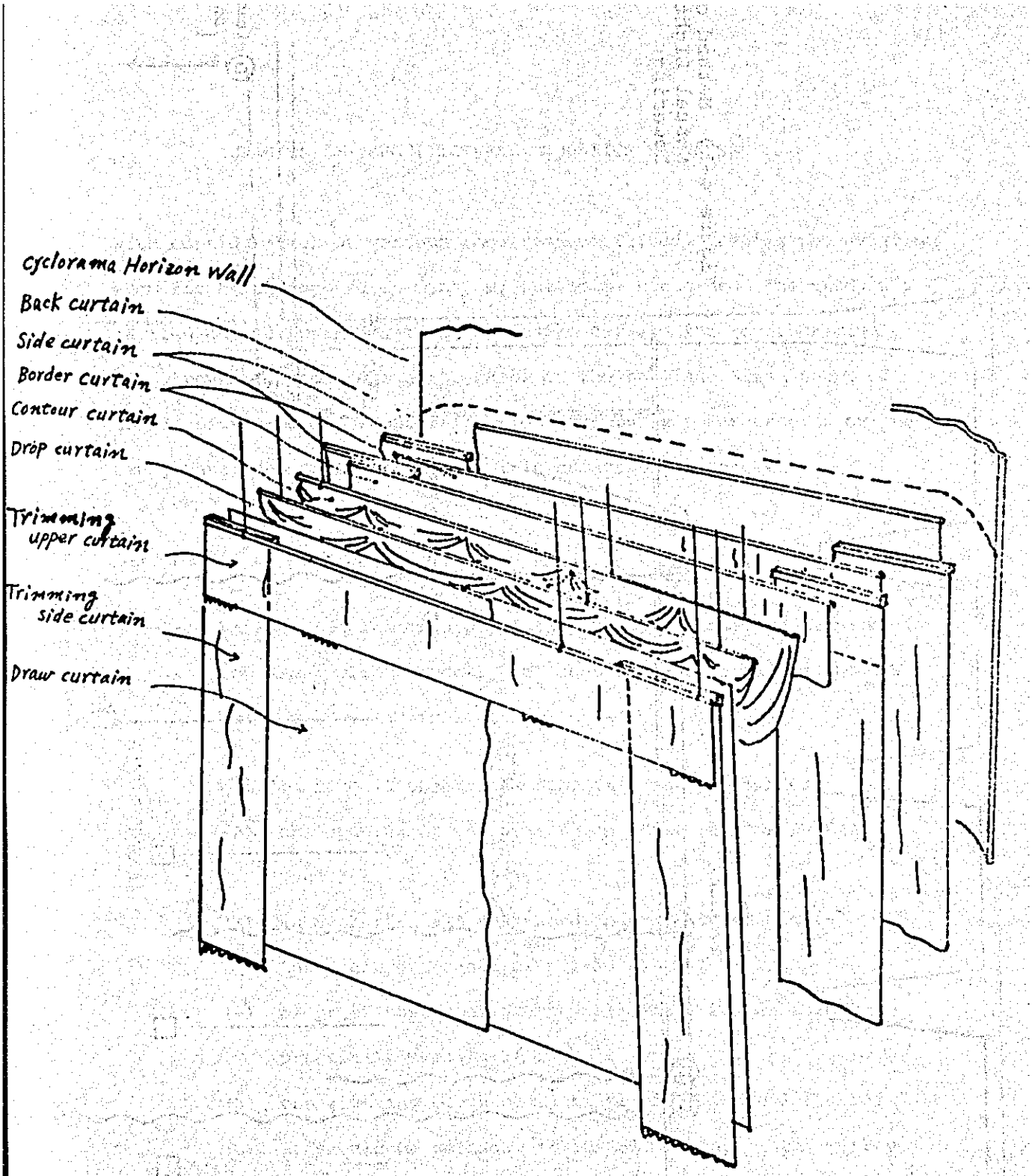


Figure 4-9 Construction Scheme for Art Battens

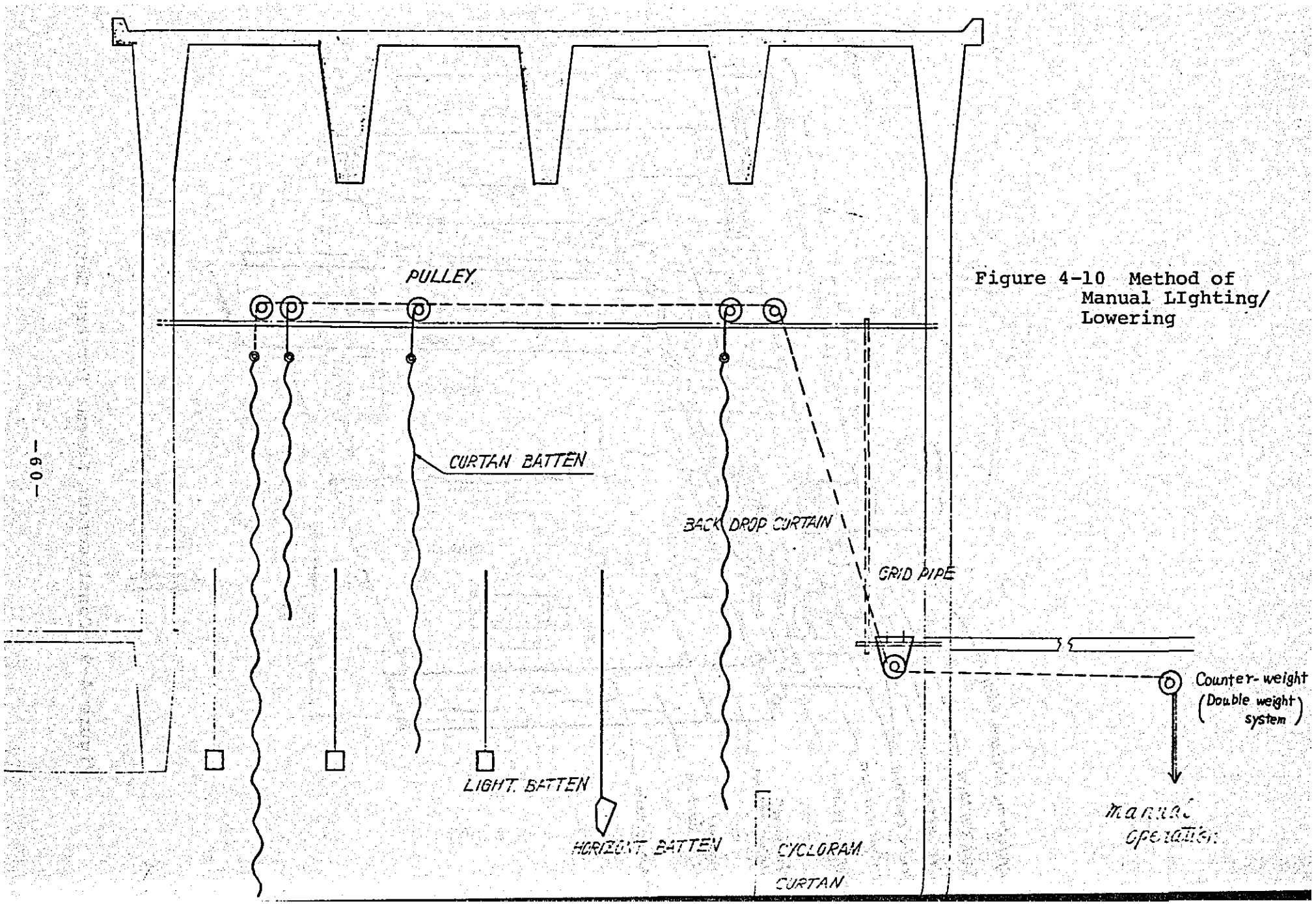


Figure 4-10 Method of Manual LIghting/ Lowering

CHAPTER 5: ARCHITECTURAL ACOUSTICS PLANNING

With consideration of various requirements raised, keeping the existing room for hall proposed in mind, by the local concerned, the study was carried out for mainly setting of design targets for reverberation time, reverberation scheme, the shape of the hall and arrangement of sound absorption and sound reflection structures. The results of the study have been taken into account in construction scheme.

5-1 Design of Room Shape

5-1-1 Various requirements proposed: Various requirements being concerned with the design of room shape proposed by the BTV are summed up as follows:

(1) to make it theatrical type that has proscenium,
(2) the opening of the proscenium shall be 44 x 20 feet (refer to Figure 5-1),
(3) an orchestra pit that accommodates approximately forty players shall be provided,
(4) slope of the floor of the hall shall be, as far as practical, used as it is,
(5) one lighting booth shall be provided in ceiling, and
(6) it should be possible to install a stage sound reflector for western music in the future although it is not planned in the present design.

5-1-2 Shape of Cross section

(1) Ceiling:

Early reflection sounds that reach the auditorium following direct sound will contribute to sound pressure distribution, articulation, and directional sense of audience to the sound source. Therefore, the design of the cross-sectional shape of the ceiling has been carried out by assuming several sound sources on the stage, with principal attention paid to direct sound and primary reflection sounds reaching the auditorium with a time lag of within 50 mili-seconds enhancing the direct sound. Namely, the studies were carried out on the shape with consideration of the various requirements described above and the location of proscenium speakers for sound reinforcement being installed so that the primary reflection sounds from the auditorium ceiling would cover the whole area of auditorium and yet sound would be evenly distributed throughout the room by setting sound source S1 on the stage directly below proscenium and sound source S2 at location 2 meters behind S1. The results of the final study are shwon in Figures 5-2 and 5-3.

In these figures, study was also made of the location of the stage sound reflector for recitals that would be installed in the future and certain consideration has been

paid so that sufficient primary reflection sounds would reach the back of the room, which normally suffers from lack of sound volume. This cross-sectional shape has been incorporated in the architectural scheme.

(2) Slope of floor

A seat suitable for viewing the stage is also suitable for hearing. From the point of view, a study of the height of the visual points on a visual focus set on the stage was carried out with the floor slope of the existing hall.

Visual focus points were set at a location F1 on the leading edge of stage and at F2, 1.8 meters behind the point F1 which is directly below the proscenium, as shown on the slope of floor in Figure 5-4. The calculation of the height of visual points has been carried out for the two conditions involved in the cases:

(1) for seeing each visual focus point over the heads of people sitting one row ahead, and

(2) for seeing the same over the heads of people sitting two rows ahead, and in both cases distance between adjacent rows of seats was 45 inches and height of the stage above the floor was 40 inches.

As there were no data available regarding the average height of the eyes of adult Bengalese men and women in the audience and their standard deviation, the data of Japanese whose

physical type is similar to that of the Bengalese were used for. In the calculation, the adult men and women were seated in the seats at random. The results of the calculation carried for the average height of visual point of the audience and the rate of the seats from which the stage floor can be seen are shown in Table 5-1. Similarly the distributions of height of visual point in case of seeing each visual focus point over the row ahead are shown in Figure 5-4.

According to the results, the rate of the seats from which the leading edge of stage F1 can be seen over two rows ahead is 71.4 per cent, and that of the seats from which F2 can be seen is 82.2 per cent. These facts obviously indicate the effect of moving the leading edge of stage backward as far as the orchestra pit has been provided, and thus the conclusion can be given that the slope of the auditorium floor will serve the purpose. As a result, it has been determined that the existing slope of floor would be used as is in the present plan.

5-1-3 Plane shape

Study of the plane was carried out considering the width of the proscenium and the locations where side speakers would be installed. The acoustically recommended semi-fan shape

comprised of a fan shape around the area neighboring the stage and an approximate oblong shape from the center through to the rear part of auditorium has been employed as the basic plan.

As the reflected sounds from the side walls affect the space impression in the field of sound, a study was made to enhance the density of early reflection sound rather than reinforcing direct sound, together with the thought of providing that early reflected sounds reach the auditorium as strong as possible. The basic plane determined upon the result of study is shown in Figure 5-5. For this shape of room, diffusing walls with rugged surface have been employed. The details will be studied when the design is carried out.

Table 5-1 Average Height $\overline{H}$ of Visual point Over the Visual Focus Point Set on the Stage and the Rate R of the Seats from which Visual Focus Point can be Seen, (Refer to Fig. 5-4)

(a) Seeing over one row ahead.

Visual Focus Point F1		Visual Focus Point F2	
Ave. Height $\overline{H}$ (m)	Rate R (%)	Ave. Height $\overline{H}$ (m)	Rate R (%)
1.28	37.8	1.04	48.9

(b) Seeing over two rows ahead

Visual Focus Point F1		Visual Focus Point F2	
Ave. Height $\overline{H}$ (m)	Rate R (%)	Ave. Height $\overline{H}$ (m)	Rate R (%)
0.74	71.4	0.40	82.2

Provided, height of auditorium floor is 0m.

5-1-4 Room dimensions for determined shape

Based on studies of the cross-sectional and plane shapes as described above, the basic shape of room was determined, and for these shapes, the required surface area and the volume of the room were calculated. The results of the calculations are shown in Table 5-2, from which the total volume V is found to be 3,771 m^3 and the whole surface area of the room S is 1,847 m^2 provided the volume of effective section of the stage being 669 m^3.

5-2 Design of Reverberation

5-2-1 Setting of the design target for reverberation time

This hall is to be multi-purpose as described in Section 2, and will be used for performing various programs such as national functions, national meetings, dramatic performances, production of TV programs, lectures and so forth. Based on various possible uses, a target value of reverberation time suitable for the purpose has been set.

Reverberation time is one of measures which indicate the magnitude of reverberation in room. The optimum value of reverberation time differs in accordance with the purpose of the room. Even for a similar purpose of use, different values are proposed by various scholars. Generally, the optimum values are recommended with regard to the room volume and the purpose of the hall.

Table 5-2 Estimate of Dimensions of the Hall

(a)	Area S	
	Area of floor of auditorium F (incl. orchestra pit)	448 m^2
	Area of the stage S_s 18.5 x 16	300 m^2
	Effective area of the stage in case of calculating of v/s 13.7 x 7.9 + 30.6	138 m^2
	Area of wall (excl. part of effective area of the stage, 96 m^2)	407 m^2
	Area of ceiling (excl. part of effective area of the stage, 108 m^2)	443 m^2
	Rear wall	100 m^2
	Front wall of the stage 13.7 x 7.9	107 m^2
	Total Surface Area S	1,847 m^2
(b)	Volume of Room V	
	Auditorium (within proscenium)	3,102 m^3
	Effective volume of the stage	669 m^3
	Total volume V	3,771 m^3
(c)	V/S	2.04 m
(d)	Seats Capacity	
	Fixed and movable seats	410
	Auxiliary seats	approx. 50
	Total	approx. 460

The scale of this hall is, as is also given in Table 5-1 and the volume of the hall V in which the stage enclose with the stage reflectors is about 3,770 m^3 and V/S is 2.04 m. Its seating capacity, excluding auxiliary seats, is 410 persons. The reverberation time has been determined on the basis of the purposes of use and the room volume so that it would provide; adequate sound with music in the case of a recital with the use of the stage sound reflector, provided that one would be installed in the future, and adequate sound with dramatic performances and such programs as mainly use electric sound reinforcement system, by making the wall surfaces of the stage flies absorptive. In that case, the stage sound reflector is removed.

The design goal for reverberation times at 500 Hz is approximately 0.9 second for full occupancy under conditions of the hall without the stage reflectors. The value for the empty hall is about 1.0 second.

As to recital, it would be adequate a slightly longer period. Therefore, the design goal for full occupancy under conditions of the recital hall type is set as approx. 1.1 sounds, and the value for the empty hall is set as approx. 1.25 seconds. The comparison of the design goal for reverberation time for the said hall with that of others is shown in Fig. 5-6. As for the frequency characteristics of reverberation time, it has been considered of a little higher characteristic at low frequency range as compared with middle frequency range (approximately 1.3 - 1.4 times as much at 125 Hz as against 500 Hz).

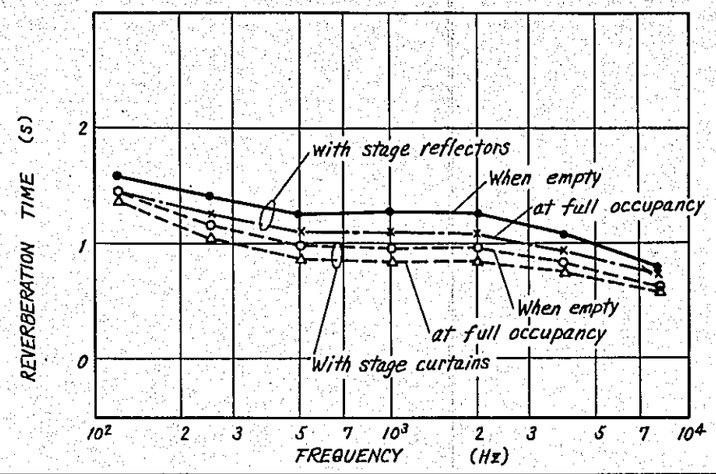
Table.5-3 Trial calaulation of reverberation time.

Dimensions

L	m	S	1,847	m^2
W	m	V	3,771	m^3
H	m	V/S	2.04	m
F	448 m^2	Number of Seats. N.	410	seats (except subsiding seats)

Uses multipurpose

Reverberation time at 500Hz
T 1.25 seconds
(When empty)



	items	Si (m^2)	125Hz		250Hz		500Hz		1000Hz		2000Hz		4000Hz		8000Hz		Remarks
			ai	Ai	ai	Ai	ai	Ai	ai	Ai	ai	Ai	ai	Ai	ai	Ai	
(1)	With stage sound reflectors																
(i)	at full occupancy																
	design goal for reverberation time (sec.)		1.40		1.25		1.10		1.10		1.13	(1.07)	1.15	(0.94)	1.14	(0.73)	
	absorption coefficient and power	1847	0.210	387.9	0.231	426.7	0.258	476.5	0.258	476.5	0.252	465.4	0.249	459.9	0.250	461.8	
(ii)	When empty																
	substracting absorption of 410 persons		-0.11	-45.1	-0.10	-41.0	-0.11	-45.1	-0.12	-49.2	-0.12	-49.2	-0.11	-45.1	-0.08	-32.8	
	absorption coefficient and power	1847	0.186	342.8	0.209	385.7	0.234	431.4	0.231	427.3	0.220	406.2	0.225	414.8	0.232	429.0	
	reverberation time (sec.)		1.60		1.41		1.24		1.26		1.33	(1.25)	1.30	(1.06)	1.25	(0.77)	
	absorption power of 410 upholstered seats		0.12	49.2	0.20	82.0	0.29	118.9	0.34	139.4	0.32	131.2	0.32	131.2	0.34	139.4	
	mean absorption coefficient of materials																
	except the seats ($S = 360\ m^2$)	1487	0.197	293.6	0.204	303.7	0.210	312.5	0.194	287.9	0.185	275.0	0.191	283.6	0.195	289.6	
(2)	With stage curtains																
	difference between absorption coefficients		0.30	-0.20	0.35	-0.15	0.40	-0.12	0.43	-0.07	0.45	-0.07	0.50	-0.07	0.50	-0.08	
	of the curtains and the reflectors																
(i)	When empty																
	additional absorption power of stage	311	0.10	31.1	0.20	62.2	0.28	87.1	0.36	112.0	0.38	118.2	0.43	133.7	0.43	133.7	
	absorption coefficient and power	1847	0.202	373.9	0.243	447.9	0.281	518.5	0.292	539.3	0.284	5244	0.297	548.5	0.305	562.7	
	reverberation time (sec.)		1.46		1.18		1.00		0.95		0.98	(0.94)	0.93	(0.80)	0.90	(0.62)	
(ii)	at full occupancy																
	absorption coefficient and power		0.227	419.0	0.265	488.9	0.305	563.6	0.319	588.5	0.311	5736	0.321	593.6	0.322	595.5	
	reverberation time (sec.)		1.38		1.06		0.90		0.85		0.88	(0.84)	0.85	(0.74)	0.85	(0.60)	

( ): 60% relative humidity

5-5-2 Calculation of reverberation time and study of interior finishing material

Fundamental consideration has been given to the process of interior finishing of the hall that the distribution of interior finishing materials would provide sound absorption within the stage, reflection in the middle and absorption on the wall surface toward the rear part of the auditorium so that it would be suitable both for use in the production of TV broadcasting programs and for programs in which on electric sound reinforcement system is used. On the other hand, when the stage sound reflector is used, the so-called "live end and dead end type" arrangement has been adopted where the stage side is made reflective.

The reverberation time RT (second) can be derived from the following formula:

$$RT = 0.161 \frac{V}{-S \log_e (1 - \bar{\alpha}) + 4mV}$$

where

$V(m^3)$ = volume of room,

$S(m^3)$ = total surface area of room,

$\bar{\alpha}$ = mean sound absorption coefficient of room, and

m = attenuation coefficient of sound due to air absorption when it transmitts through air.

The calculation of reverberation time was carried out using the above formula and the results of the calculations are shown in Table 5-3. The calculation was done on condition of the use of sound absorptive upholstered seats, and for that reason, the use of medium grade seats or above would be required.

According to the results, the mean absorption coefficients with 500 Hz when the stage is set with curtains are: 0.281 for the empty hall, and 0.305 at full occupancy. On the other hand, when the stage sound reflectors are used, they are 0.234 and 0.258, respectively.

These values are satisfactorily practicable. The absorption coefficients of the wall surface excepting sound absorption by the seats are, as shown in (1) - (ii) of Table 5-3, about 0.20 at each frequency. In order to realize these values, the use of one of the following is recommended: for the rear wall, vertical strips of wood that have 50 per cent or more opening on their surface or perforated boards of about 9 mm in diameter and 15 mm in pitch or some cloth such as Hessian Cloth with 50 mm thick glass fibre blanket and 100 mm thick air space behind respectively; for wall and ceiling surface, partially reflective thick plywood and partially plywood of approximately 6 mm thick with air space of 40-50 mm in thick-

ness behind or noninflamable perforated board of adequate selective sound absorption.

Considering the desire expressed by BTV for using domestic materials, the use of plywood would be most suitable for realizing the reverberation design, although the use of noninflamable material is required when considering fireproof. Furthermore, the use of 50 mm thick cemented board with chipped wood pieces, or 50 mm thick glass fibre or rock wood board are recommended as thermal insulating, as well as a sound absorbing materials for stage flies.

In additiion, when fabrication of a stage sound reflector takes place in the future, the use of laminated board consisting of 6 mm thick plywood, 6 mm thick linoleum and 9 mm plywood is desirable, but approximately 20 mm thick plywood might be used in substitution for it.

5-3 Design of Sound Insulation

A study was carried out on sound insulation and isolation of vibration in the hall and the various associated rooms, as well as on prevention of noise from the air conditioning system. However, the noise control of the air conditioning system is left out here as it will be reported in CHAPTER 7.

For the present, these are no sources of troublesome noise outside the building, but it will become necessary to treat of sound insulation of the exterior walls of the hall when the new Dacca Airport is completed because the hall is said to be located just below an air route. As the area of ceiling of the hall is broad, noise from airplanes, especially when they fly over the hall, might be a source of trouble. Therefore, a double sound insulation structure with thick plaster board should be installed underneath the concrete roof slab.

Noise and vibration from the proposed air conditioning system will be a problem inside the building and preventive measures will need to be taken. While providing the wall surface of the machine room with a sound absorption treatment of 50 mm thick cemented board containing chipped wood pieces, the provision of vibration isolator supports for the air conditioning machine, the main ducts and chambers is also recommended.

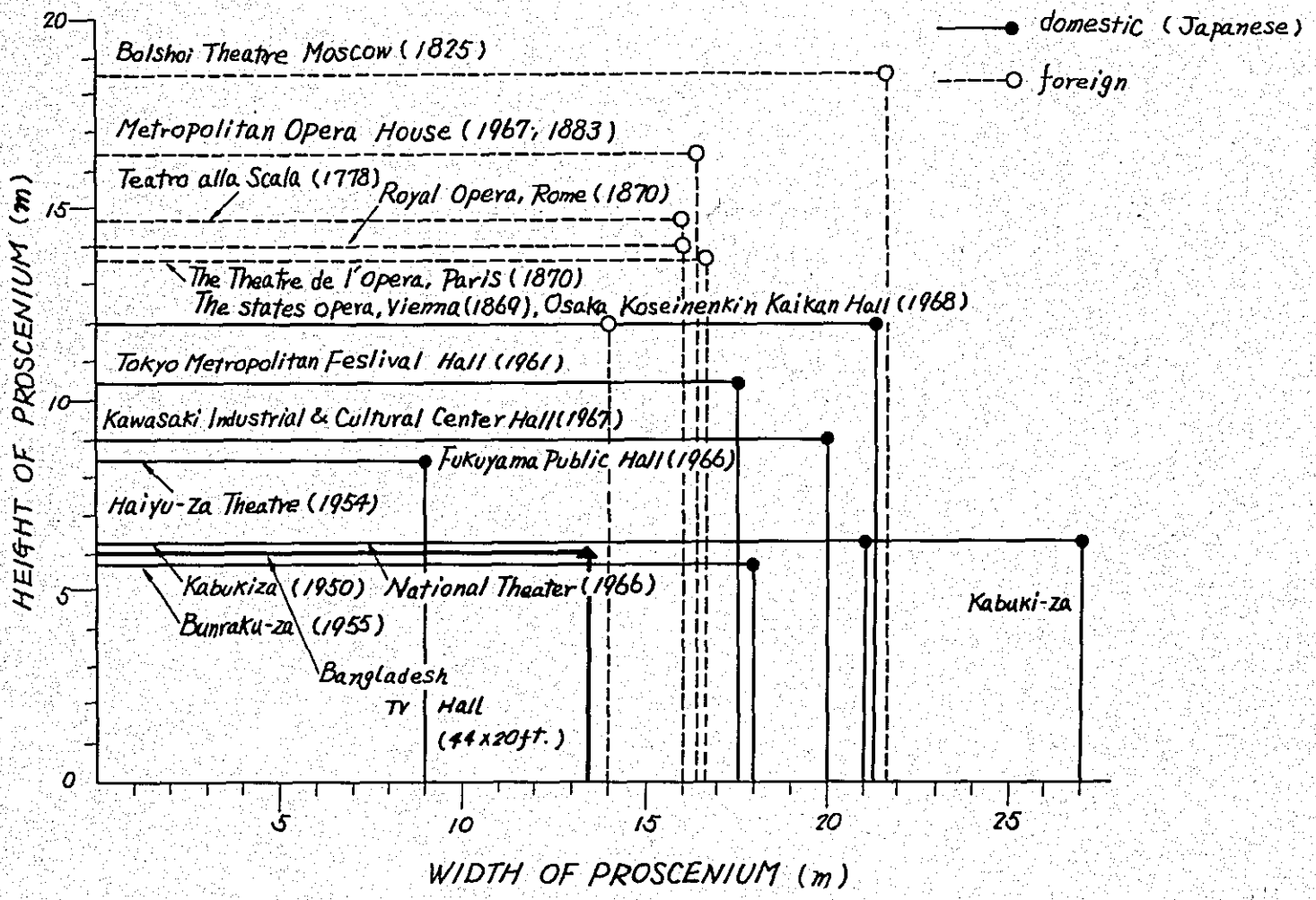


Fig.5-1 Dimensions of Proscenium of theaters.

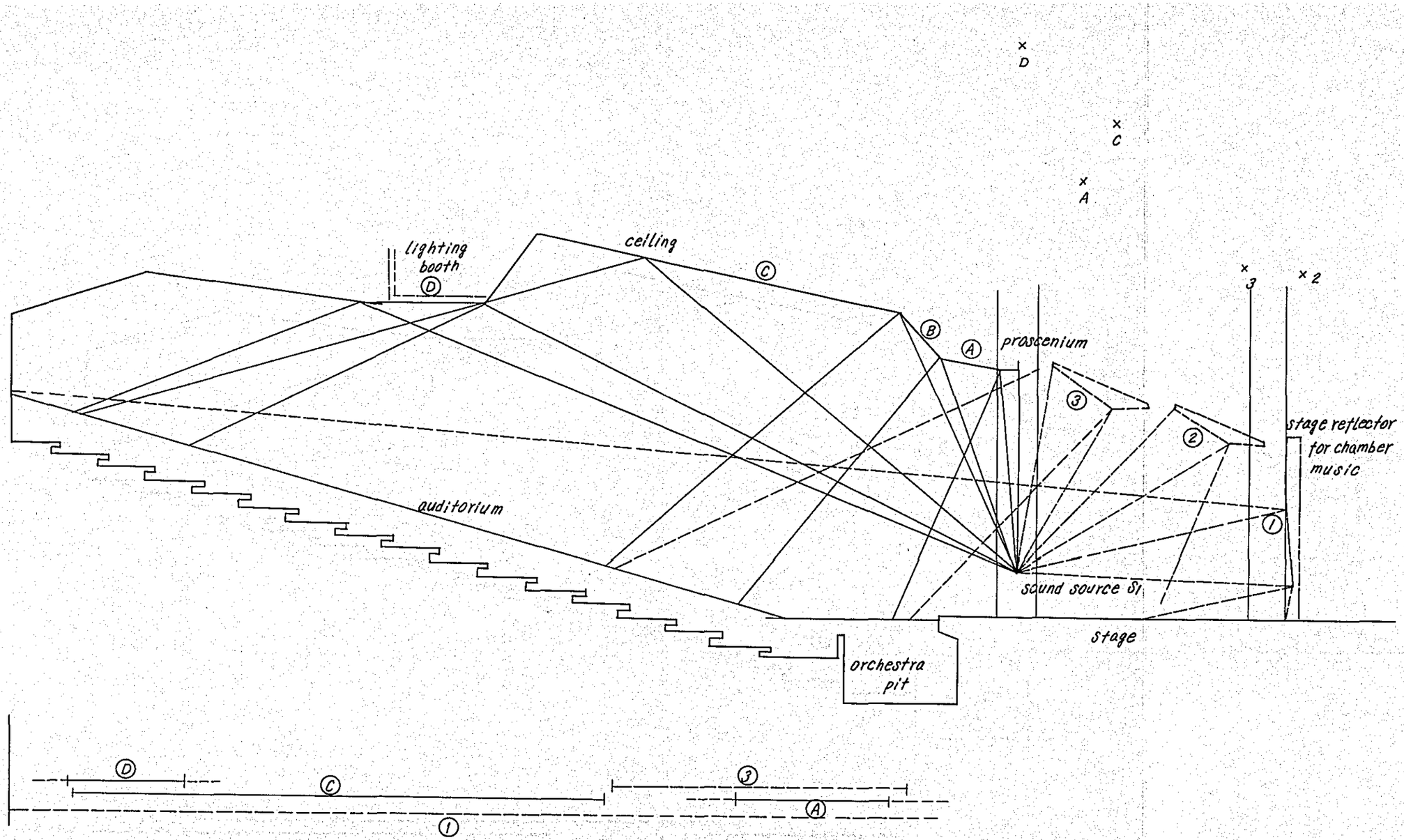


Fig.5-2 Examination of the cross-section for sound energy distribution of primary reflection sound 1.

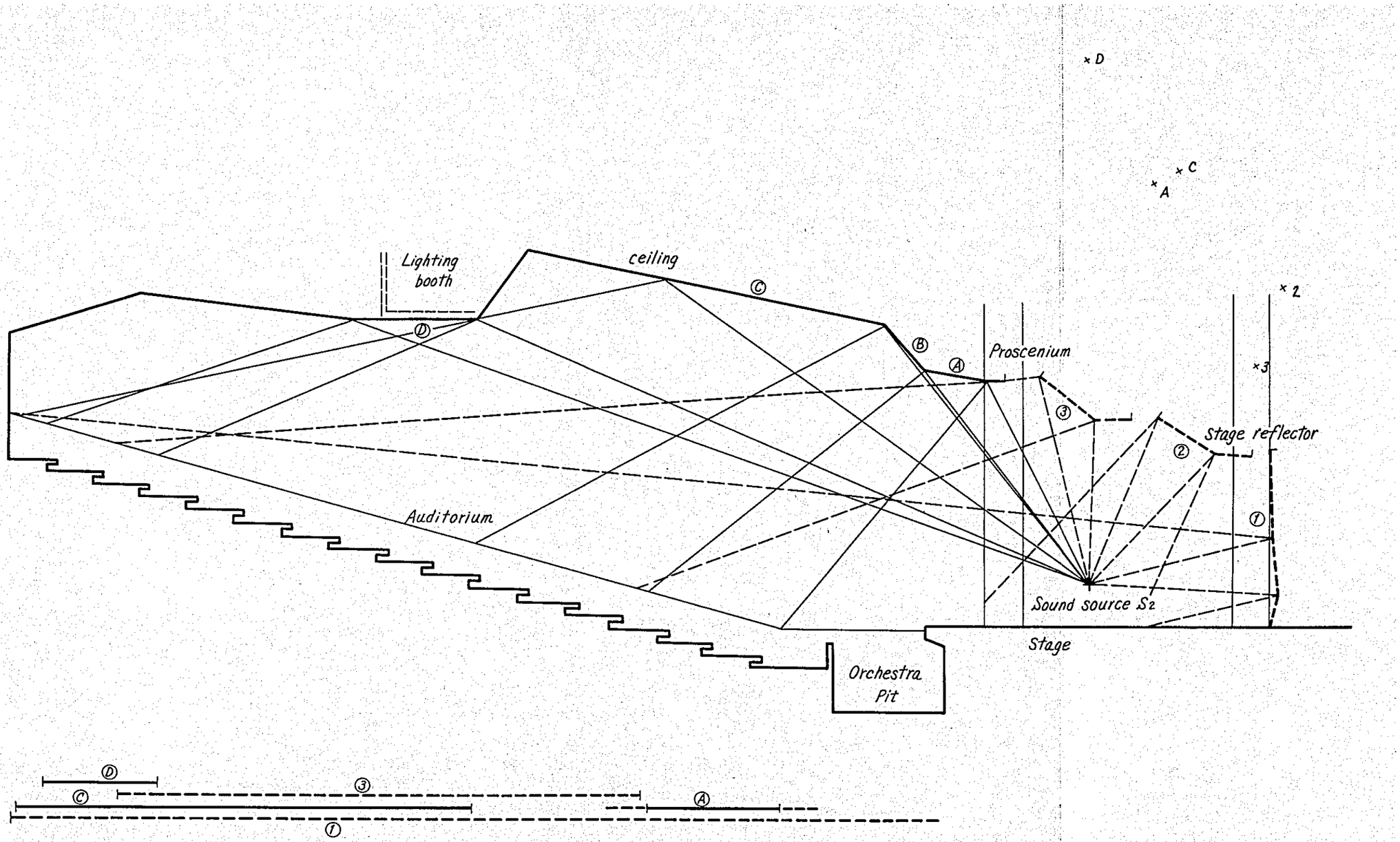
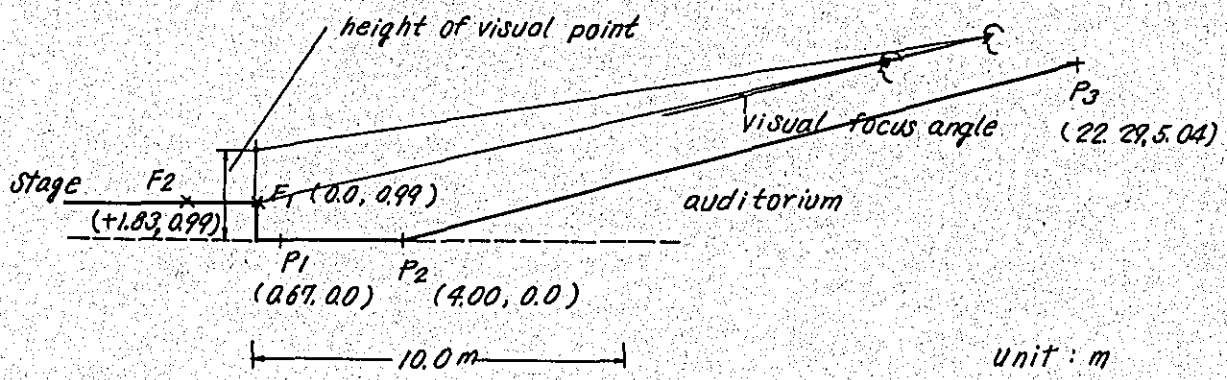


Fig. 5-3 Examination of the cross-section for sound energy distribution of early reflection sounds 2



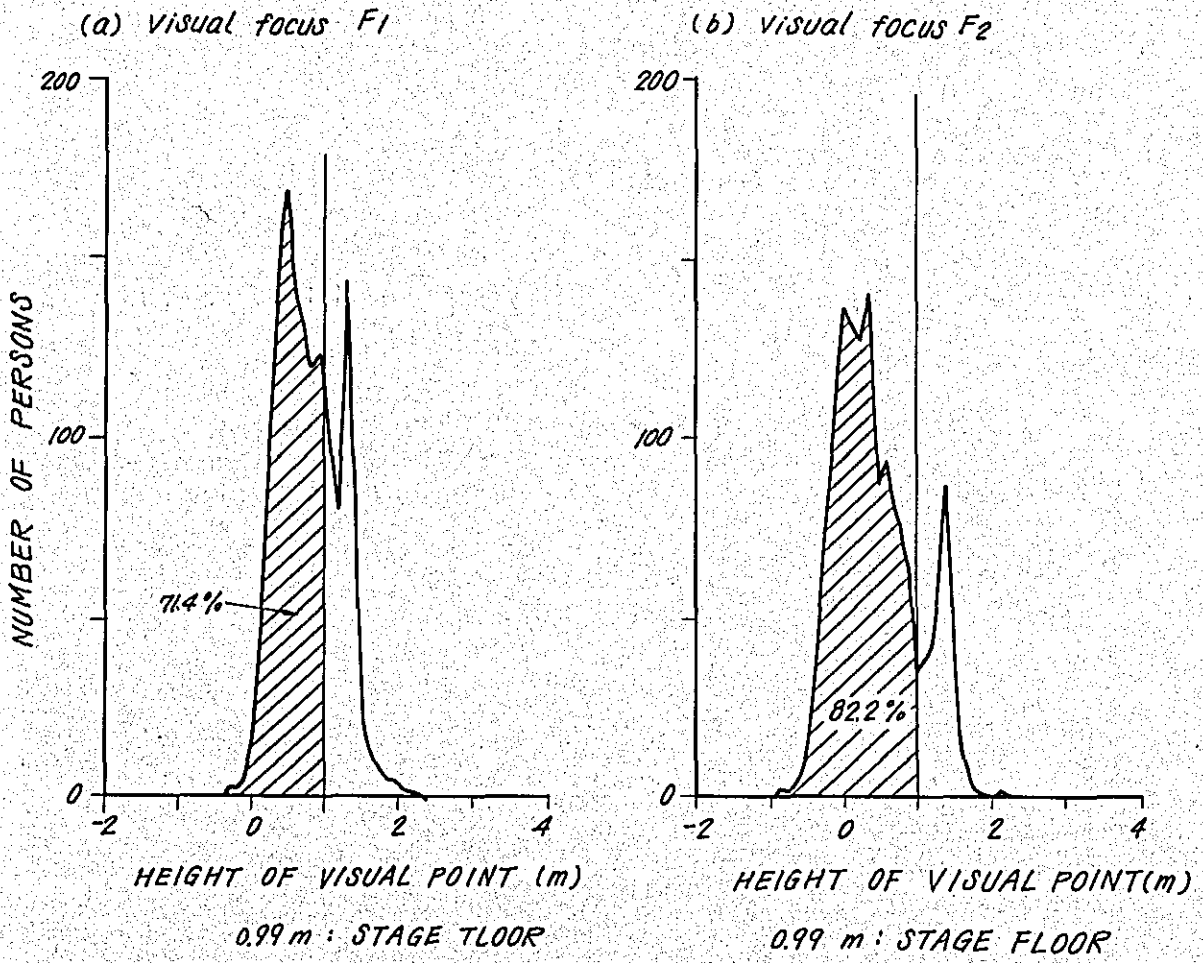


Fig. 5-4 Distribution of the visual focus height in case of seeing each visual focus over audiences heads sitting tow rows ahead.

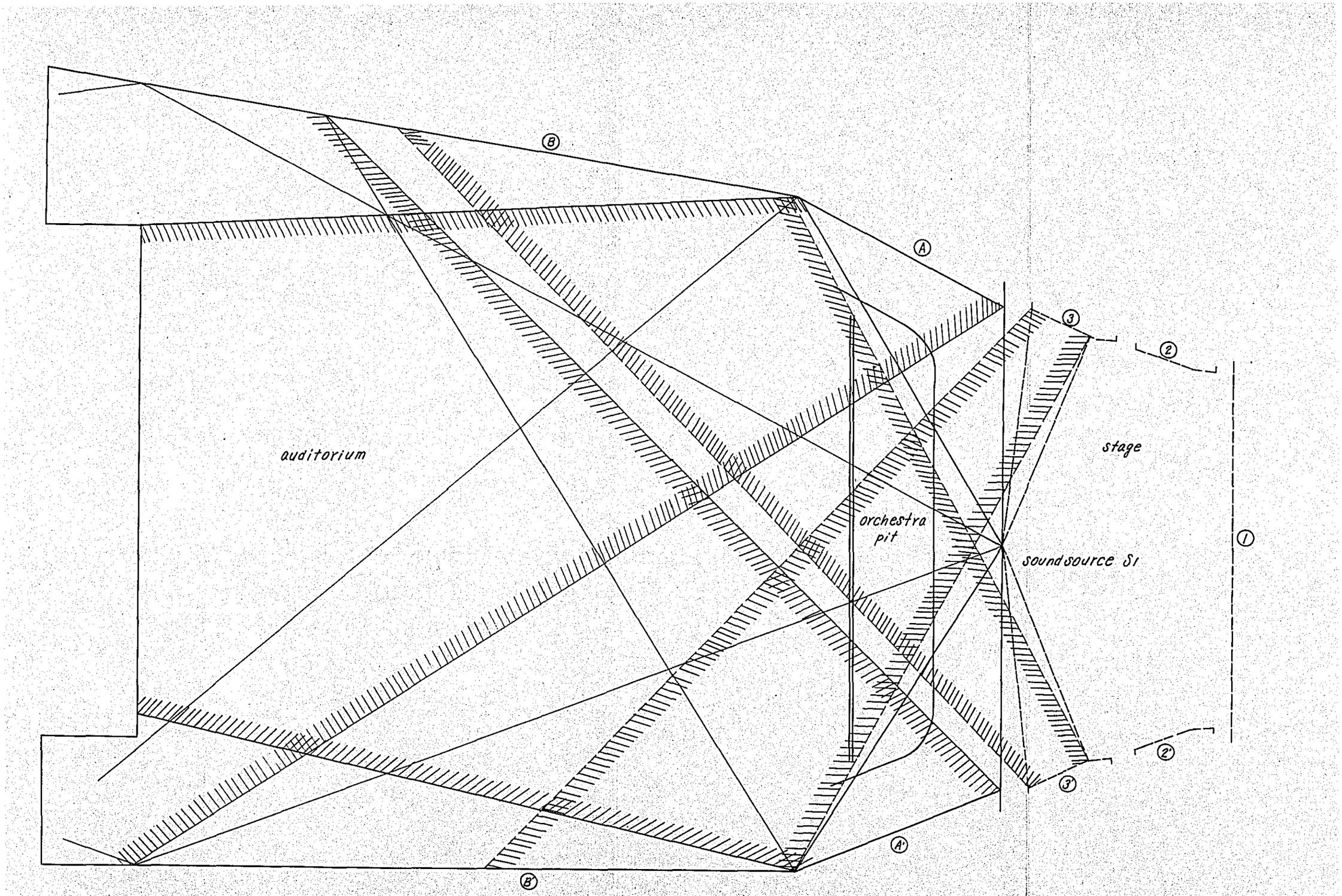


Fig 5-5 Examination plan for primary reflection sounds from walls and stage reflectors.

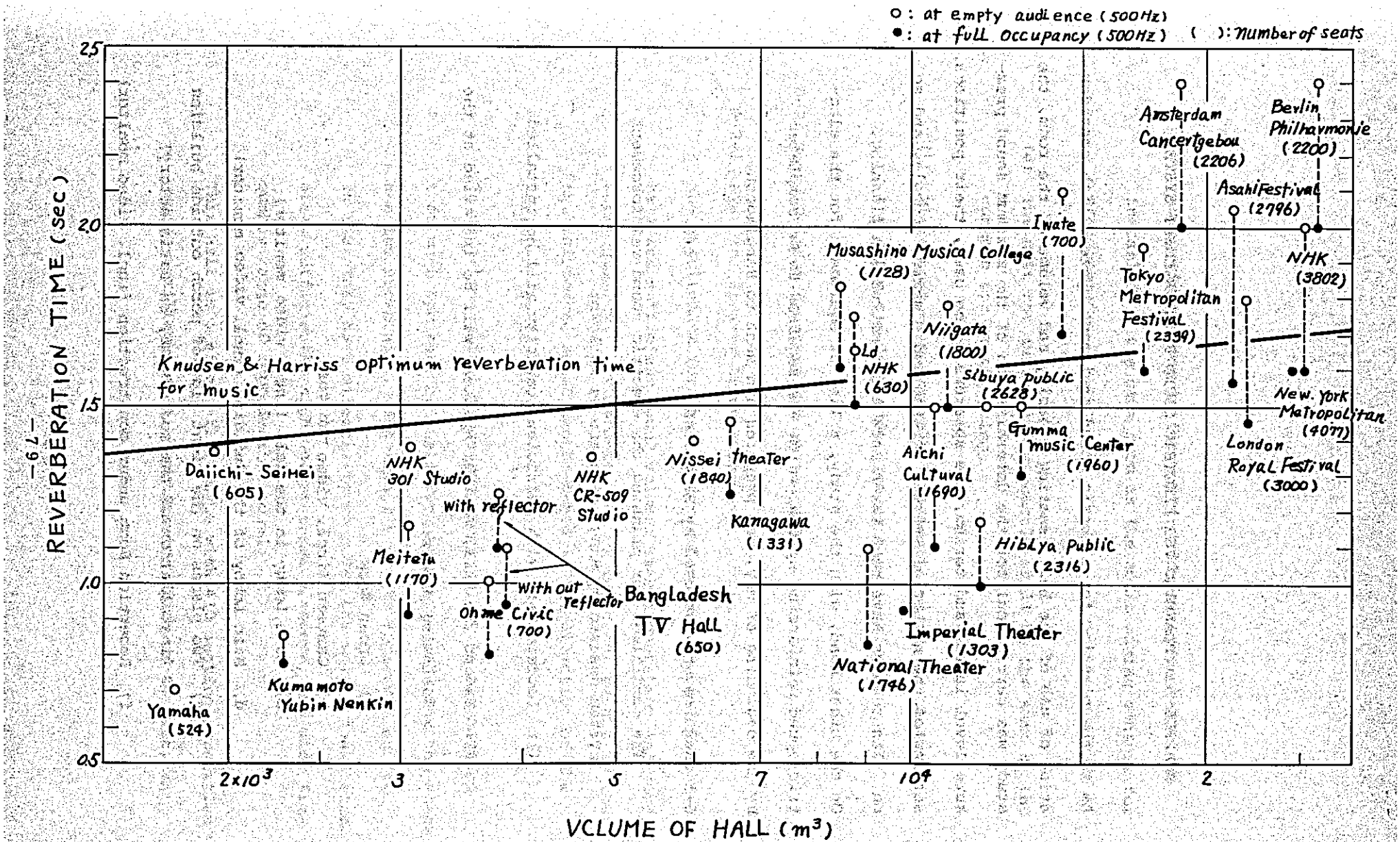


Fig. 5-6 Reverberation time of halls

CHAPTER 6: PLANNING FOR ELECTRIC SOUND REINFORCEMENT SYSTEM

As to the planning for electric sound equipment system, with consideration of use of the hall, seating capacity and volume of the room, the study was carried out for the determination of the maximum sound pressure level in the auditorium, the speakers to be used, their positions, setting of the number of systems for the audio mixing console, and so on. Its results have been taken into the construction planning.
On the other hand, with the study, a list of equipment for the electric sound reinforcing system, which was required to be completed by the beginning of May, was prepared and sent to Bangladesh.

6-1 Requirement Proposed by Bangladesh

The conditions for planning the electric sound reinforcement system desired by Bangladesh are as follows:

(1) Loudspeakers with sufficient capacity will be installed.

(2) Except the hall, monitor speakers will be installed at the following places:

a) Green Room
b) Canteen (incl. video monitor)
c) Main Lobby in the Hall (incl. video monitor)
d) Main Lobby of the Building (incl. video monitor)
e) Two places on the right side of porch outside building (installation of the sockets may be satisfactory)
f) Reception Room under construction (incl. video monitor)

(3) Audio mixing console for public address system shall be installed in the same room as the audio mixing console for broadcasting.

(4) The unit for audio mixing console shall be the same as the console for broadcasting.

(5) Microphone elevators shall be installed at the center of the stage and left side wing of the stage.

6-2 Sound Reinforcement System in the Hall

6-2-1 Plan for Speaker Arrangement

The requirement for the sound reinforcement system in the hall are sufficient sound volume, stable operation and good sound quality. Furthermore, one of the requirements is that the reinforced sound can be heard in the direction of the performer or lecturer.

In order to fulfill these requirements, it is recommended that main speakers be installed in the area adjacent the stage and the proscenium. The capacity of the speakers required is that they have directivity to cover the entire auditorium area, sufficiently high output sound pressure, and wide frequency range of reproduction sound.

This hall is a single-floor type with 410 seating capacities except auxiliary seats, a proscenium width of 44 feet, an

average width of approximately 20 m, and a depth of approximately 22 m for the auditorium. As for the arrangement of loudspeakers suitable to the scale of this hall, installation of two speakers in the ceiling of the proscenium and two on columns of the proscenium is considered to be sufficient.

For the front part of the auditorium where it can not be covered satisfactorily these speakers about three stage front speakers will be furnished on the leading edge of the stage. It has been determined that the arrangement of the wall speakers in the original plan of two years ago will be abolished.

In this plan, the capacity and characteristics of the speakers have been determiend by employing the arrangement as shown in Fig. 6-6.

6-2-2 Determination of Pressure Level of Sound Reiforcement in Auditorium and of Scale of Speaker

Considerable sound volume is required for such programs as light music and TV shows using an electric sound reinforcement system. For sound reinforcement of normal light musics, the maximum average sound pressure level in the auditorium is approximately 90 dB (approximately 70dB for lectures). Therefore, taking into consideration of about 80 dB as an allowance, the pressure level of sound reinforcement of 98 dB is necessary.

The sound pressure level SPL in the room can be derived, in general, from the following formula:

$$SPL = PWL + 10 \log \left(\frac{1}{4\pi r^2} + \frac{4}{R}\right) \text{ (dB)}$$

where

PWL = power level of a sound source,

r(m) = distance to the sound source,

$R = (1 - \bar{\alpha})/\bar{\alpha}$ = room constant of the hall, and

$\bar{\alpha}$ = mean sound absorption coefficient,

but sound pressure level of a direct sound from speaker is directly proportional to 10 log $(1/4\pi r^2)$.

In order to obtain, with the cross-sectional shape of room as determined above, the sound pressure level of 98 dB at representative points in the auditorium 11 m apart from the sound source, sound pressure level of 119 dB is necessary at a point on the extended line of the front axis of the speaker on the upper part of the proscenium and 1 m apart from this speaker, as shown in Fig. 6-2.

As the speaker capable of providing such output sound pressure as needed will be, as shown in Fig. 6-3, the combination type of horn load speakers of about 38 cm in diameter for low frequency range, and sectoral horn speakers for medium and high frequency range can be considered. With this system, more or less 103 dB of output per 1W of input can be obtained at the point 1 m apart. Therefore, the sound pressure level of 119 dB as determined can be obtained with input of 40W. As for the scale and capacity required, 2-way system of a bass reflex type of short horn with front loading for

low frequency range and sectoral horn speaker that have 90° horizontal directivity of 90° and vertical one of 45° for medium and higher frequency range, with impedance of 8Ω or 16Ω, output sound pressure level of 103 dB/Wm, frequency band of 50 - 10 kHz, and rated input of 40W or more is recommended.

There are products to comply with these requirements, of model WS-8500, RS-77 and S-7000 as manufactured respectively by N.T. and V companies. Further, the power amplifiers recommended for the speakers are those of 100W, taking some allowance to avoid distortion that may occur at a time when instantaneous maximum input is applied.

For stage front speaker, a pancake type of 10 cm in diameter, input power of 15W, and output of 90 dB/mW will be satisfactory.

6-2-3 The Locations where the Speakers will be Installed

(1) Proscenium Ceiling Speakers

As for the speakers installed on the ceiling, the ones that have directivity, as described is preceding section of 45° x 90° will be employed, and study has been carried out for the location, the orientation of the main axis and method of installation so that the entire auditorium will be within the range of sound reinforcement. The result of studies on arrangement is shown in Fig. 6-4 and the details of installation location are shown in Fig. 6-5.

According to the studies, it will be necessary for the speakers' main axes to be tilted 30° downward from the horizontal plane. The two speakers each at left and right sides should best be installed at a location 3 meters from the center line of the hall respectively, and with spacing of 6 meters, as shown in Fig. 6-6. As for the method of hanging the speakers, it will be necessary to plan to hang from roof structures independent of the main ceiling in order to isolate the vibration of the ceiling panels, and the speakers will be

Further, each distribution of sound pressure as 92 dB in the center and 87 dB at the rear part of the auditorium by one speaker for 10W input can be expected.

(2) Proscenium Side Speakers

The similar type of speakers as the ceiling speakers will be used for the ones to be installed on the proscenium columns at the stage wings. Studies have been carried out for the positions, orientation of main axes and type of installation. The result of the studies on arrangement is shown in Fig. 6-6 and the details of installation are shown in Fig. 6-7.

According to these studies, it will be necessary to provide of a base for speakers 1.6 m above the stage floor at both sides of the stage, to set the direction of speakers' main axes in the horizontal plane 57° inward to the proscenium arch line,

and to install sectoral horn speakers for medium and high frequency range, tilting them approximately 10° downward. It will be preferable to make shapes of speakers' openings on the surfaces of the walls as shown in Fig. 6-7.

(3) Stage Front Speakers

The locations of the front speakers have been fixed at the points within the rail of the leading edge of the stage. The center speaker has been set on the center line of the hall, and the speakers on left and right hand sides have been set at points approximately 4.5 meters apart from the center line of the hall. The size of the cabinet should be approximately 40(W) x 15(H) x 20cm(D).

(4) Other Speakers

For movie show or depending on the composition of music bands, it may be better to provide speakers on the stage. For this purpose, portable stage speakers need to be provided. As speakers of a similar capacity to the proscenium side speaker are required, the plan has been formulated to provide the same kind as the proscenium speaker so that they will not only serve the purpose but also be as reserved for proscenium speakers.

As for the monitor loudspeakers to be installed in the main lobbies of the hall and building, canteen and eception room, speakers of the same scale as had been proposed in the draft of the original plan* for the sub-control room but with an input of 10W, and diameter of 18 cm with approx 520 x 140 x 300 mm size cabinet of bass reflex type (model M2S-2 as manufactured by T Company or equal) have been considered for use.

* The Technical Guide to the Construction Plan of the Auditorium of Bangladesh, draft as completed in May, 1975.

6-3 Facilities for Sub-control Room

6-3-1 Plan for Audio Mixing System

The requirements for the use of the audio mixing system for this hall are as follows:

(1) Only the audio mixing console for broadcasting will be used when the stage will be used as a studio for TV broadcasting.

(2) Both audio mixing consoles for broadcasting and public address system will be used in parallel when broadcasting will be carried out with an audience in the auditorium.

(3) Only the audio mixing console for public address system will be used for such programs as lectures or shows that would not be put on the air.

The block diagram for the sound system formulated in compliance with the above mentioned three requirements and yet, based on conditions where both audio mixings for public address and broadcasting would have to be carried out in the sub control room is shown in Fig. 6-8.

As for control equipment for the broadcasting system, two tape recorders, an echo machine, record players and monitoring equipments as well as boradcasting control console, will base to be provided as in the draft of the original plan. On the other hand, various equipments will, in addition to audio mixing consoles, become necessary for requirement (3), but the various equipments for the broadcasting system can be appropriated for this purpose and the connections among them can be done through the patching board in the sub control room. A plan has been formed to branch off microphone inputs to broadcasting and audio mixing systems at the time, as a principle, of mixing for broadcast so that each one can be independently operated.

It was also planned that depending in situation, an audio mixing control up to certain extent could be conducted on the console for broadcasting by connecting its output to the input of the audio mixing console for the public address system.

6-3-2 Composition of the Mixing Console

As described in the original plan, mixing console, model AST-1973 of with 11 inputs or equivalent, can be used as is for the broadcasting console. As for the mixing console for public address, the same type of console cannot be used because of insufficient sub and main outputs.

As for the output of the audio mixing console, the following 8 output systems will be necessary at least to satisfy the proposed requirements.

1) and 2) ..... proscenium ceiling speakers L, R (main)

3) and 4) ..... proscenium side speakers L, R

5) and 6) ..... stage speakers L, R fold back

7) ..... back stage speakers/stage front speakers

8) ..... lobby system

The plan, therefore, has been made to form the groups as: 8 systems as for output matrix, and a total of 6 systems composed of 4 systems for main control and 2 systems for sub control for solo and fold back. The block diagram for the planned audio mixing console is shown in Fig. 6-9.

It has been planned that as remote controls for tape recorder, 2 units of control divices for microphone elevators would be furnished in addition to the installation of 12 micro-hone inputs, the same as that of the broadcasting console, 1 echo

unit, 1 oscillator unit and 1 talk-back unit. Furthermore, the audio mixing console for the public address system has been composed, in consideration of interchangeability with the console for broadcasting system, of the same units of head amplifier, talk-back, echo, oscillator, and buffer amplifier as those of the console for broadcasting.

6-3-3 Dimensions and Arrangement of the Audio Mixing Console for the Public Address System

As the design is carried out based on the scale described in preceeding items, the dimension will be: approx. 1200 mm for width, approx. 1000 mm for depth, approx. 750 mm for height of surface of the operation panel and approx. 860 mm for height of the upper surface where VU meters are mounted. The location of the console will be, with the present plan, be adjacent to the window at the side of the auditorium in the sub control room because of the necessity for the audio mixing engineer for the public address system to sit at place where he will be able to observe the entire stage. It, however, will be necessary to make adjustments when executing the design because there is still weak point existing with the proposed location that the stage may not be easily observed. If separation of the sub control room and the audio mixing one is possible, it will be most suitable to provide the audio mixing room next to the projector booth at the rear part of auditorium. In this case,

however, tape recorders and record player for the exclusive use of the audio mixing room will need to be provided.

6-3-4 Monitor Speakers

As speakers of 10W allowable input are satisfactory, the same type of speakers as those used in lobby, etc., in consideration interchangeability, will be employed.

6-4 Microphone Inlet Boxes and Microphones

The study on the locations of microphone inlet boxes has been carried out in accordance with the original plan. The arrangement plan for the locations of inlet boxes made out is shown in Figure 6-1.

As for the inlet boxes on the stage, a total of 16 concents, consisting of 2 four-row type of inlet boxes and 4 double-row type ones at 6 locations between the front and the center of the stage have been installed so that microphones can be suitably set in accordance with the sound sources. Furthermore, a three-points suspension box with 2 built-in inlets for one-point sound collection for musics has been furnished at the front part of stage as well as the installation of 4 inlet boxes on the grid iron above the stage for a one point suspended microphone. Also, 2 units of microphone elevators have been installed in the position of the master of ceremonies at the center and left side of stage.

Likewise, on the floor of the orchestra pit, a four-row inlet box for collecting sound of musical instruments in the orchestra pit, and 2 inlet boxes for collecting sound in the auditorium have been installed in the neighbor of the entrance/exit to and fro the auditorium on the right side. Moreover, 2 inlet boxes for collecting effect sound in the auditorium on the floor of the ceiling lighting booth and 2 air monitors for checking mixed sound in the ceiling of the auditorium have been furnished.

The microphone elevators of the construction as shown in Figure 6-11 will be provided in the plan. The locations for these may be subject to change, in accordance with the structure of the lower part of the stage in the orchestra pit, as the overall length of the microphone elevator is considerable i.e., 2 meters long. For that reason, the locations need to be determined in accordance with the construction scheme.

As for the kinds of microphones, one kind of the condenser type, one kind of the variable directivity type, and three kinds of the dynamic type have been chosen as in the original plan, but it is desirable to provide, including ones reserve, at least 5 microphones of the same type such programs as group sounds, chorus, and the like. For that purpose, 5 microphones each for the 3 kinds respectively that had been lacking have been listed up to be provided.

And, 5 microphone stands for each of the respective types of microphones will be provided per plan.

6-5 Others

The receiving antenna for wireless microphones had originally been planned to be the type used on a removable stand, but this was found to be inconvenient to handle and, therefore, it has been determined, for this plan, that 3 antennas would be installed separately on the wall surface of the hall.

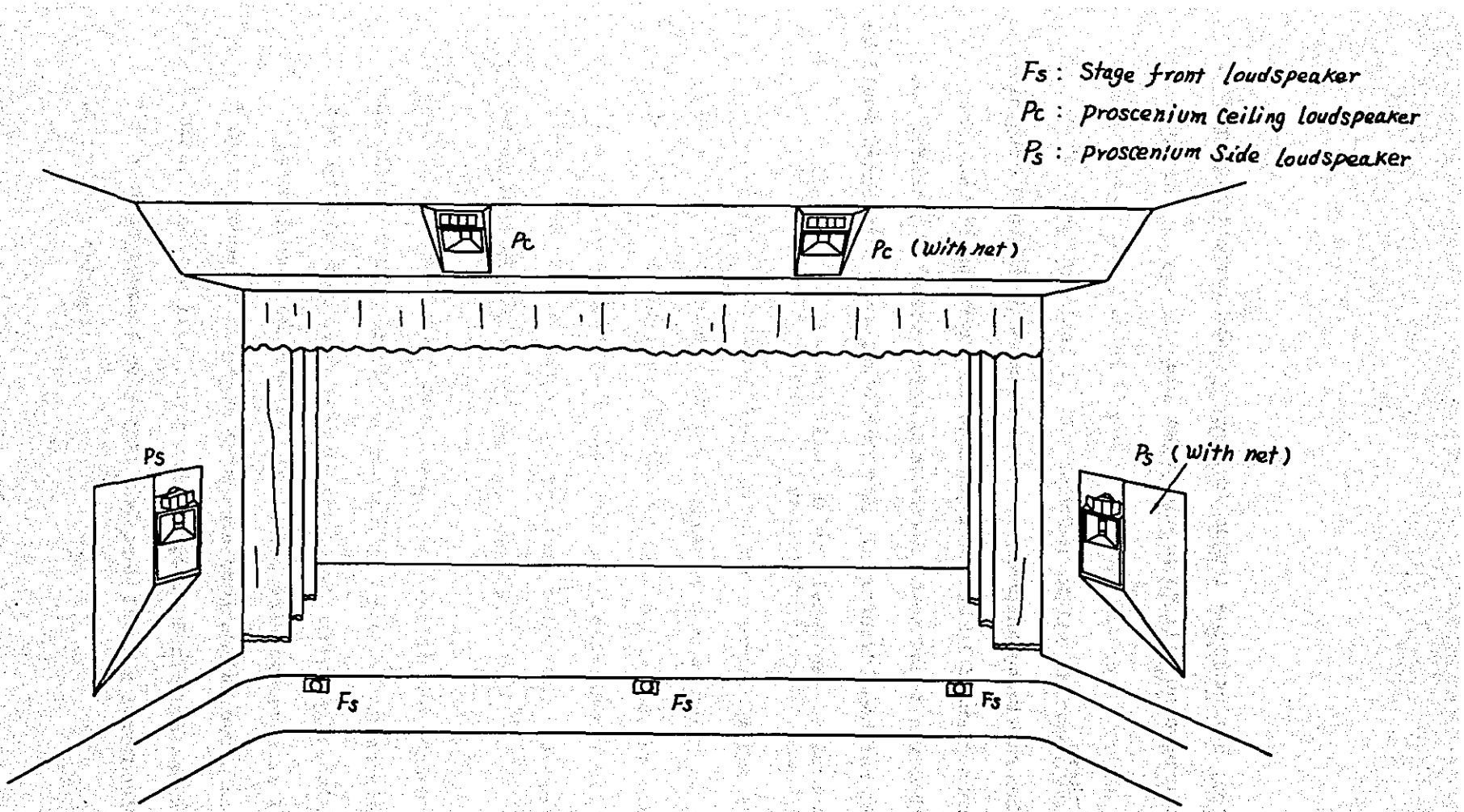
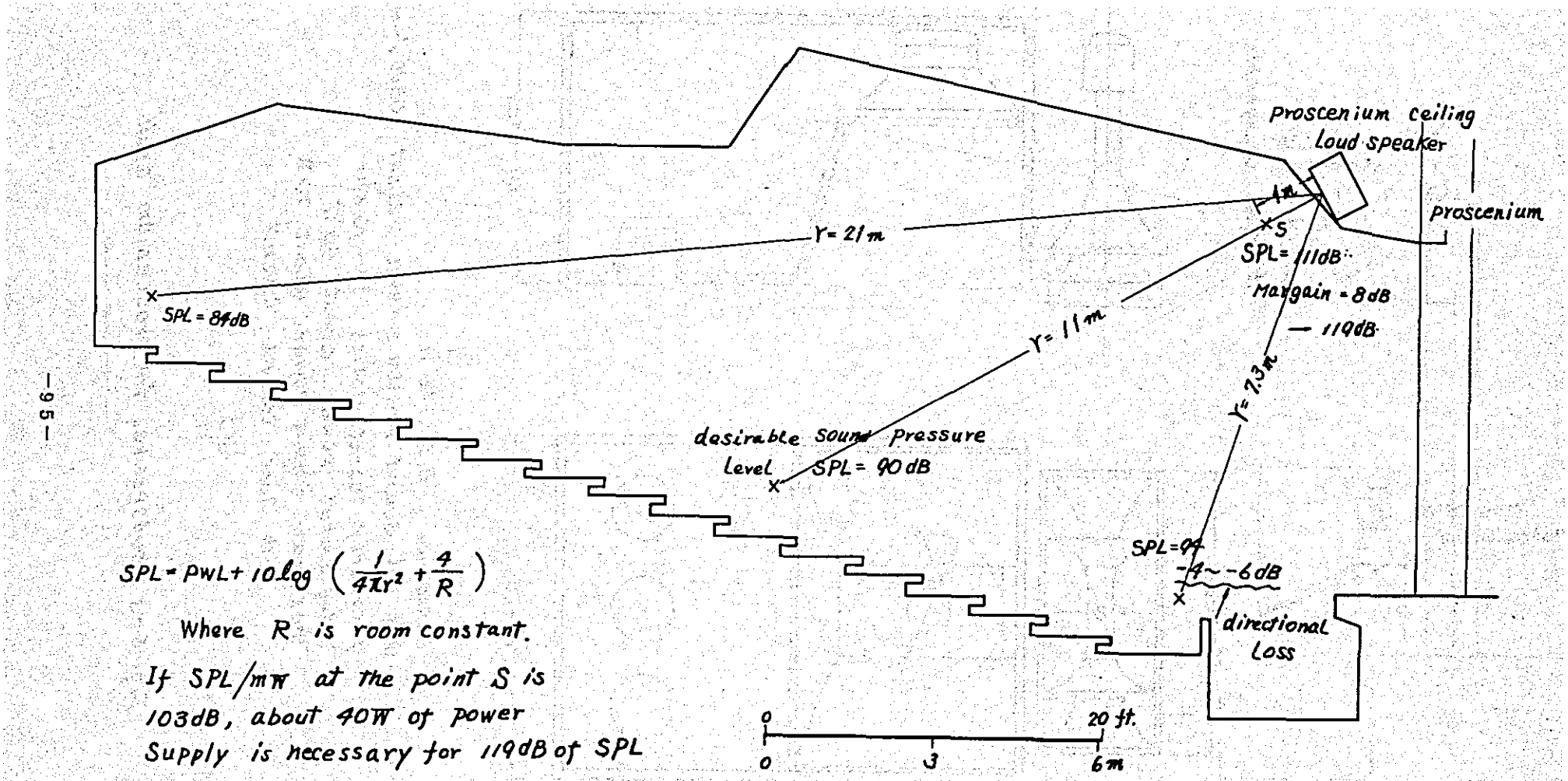


Fig. 6-1 Layout of Proscenium loudspeakers and stage front loudspeakers.

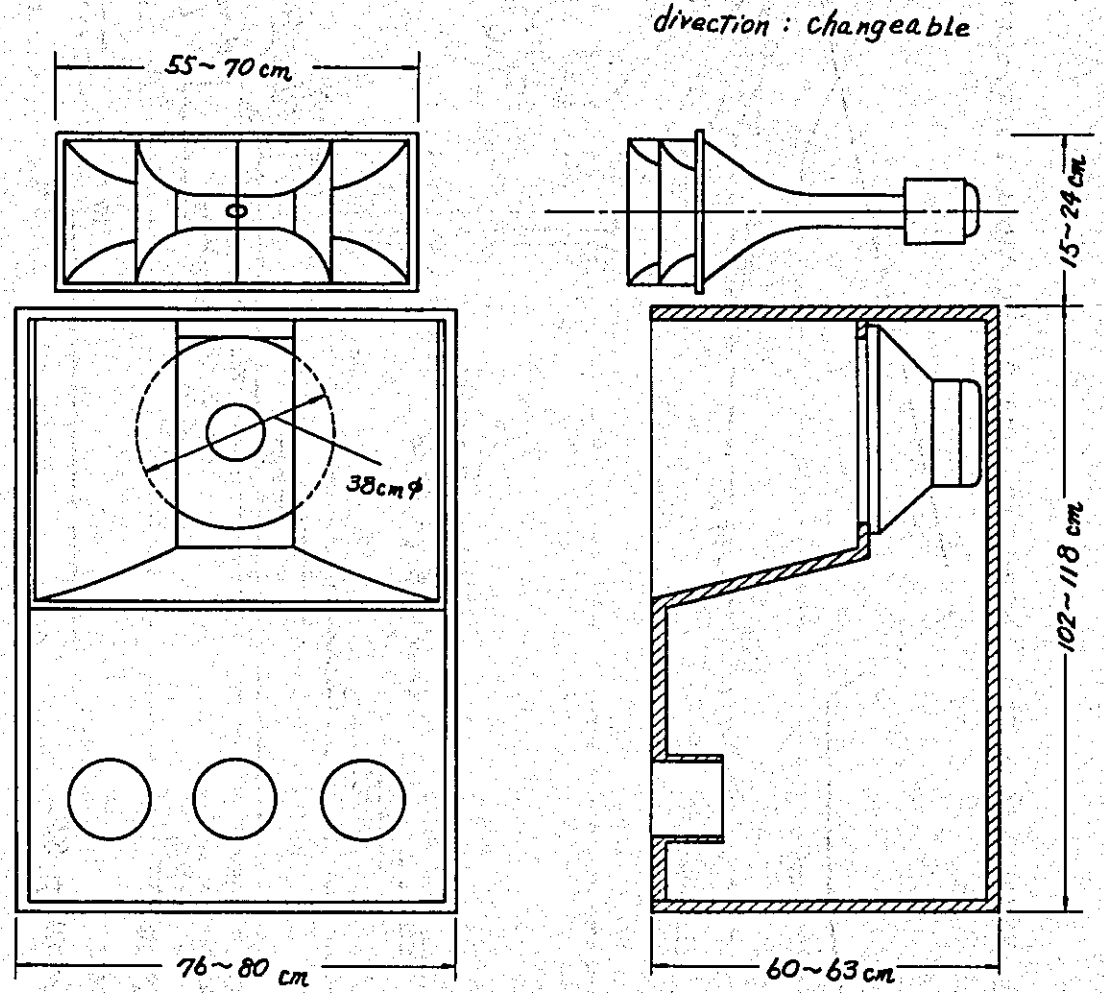


$$SPL = PWL + 10\log\left(\frac{1}{4\pi r^2} + \frac{4}{R}\right)$$

Where R is room constant.

If SPL/mW at the point S is 103dB, about 40W of power Supply is necessary for 119dB of SPL

Fig. 6-2 Calculation of the necessary power of the proscenium ceiling loudspeaker.



impedance : 8 Ω, 16 Ω
Out put sound pressure level : about 103dB/wm
frequency charatevistics : 50 ~ 10 KHz
rated imput power : about 40 W
maximum imput power : about 70 W
With tone contvol civcuit

Fig. 6-3 Loudspeaker for proscenium arch.

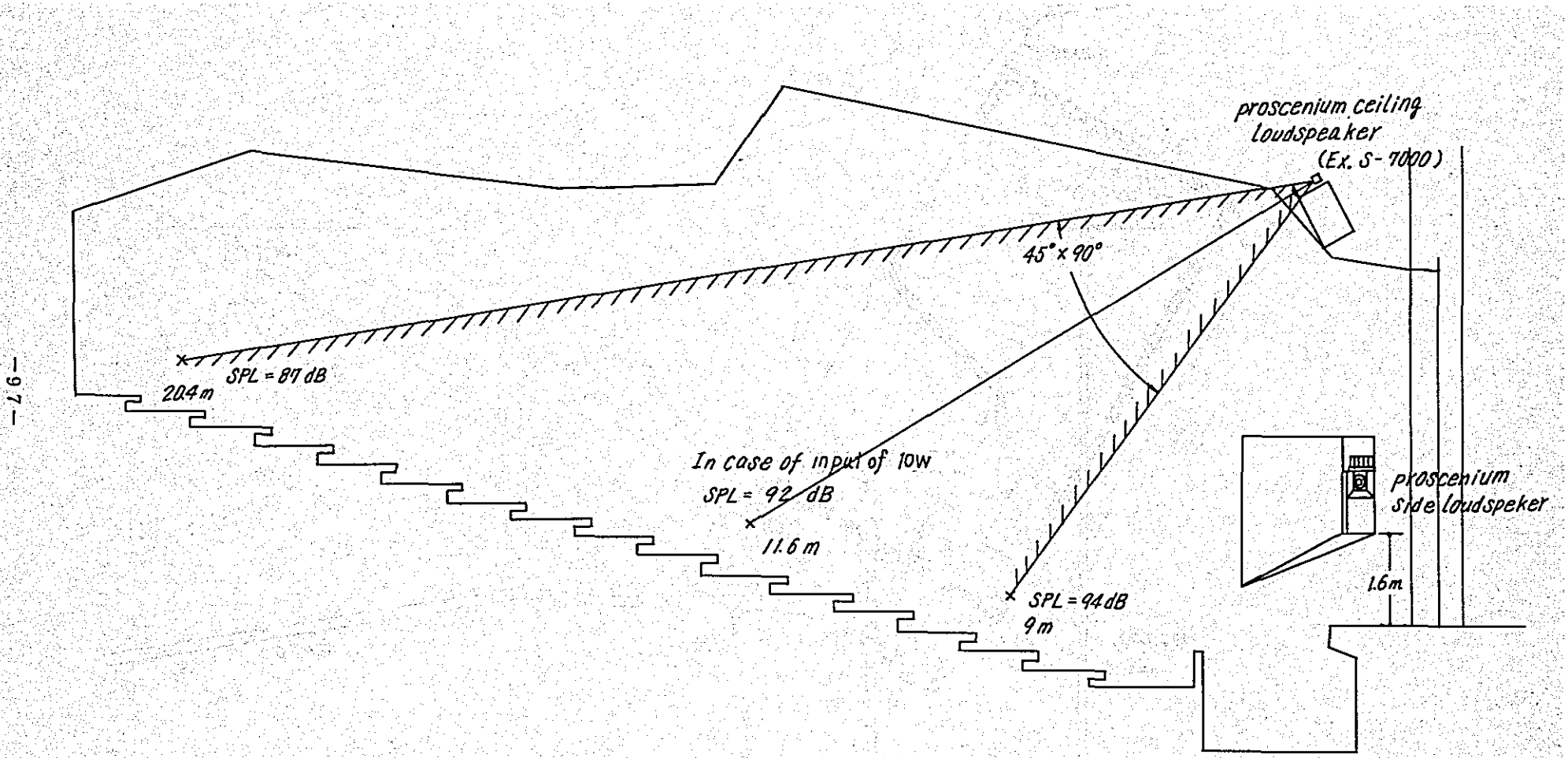


Fig. 6-4 Directional characteristic of the main loudspeaker.

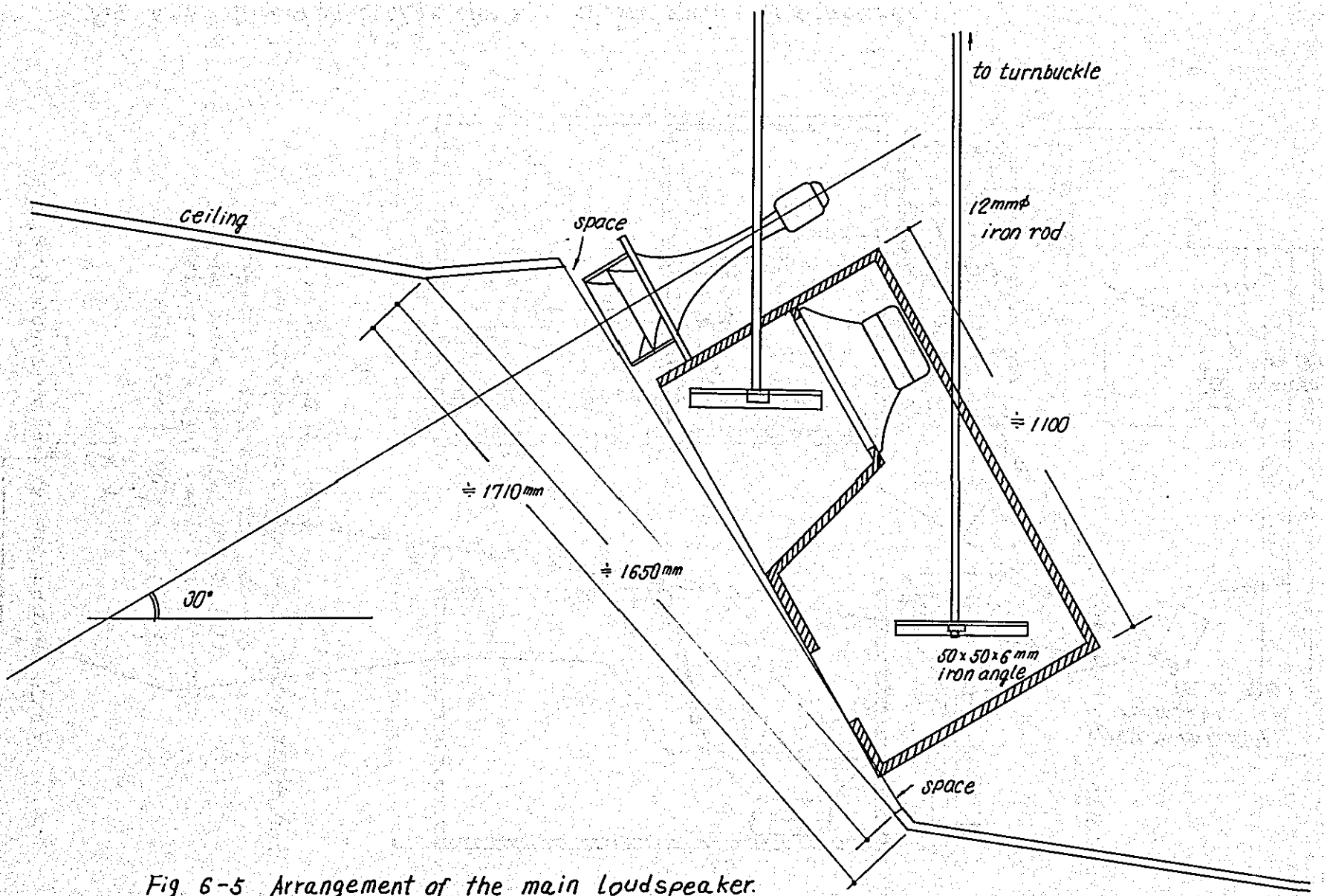


Fig 6-5 Arrangement of the main loudspeaker.

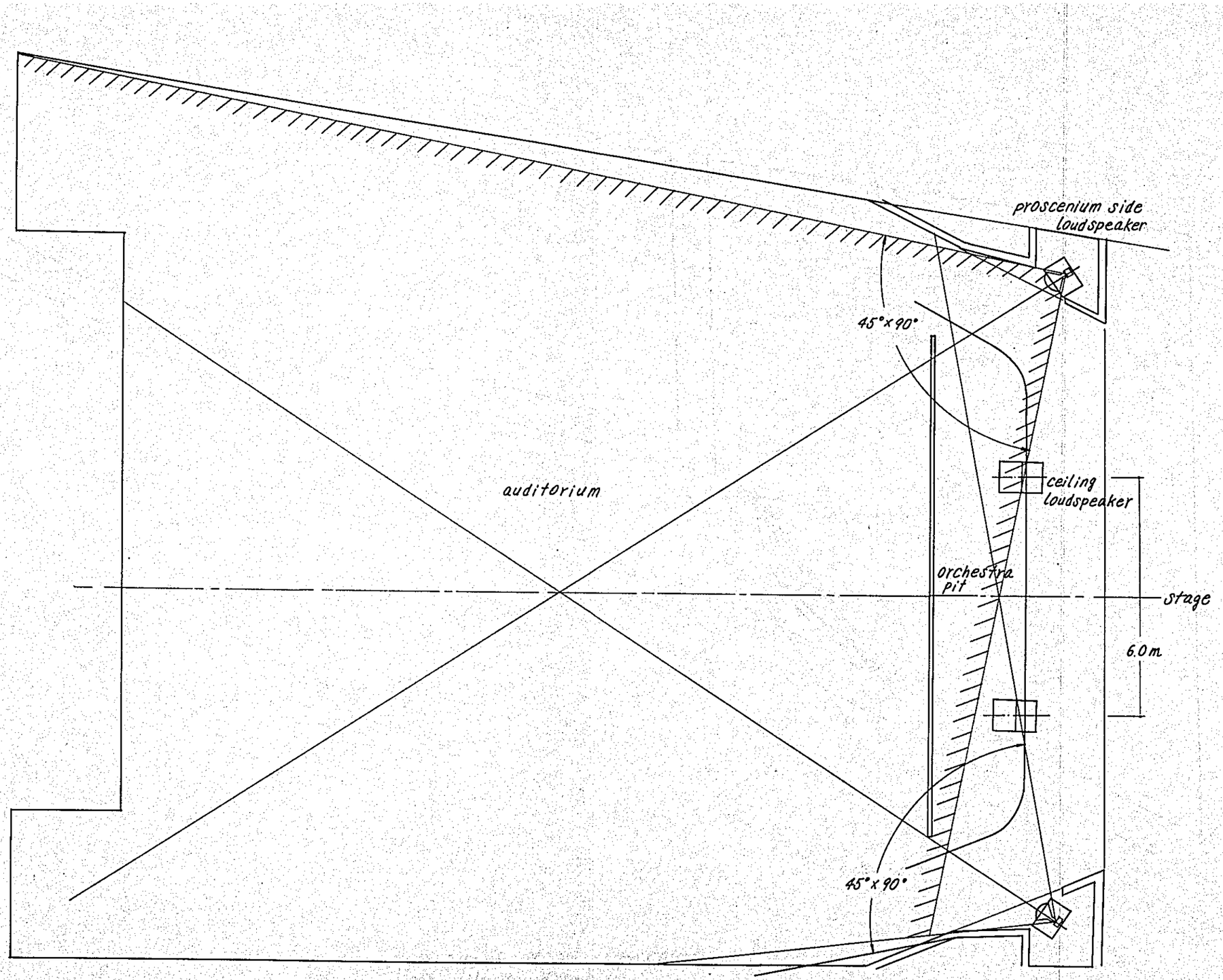


Fig. 6-6 Directional characteristic of the proscenium side loudspeaker.

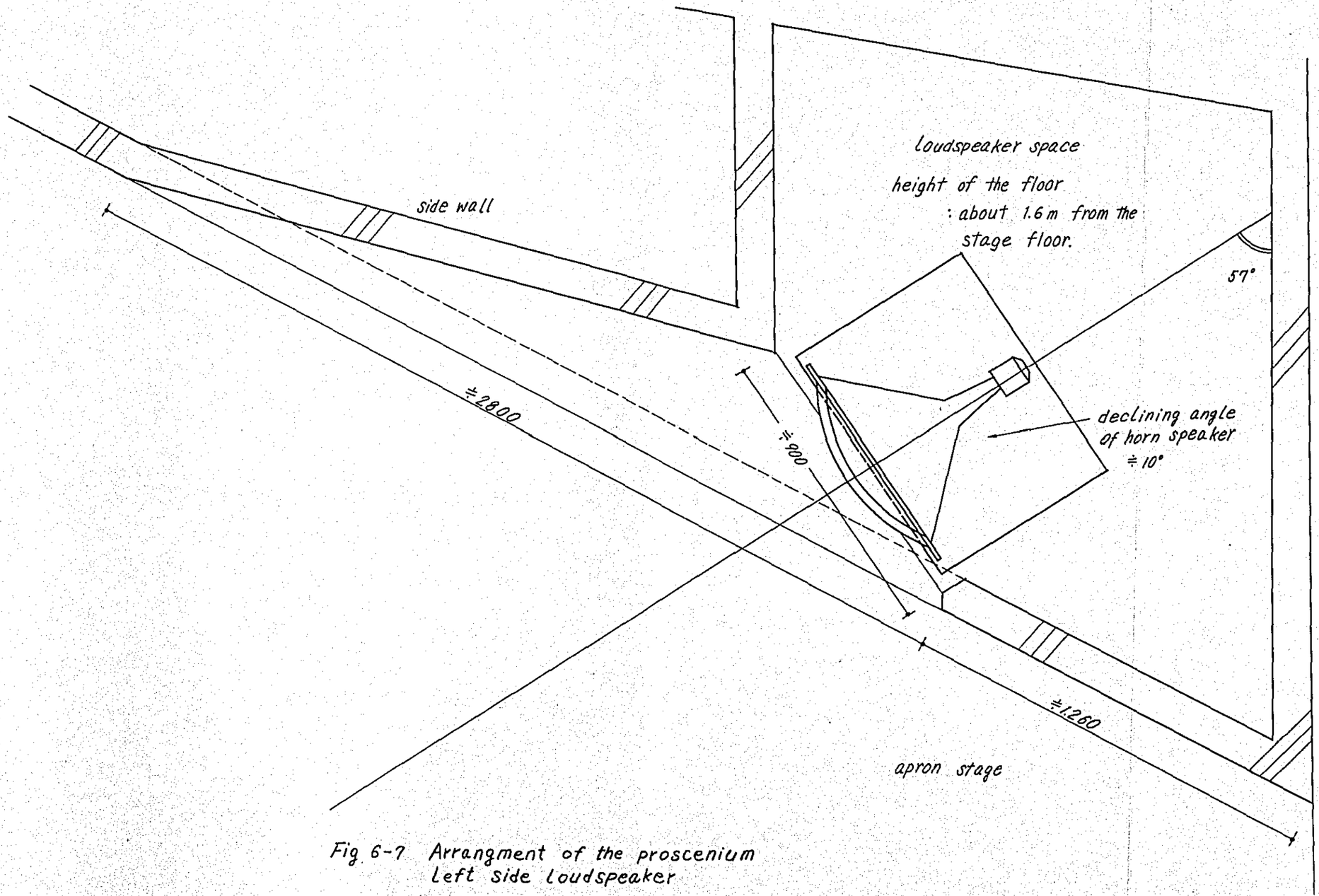


Fig 6-7 Arrangment of the proscenium
left side loudspeaker

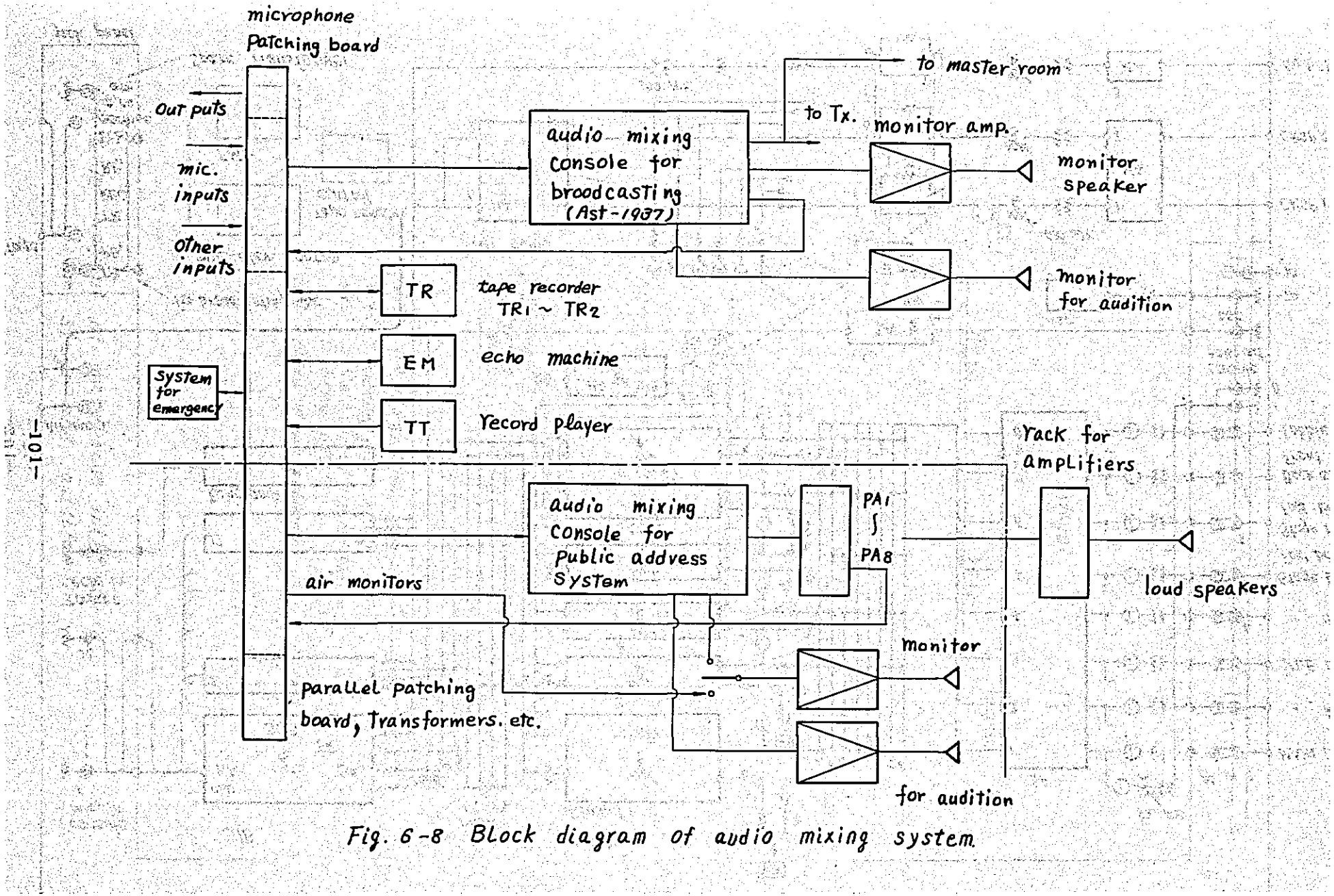


Fig. 6-8 Block diagram of audio mixing system

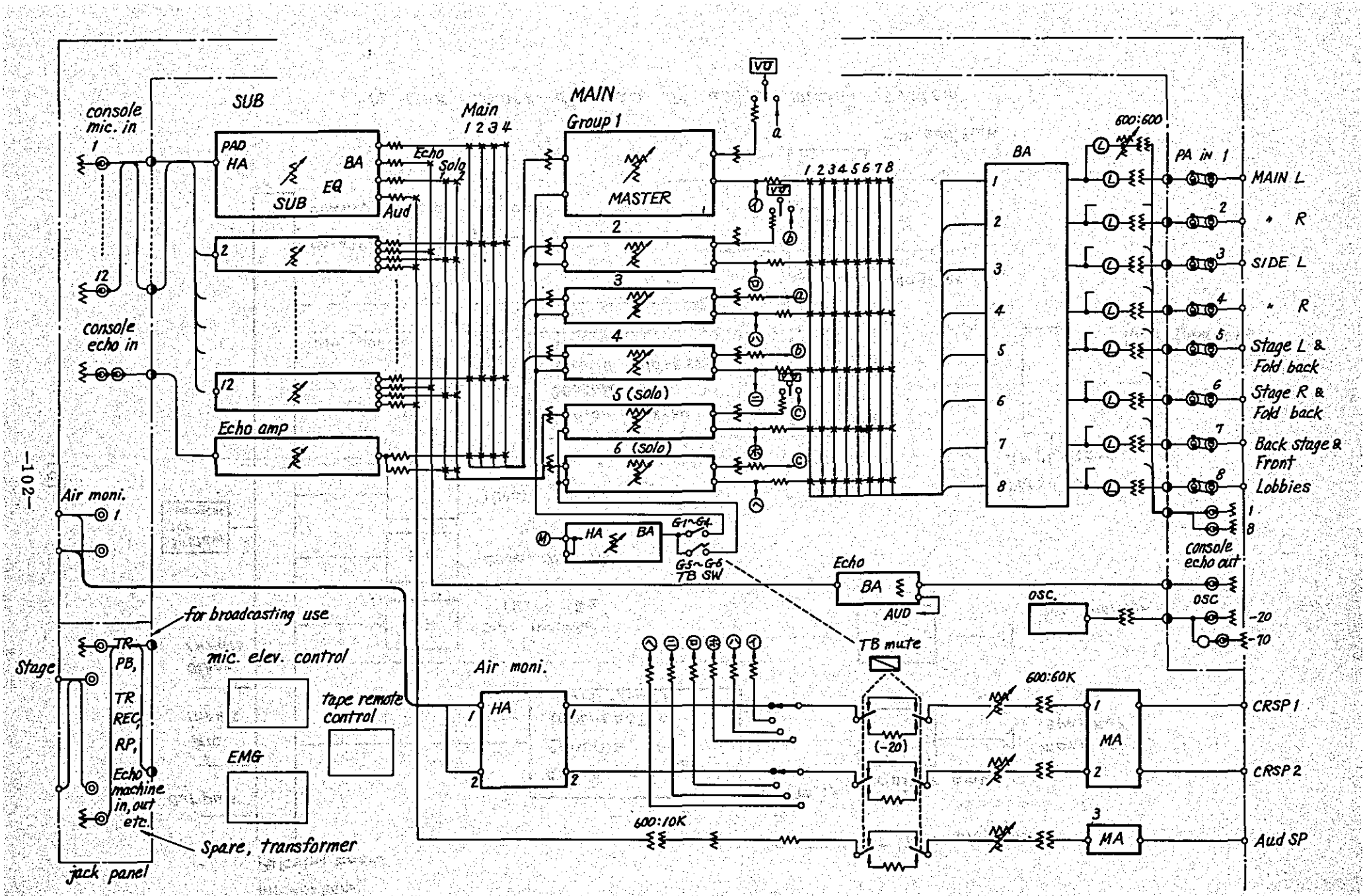


Fig. 6-9 Block diagram of audio mixing console for public address system.

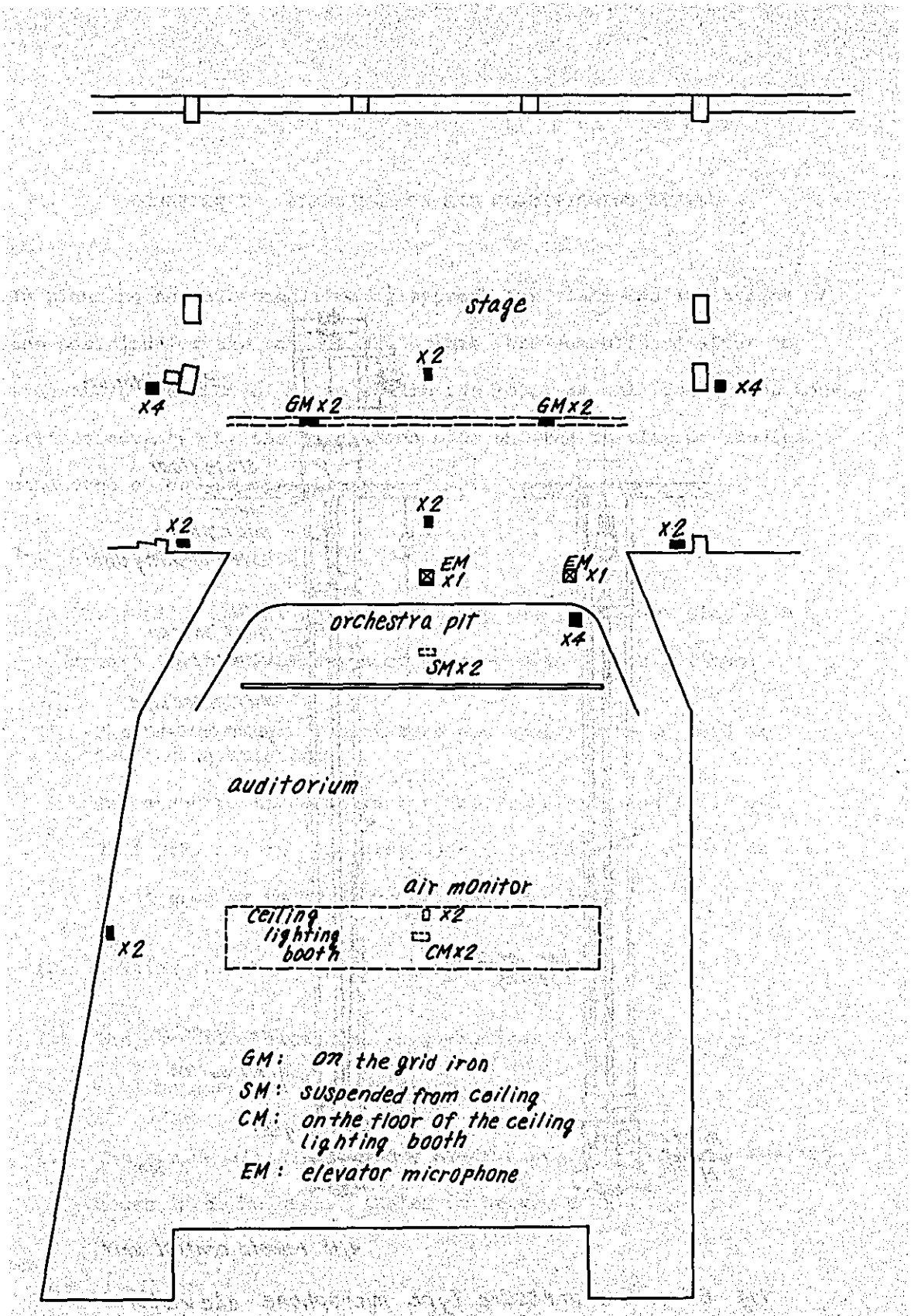


Fig. 6-10 Layout of microphone inlet boxes in the stage and auditorium.

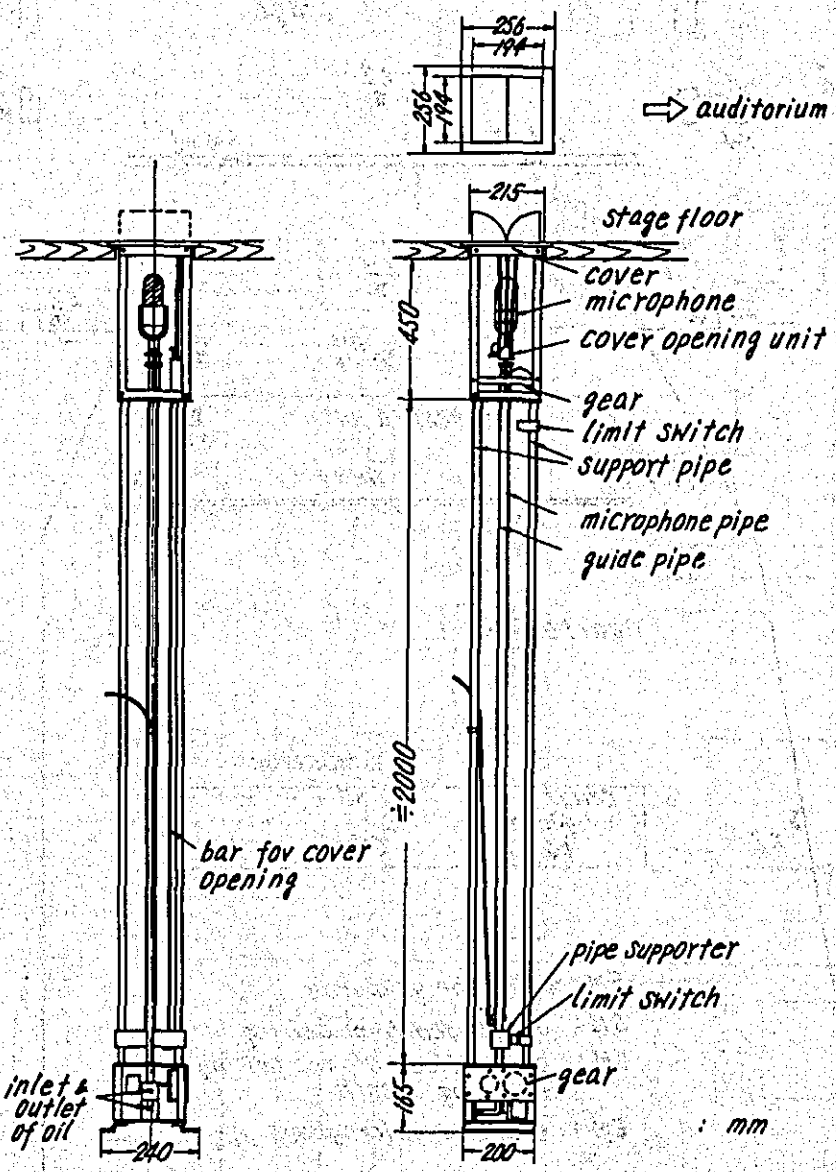


Fig 6-11 Oil pressure type microphone elevator.

CHAPTER 7: PLANNING FOR AIR CONDITIONING SYSTEM

In planning the air conditioning system, its scale and an outline of the positions of the various equipments were established after considering prevention of noise within the room, as well as various conditions advanced by the Bangladesh side and the results of studies conducted on equipments already in use.

7-1 Conditions Required

The various conditions specified by the Bangladesh side with regard to the preparation of a basic plan are as follows:

(1) The Designed Room Temperature and Humidity to be used in Cooling Calculation

The standard temperature for the Technical Area is to be 72 ± 2°F, and the humidity 50 - 60%, while the other non technical area is to be 76 ± 2°F, and 50 - 60%.

(2) Heating facilities will not be required.

(3) The essential data such as variations in outside temperature will be supplied for reference.

(4) The air handling unit Model AY-45 already supplied by Westinghouse is to be used. (Refer to survey data).

(5) The surplus cold-heat source from two Westinghouse Model PE 225 W units now in operation each with a capacity of 225 US refrigerating tons is to be used for the water chiller. (Refer to Survey data).

(6) The pipes standing at the back of the hall in the second floor are to be used for the cooling water.

7-2 Setting of Permissible Noise Criteria

The permissible noise criteria for the air conditioning equipment for the various rooms have been set after considering their purposes of use as follows:

The sound pressure level of permissible noise criteria is shown in Fig. 7-1.

(1) Hall ..... NC - 25

(2) Sub-control Room ..... NC - 25

(3) Lobby ..... NC - 30

(4) Other Clerical Work Rooms .... NC - 35

7-3 Zoning of Air Conditioning System

As the auditorium, stage and supplementary rooms differ as to internal heat generation, as well as in air circulation and noise conditions, it will be necessary to construct a separate system for each room. Particularly for the hall only, the stage

and sub-control room are used in case of productions of TV Programmes, while in case of ordinary programmes, the presence of an audience m must also be taken into consideration. From this standpoint, the 3 system given in Figure 7-2, were explained to the Bangladesh side as a rough outline of the equipment system to be adopted, as follows:

1. Stage and Sub-Control Rooms ..... 2 Duct Systems
2. Audience Seating Section and Lobby ..... 2 Duct Systems
3. Other Spaces

However, after re-studying the differences in the conditions of use of the various rooms, as well as the load factors, zoning into the eight following sections has judged to be the most appropriate method and the basic planning has been pursued on this bases:

1. Auditorium Section ..... 540 m^2
2. Stage Section ..... 690 m^2
3. Sub-Control Room Section ..... 110 m^2
4. Lobby Section ..... 300 m^2
5. Canteen Section ..... 120 m^2
6. Office Room Section ..... 120 m^2
7. First Floor Lighting Room Section.. 80 m^2
8. Ceiling Lighting Booth Section .... 60 m^2

Also, depending on circumstances, sections 5 and 6, as well as sections 7 and 8 can both be combined into single sections.

As the stage flies and the auditorium ceilings are positioned at considerable heights, the temperatures at these parts tend to rise, therefore, to prevent this heat from affecting the parts to be cooled, special exhaust fans will be installed.

A centralized system with low speed duct using a Westinghouse water chiller as the cooling heat source, will be adopted.

With regard to the air expelled by the exhaust fan, a volume equal to that of the intake of fresh air is being considered.

7-4 Discussion of Equipment Capacity

A study of the number of units required for the air conditioning equipment was conducted by referring to the hall dimensions as given in Table 3-1 for calculating the approximate capacities of the various equipment.

7-4-1 Result of Load Calculations

Calculations were carried out to satisfy peak cooling load requirements during the summer, with factors considered in planning temperature and humidity at such times being 36°C for the outside temperature with humidity at 80°C, and 25°C for the interior temperature with humidity at 50%. For the Auditorium, the sensible heat and the latent heat emanating from the human body was assumed to be 50 K cal/h for each of these heats, with calculations based on a total of 460 persons.

As regards fresh air, air circulation volume of 25 m^3 per unit surface/hour was considered. The calorific value of the lighting equipments for the stage was determined to be slightly over 300 kW as explained in Chapter 4, with an assumed simultaneous use ratio of 70%. The calorific values of the equipments used in the various rooms were considered to be 19 kW for the sub-control room, 16 kW for the lighting room on the first floor, and 12 kW for the ceiling lighting booth. An average of 100 persons was assumed to be in the lobby and the calorific value of the illuminating equipment, 75 kW.

By calculating the air-conditioning loads for the various systems under the conditions mentioned above, the values for all 8 systems will be about 114 refrigerating tons for sensible heat, 11 refrigerating tons for latent heat, 120 refrigerating tons for the fresh air load, to a total of 245 refrigerating tons. This result indicates that the water chillers now under consideration do not have sufficient capacity. If load is recalculated under conditions in which all heat exchangers are employed, the total will be 165 refrigerating tons which means that the problem of under-capacity will be solved. In addition, the present piping system, in which pipes of 3" in diameter are installed, is entirely insufficient, and a new piping system must be installed parallel with the existing piping.

However, as these calculations were made to provide for peak loads, the cooling capacities required are considerable, but by reducing the intake volume of fresh air or if some increase in temperature can be tolerated during peak load periods, load requirements will, of

course, vary. For this reason, further consultations with the Bangladesh side will be necessary to solidify the conditions under which the most suitable design can be drawn for the actual planning.

7-4-2 Number of Units Required

As mentioned above, eight systems are to be adopted for air conditioning. For the auditorium section, the AY-45 Unit with a refrigerating capacity of 68 tons can be used, but for the other systems a total of 7 air handling units of varying capacities must be installed. In addition, air exhaust fans must be installed for every system if circulation of fresh air is considered.

7-5 Noise-Proof Equipment for the Air Conditioning Systems

In the process for completing plans for the air conditioning system, the existing air conditioning equipment was studied. At that time, at the request of the Bangladesh side to minimize the noise emanated by the existing equipment, the noise from the clerical work room system was measured. As a result of this study, it was ascertained that the noise in the office reached NC-55 (Refer to Fig. 7-3), the reason being that no noise insulation and absorption equipment had been installed in the duct system. In the present plan, this fact has been considered, and in the basic plans given below, suitable provisions have been made regarding locations which may rise problems in the air conditioning plans, as well as factors requiring

consideration from the acoustic aspect.

(1) For the auditorium and the stage system, sufficient space will be provided for the installation of about 5 sound absorption elbows, viz. about 3 within the block for the air conditioning machine room and about 2 near the hall. The construction of the sound absorption elbow is shown in Fig. 7-4. For the lobby system, 3 units in the machine room and 1 near the lobby, or a total of about 4 sound absorption elbows is being considered for installation.

(2) Space will also be provided for the installation of about 2 sound absorption chambers or elbows in the fresh air inlet and the exhaust air systems.

(3) As a rule, double walls will separate the machine room from the adjoining rooms while sound-proof doors will be installed in the machine room. An example for the construction of a sound-proof door is given in Fig. 7-5.

(4) Generally, the main ducts within the machine room will be provided with sound insulation covers and vibration-proof supports. The method of installing a vibration-proof support is shown in Fig. 7-6.

(5) Vibration-proof penetration is adopted for the main penetration points of the ducts. The details and the installation method are shown in Fig. 7-7.

(6) The passage of the ducts will be made as long as possible. An example for the basic idea resulting in the adoptions of the noise-proof and vibration-proof methods mentioned above are given in Fig. 7-8. Regarding the equipment now in use which causes noise disturbance, if repairs are conducted by referring to Fig. 7-4, -6, -7, etc. this problem will be solved.

7-6 Layout of Air Conditioning Machine Room and Duct Space

Basing our studies on the factors mentioned above, the position and size of the machine room for the air conditioning equipment and the location of the duct space were considered.

According to the basic plan, the machine room for the air conditioning equipment was to have been constructed against the back part of the auditorium on the 2nd floor, and was not sufficiently provided as to the number of air handling units, the quantity of sound absorbing ducts, as well as to its position and area when its distance from the auditorium was taken into account. It was originally planned to allot the office room and a part of the library to the machine room, but this plan was abandoned since the space behind the ceiling between these rooms and the hall only measured 30 inches and, moreover, it was impossible to position the ducts because only about 10 inches of space was available below the beams. Finally, it has been decided to allot the 2nd floor of the additional part to be constructed on the right side of the

hall as the main machine room, and for sound-proofing the room, we considered a dual wall consisting of the existing wall and the wall of the additional construction.

The new constructional plan also provides for shafts to be used for the ducts.

A diagram of the duct work drawn according to the plan mentioned above is shown in Fig. 7-9.

In addition, for the construction of the floor of the mechine room, the use of concrete slabs of more than 1.5 times the normal thickness is desirable.

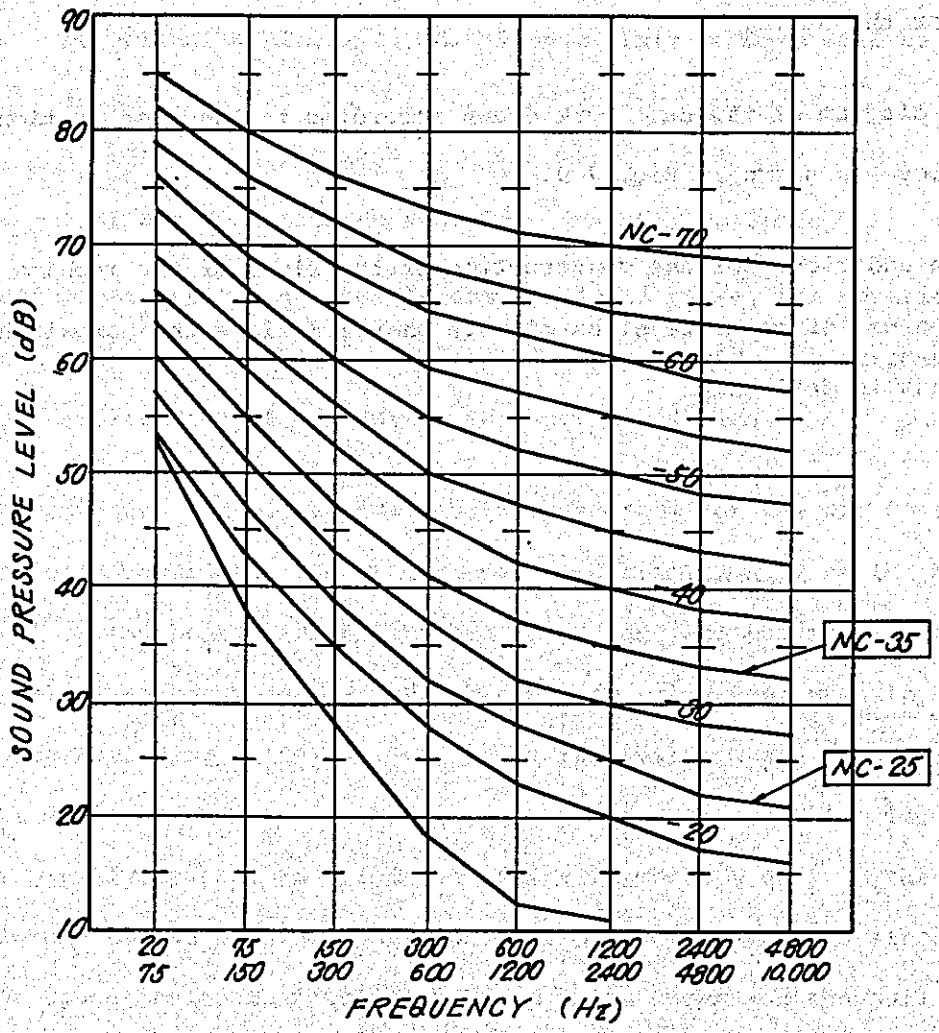


Fig. 7-1 Noise Criterion

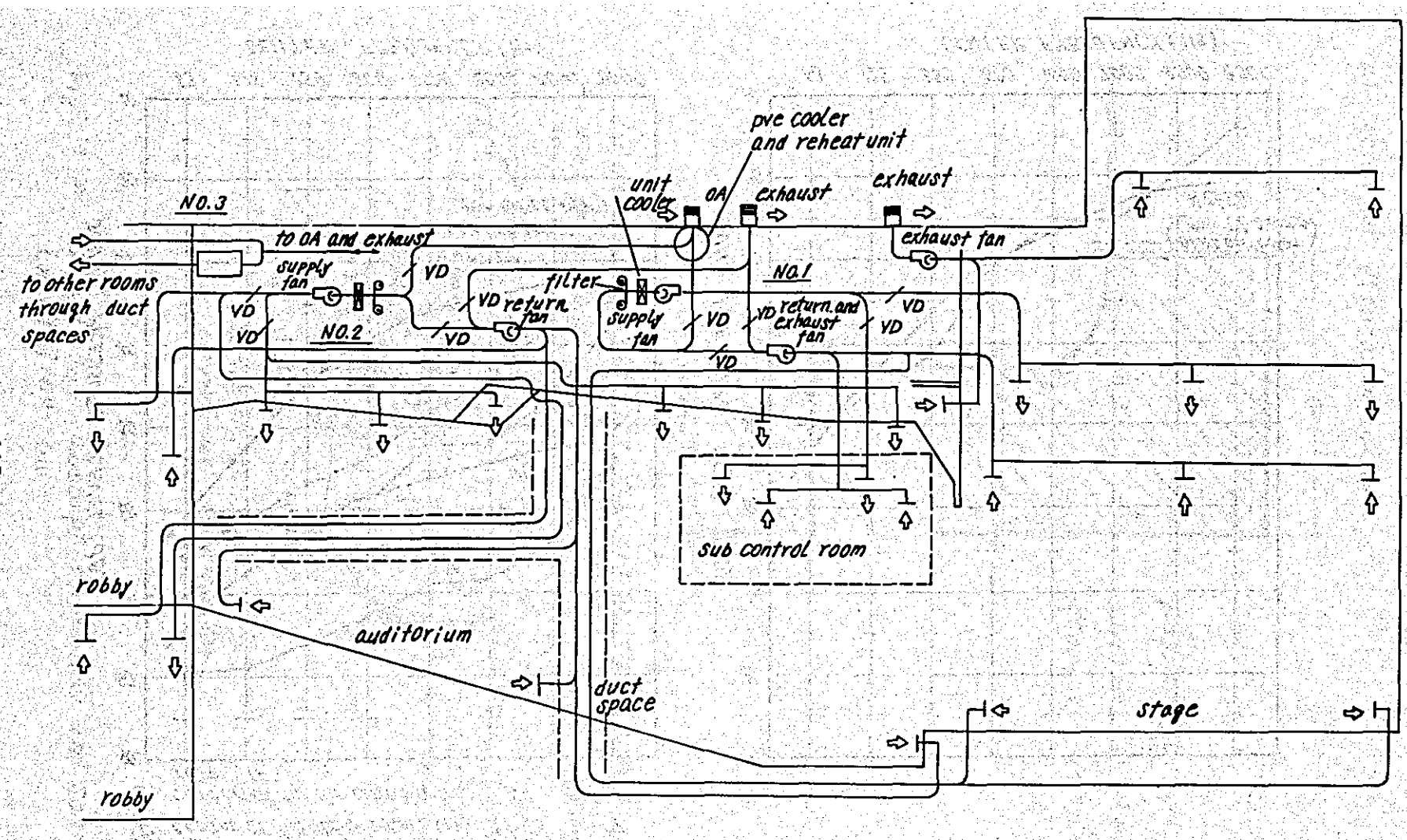
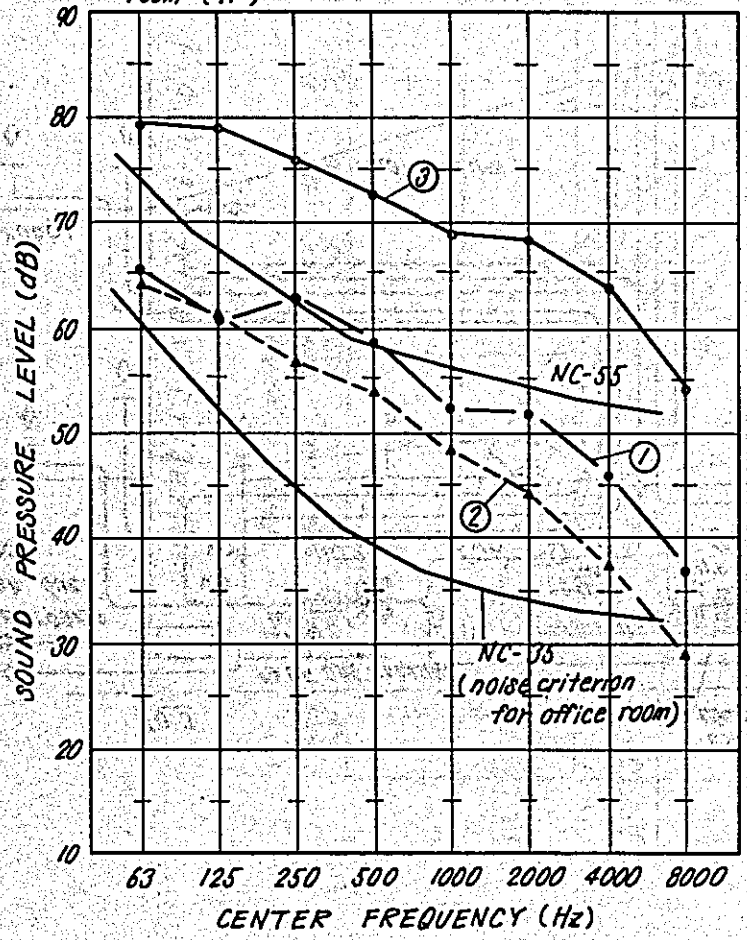


Fig. 7-2 Sketch of Layout of the air conditining system.

(a) office room

Measurement position	Indication of noise level meter A	C
① center of the office room A (2F)	61.5	74~78
② center of the office room B (1F)	57~58	70~72
③ center of the air conditioning room (1F)	79	85~87



(b) TV studio B

Measurement position	Indication of noise level meter A	C
① center of the studio	38	64

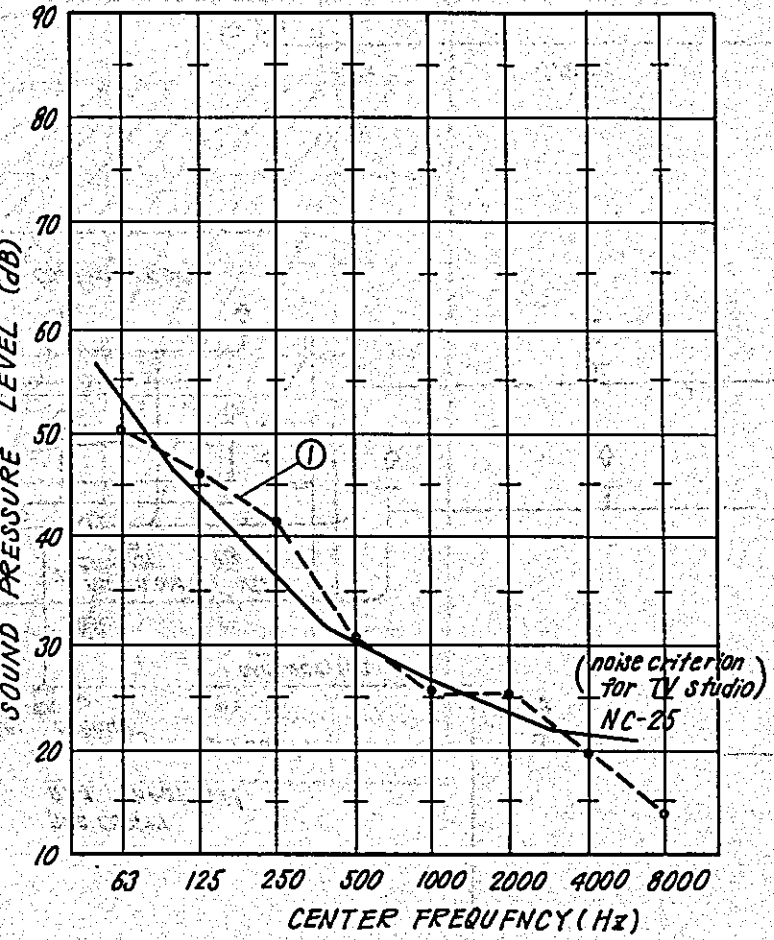
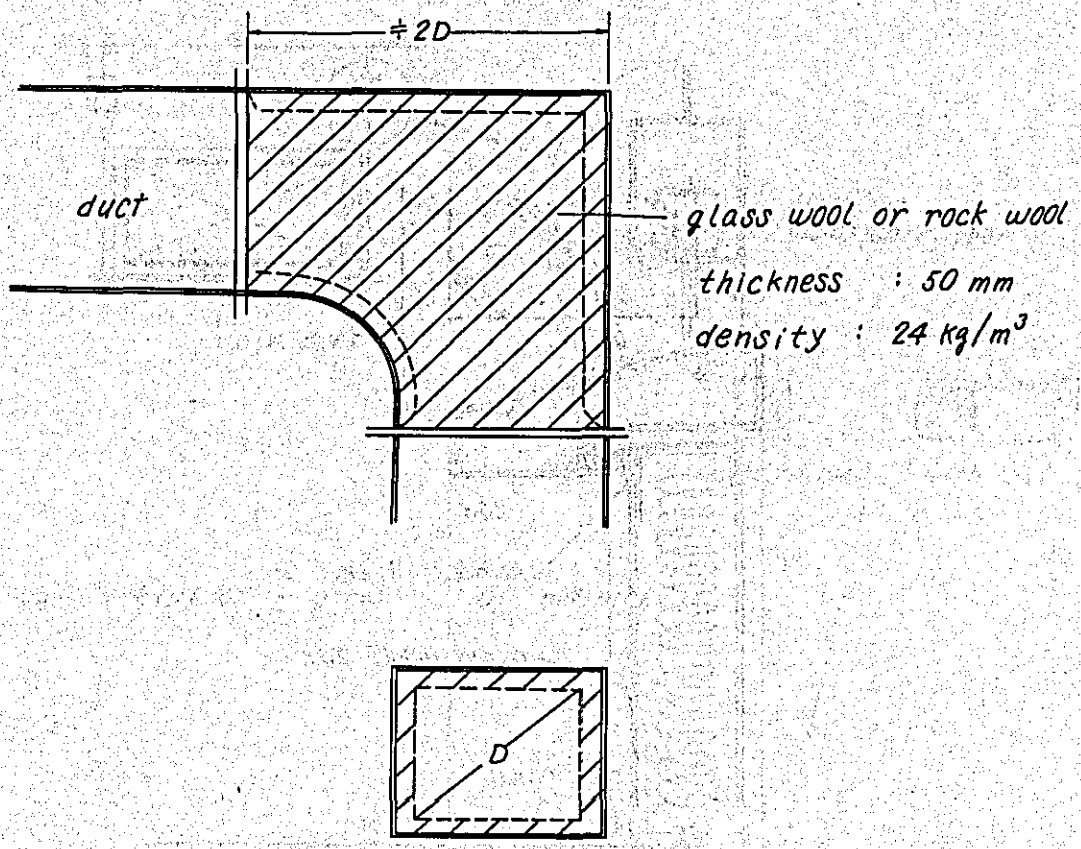


Fig. 7-3 Air conditioning noise

(a) detail of absorption elbow



(b) insulation method for absorption elbow orduct used in airconditioning machine room.

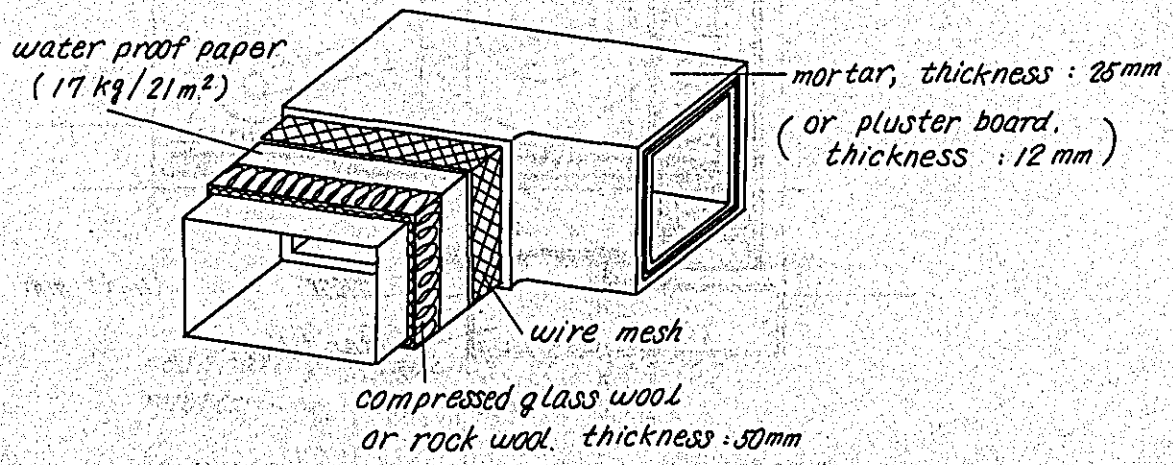


Fig. 7-4 Details of absorption elbow and sound insutation duct.

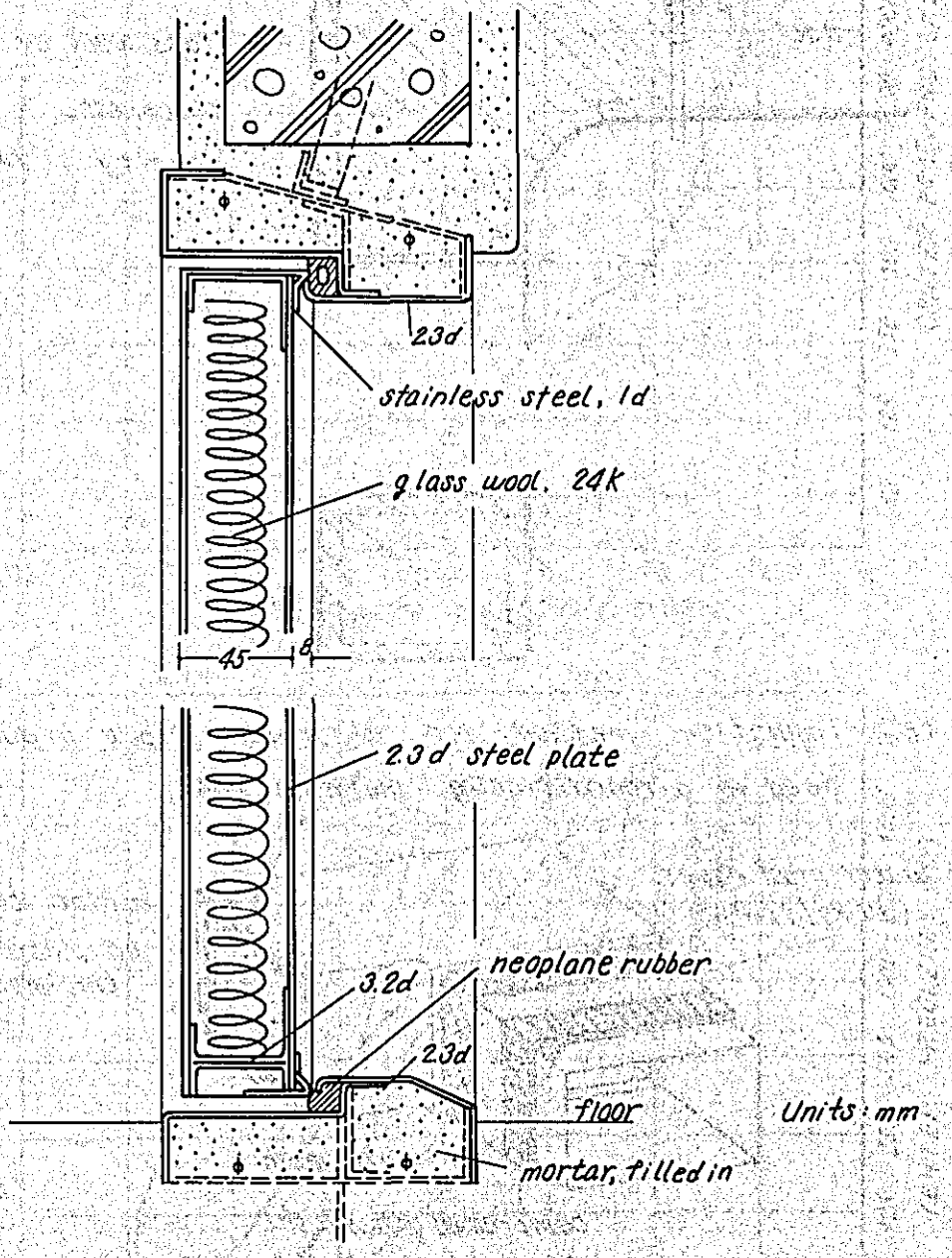
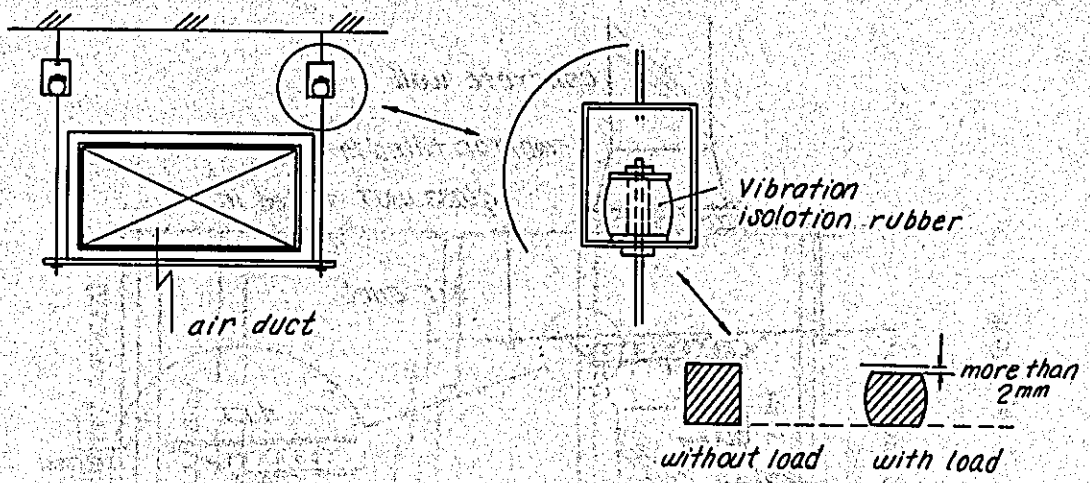
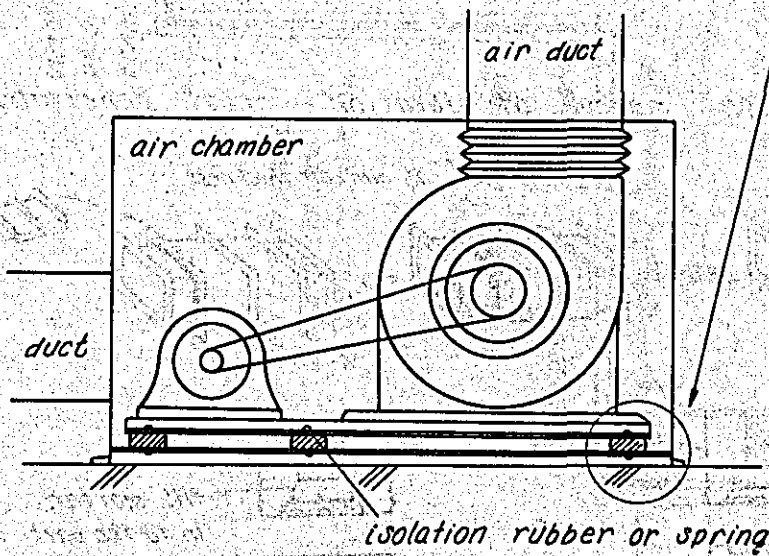


Fig. 7-5 Details of a steel type sound-proof door for the air conditioning machine room.

(a) Vibration - proof of duct



(b) Vibration - proof of machine

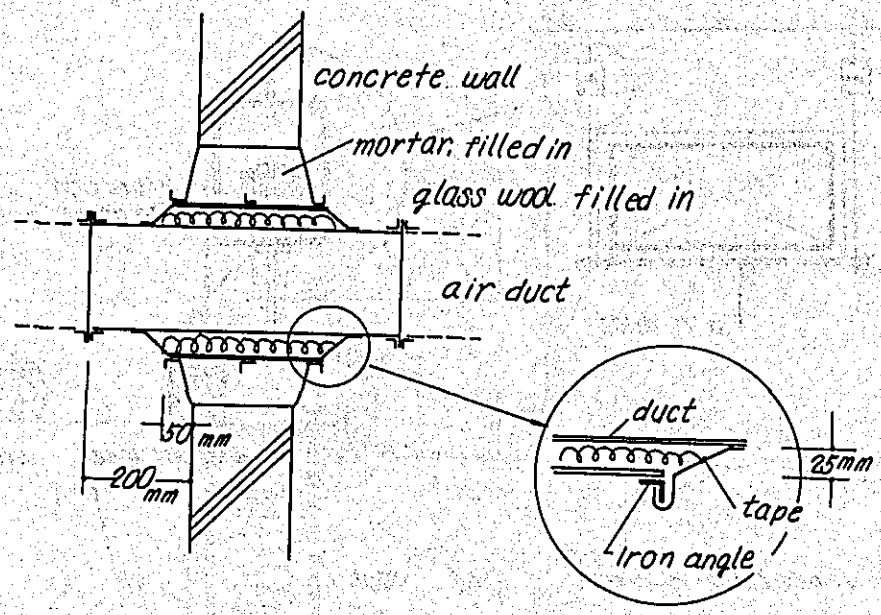


resonating frequency of isolation rubber : less than 10 Hz

deflection of the rubber : more than 2mm

Fig. 7-6 Method of vibration proof

(a) detail of vibration-proof penetration of duct



(b) construction method of vibration-proof penetration part

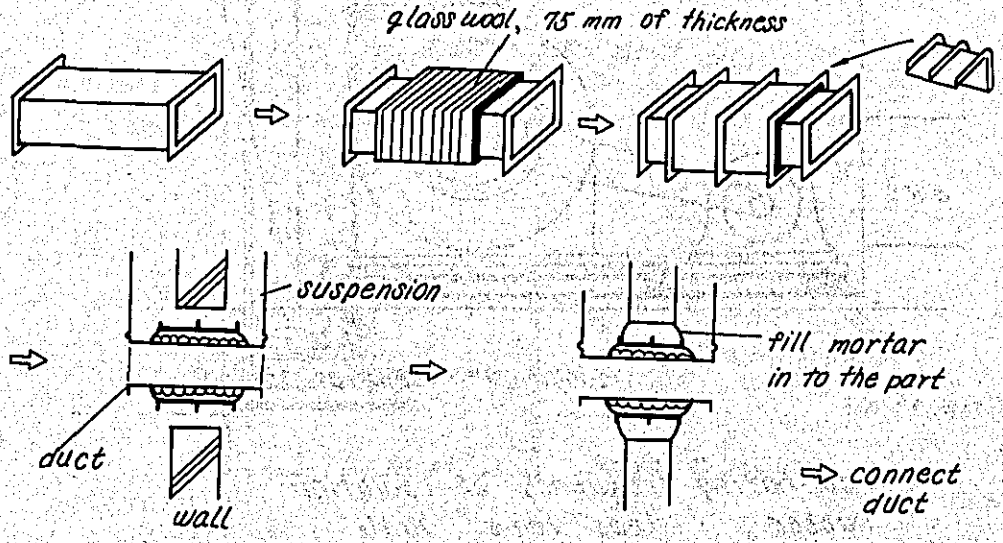


Fig. 7-7 Vibration-proof penetration part of air duct.

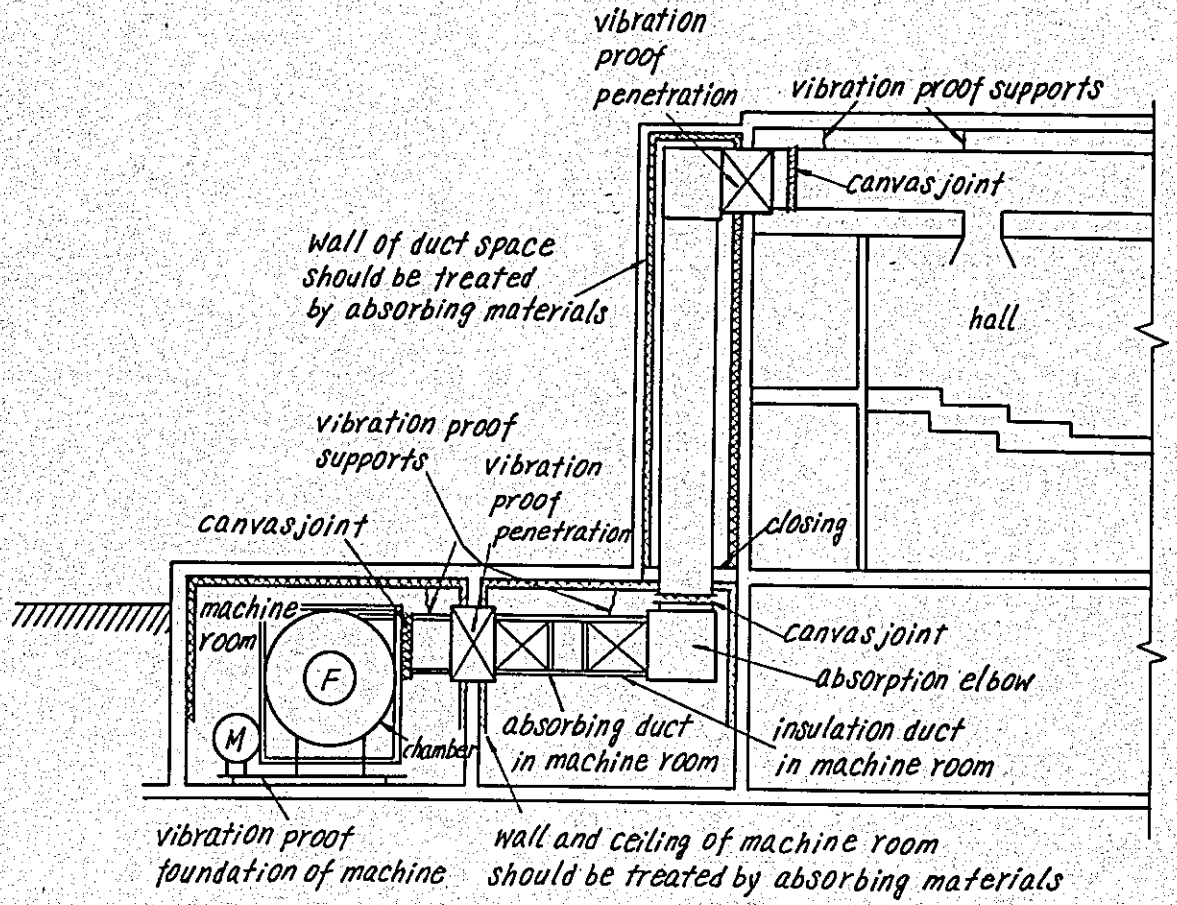


Fig. 7-8 An example of layout of air conditioning system

EXPLANATION OF SYMBOLS

SYMBOLS	ITEMS
AC — 1	HALL AIR HANDLING UNIT
AC — 2	STAGE AIR HANDLING UNIT
AC — 3	SUB-CONTROL ROOM AIR HANDLING UNIT
AC — 4	LOBBY AIR HANDLING UNIT
AC — 5	CAFETERIA AIR HANDLING UNIT
AC — 6	OFFICE AIR HANDLING UNIT
AC — 7	LIGHT ROOM AIR HANDLING UNIT
AC — 8	PROJECTION ROOM AIR HANDLING UNIT
F — 0	FRESH AIR SUPPLY FAN
F — 1	HALL RETURN FAN
F — 2	STAGE RETURN FAN

SYMBOLS	ITEMS
F — 3	SUB CONTROL ROOM RETURN FAN
F — 4	LOBBY RETURN FAN
F — 5	CAFETERIA RETURN FAN
F — 6	OFFICE RETURN FAN
F — 7	LIGHT ROOM RETURN FAN
F — 8	PROJECTION ROOM RETURN FAN
F — 9	CEILING SPACE EXHAUST FAN
F — 10	STAGE EXHAUST FAN
F — 11	PANTRY EXHAUST FAN
F — 12	LAVATORY EXHAUST FAN
—⌀—	AIR DAMPER

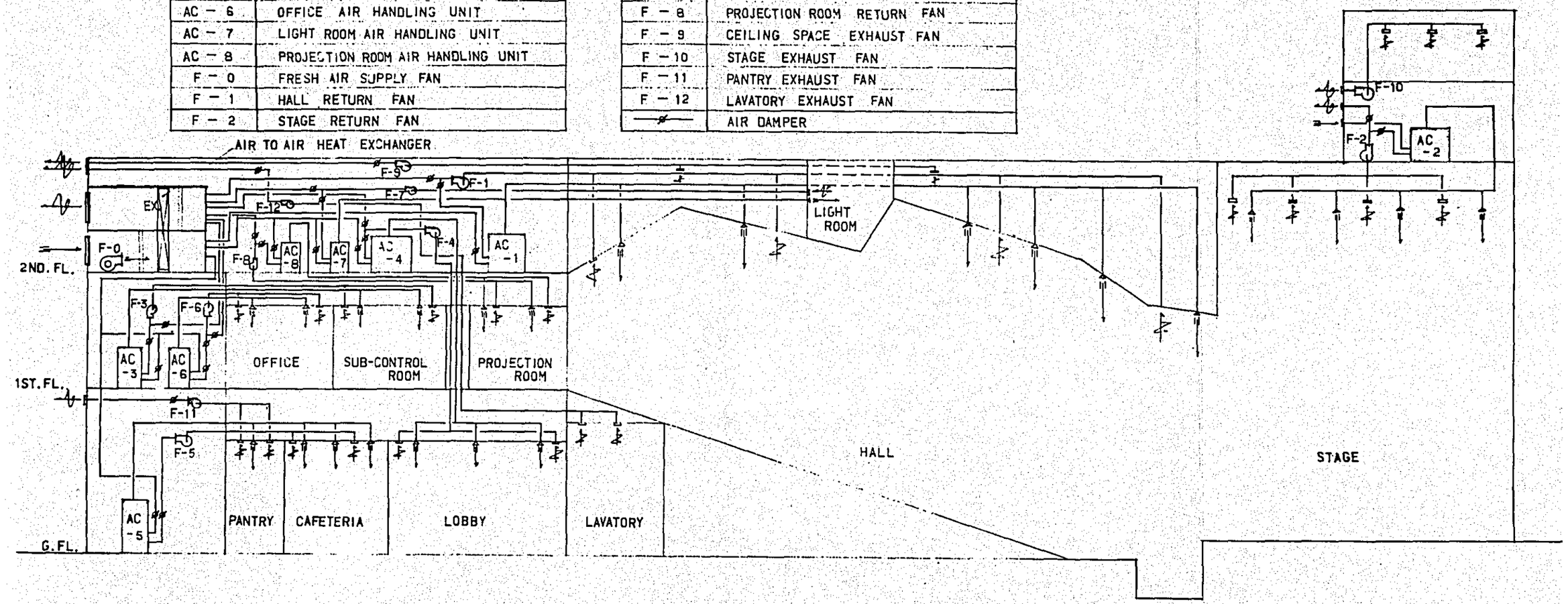


FIG. 7-9 DIAGRAM OF THE DUCT WORK FOR AIR CONDITIONING SYSTEM

CHAPTER 8: PLANS FOR OTHER EQUIPMENT

8-1 Communication Equipment

Communication equipment for the various systems will be carried out according to the original plan, as regards communication involved with preparation of programs, broadcasting cues, etc.

8-2 VIDEO Facilities

For VIDEO facilities, the equipment for the monochrome system as given below will be provided. However, consideration will be made to make feasible in the future broadcasting in color system through the addition of various equipment, such as color cameras. The system to be adopted at that time will be the B-PAL System of CCIR, as specified by BTV.

1) 1 - Lead Oxide Tube Camera ..... 4 sets

2) Telecine ..... 2 sets

Of the above, one set will be a 1V Camera, while the other a 3V Color Camera. The output to the main line will be in the form of monochrome signals through a burst killer, but for the monitoring system, color monitors will be provided.

3) Video Mixing System ..... 1 sets

Video Input.....Color 4, Telecine 2, AUX 3

Lines ..... MIX lines 4, CUT Series 1,

MONITOR Lines 3, (PV, VE, LD)

Special Effects .... 3 MIX Lines - Wiping Feasible.
Chroma Key installation in future possible.

4) Synchronization Signal An independent synchronization signal generator will be installed.

5) VE Console ..... 1 Set
Although the Vectorscope will be installed for various colorific uses in the future, it will be limited to the 3V Colour Camera for the pesent.

A Block Diagram and other details are shown from Fig. 8-1 to 8-4.

.....oOo.....

Fig. 8-1 ... VIDEO Equipment System Diagram

Fig. 8-2 ... VIDEO Control Console

Fig. 8-3 ... Camera Control Table

Fig. 8-4 ... VIDEO Equipment Rack

8-3 Construction Details Regarding Electrical and Safety Equipment

The power source for the Hall and related rooms will be a 440 supply from the existing Power Transformer Room.

A transformer to be used exclusively for this purpose will be installed to eliminate the possibility of other sources being effected by the heavy load and excessive fluctuations usually involved with illumination. In addition, the starting and stopping operations of other equipment, including the air conditioner, will be operated at the sub-control room.

A plan has also been advanced for the construction of an independent 250 kVA Electric Power Generator for use during emergencies, and although this power souce will usually be sufficient to bear the load for the Hall during emergencies, it may be necessary to study details regarding distribution at the time of actual planning.

Illumination for the rooms in general will be effected through fluorescent lighting, but those for the lobby and audience seating section will be through the combined use of incandescent and fluorescent lighting or through incandescent lighting alone. Control for the illumination in the audience seating section will be carried out in the subcontrol room, and maintenance facilities will be installed inside the ceiling.

The aisles in the audiences seating section will be illuminated by foot lights, while "EXIT" lights will be installed in the emergency exits and at the entrances and exits. All these lights will be powered by storage batteries.

Power outlets, will be installed at strategic points.

Piping and wiring for the broadcasting equipment, electro-acoustic equipment, various stage equipment, and various communications equipment (including telephones) will be installed, but wherever necessary, the connections will be made to existing sections. An electrical clock for program production will be installed in the audience seating section, and another in the subcontrol room.

The earthing positions for high power like listing etc. use and one for facilities will be installed.

Every room will be provided with a smoke-sensitive a fire alarm. The signals from these alarms will be received in the main control room. Naturally, the stage and audience seating section will be provided with sprinklers and other necessary fire prevention equipment.

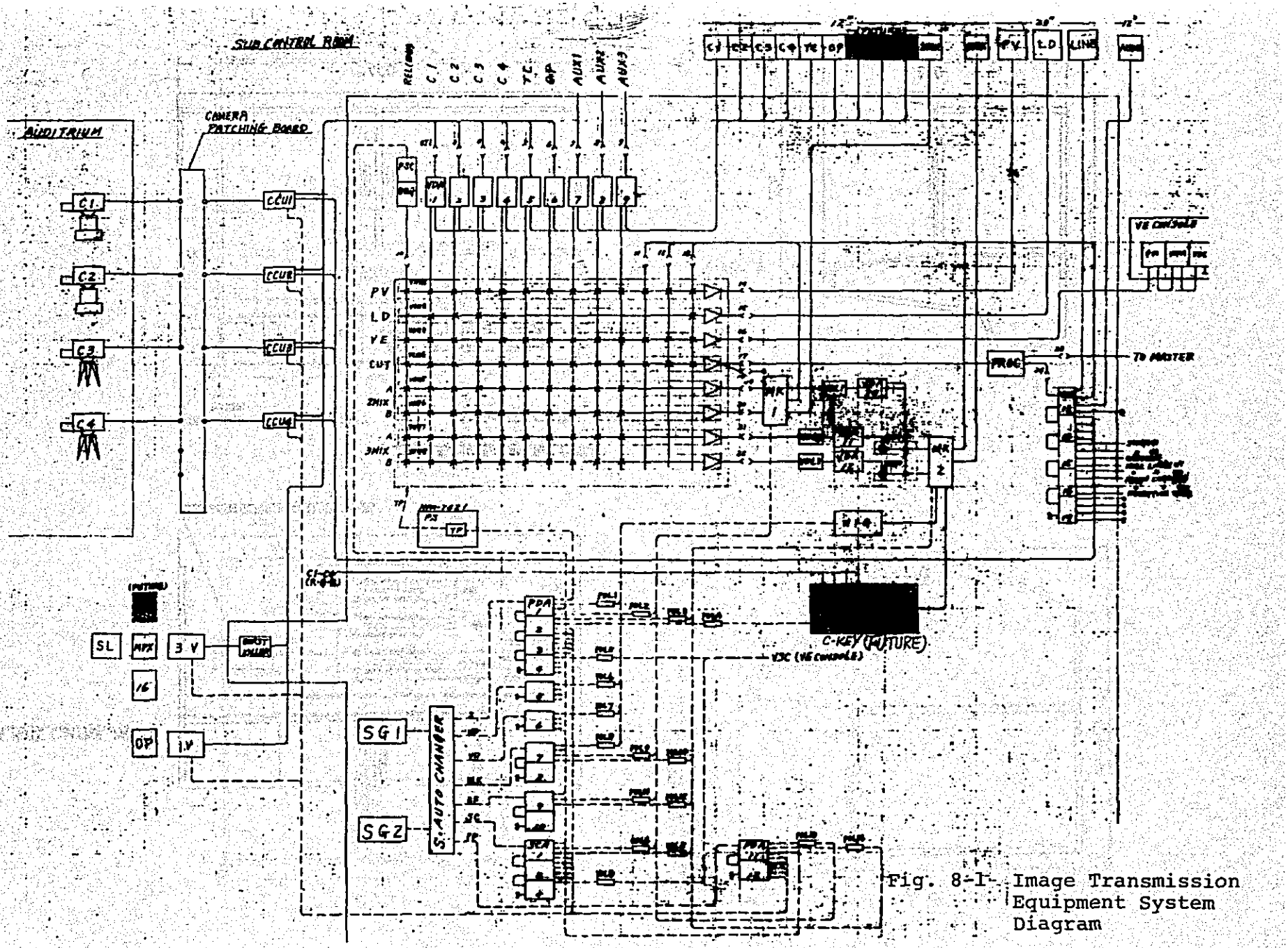


Fig. 8-1 Image Transmission Equipment System Diagram

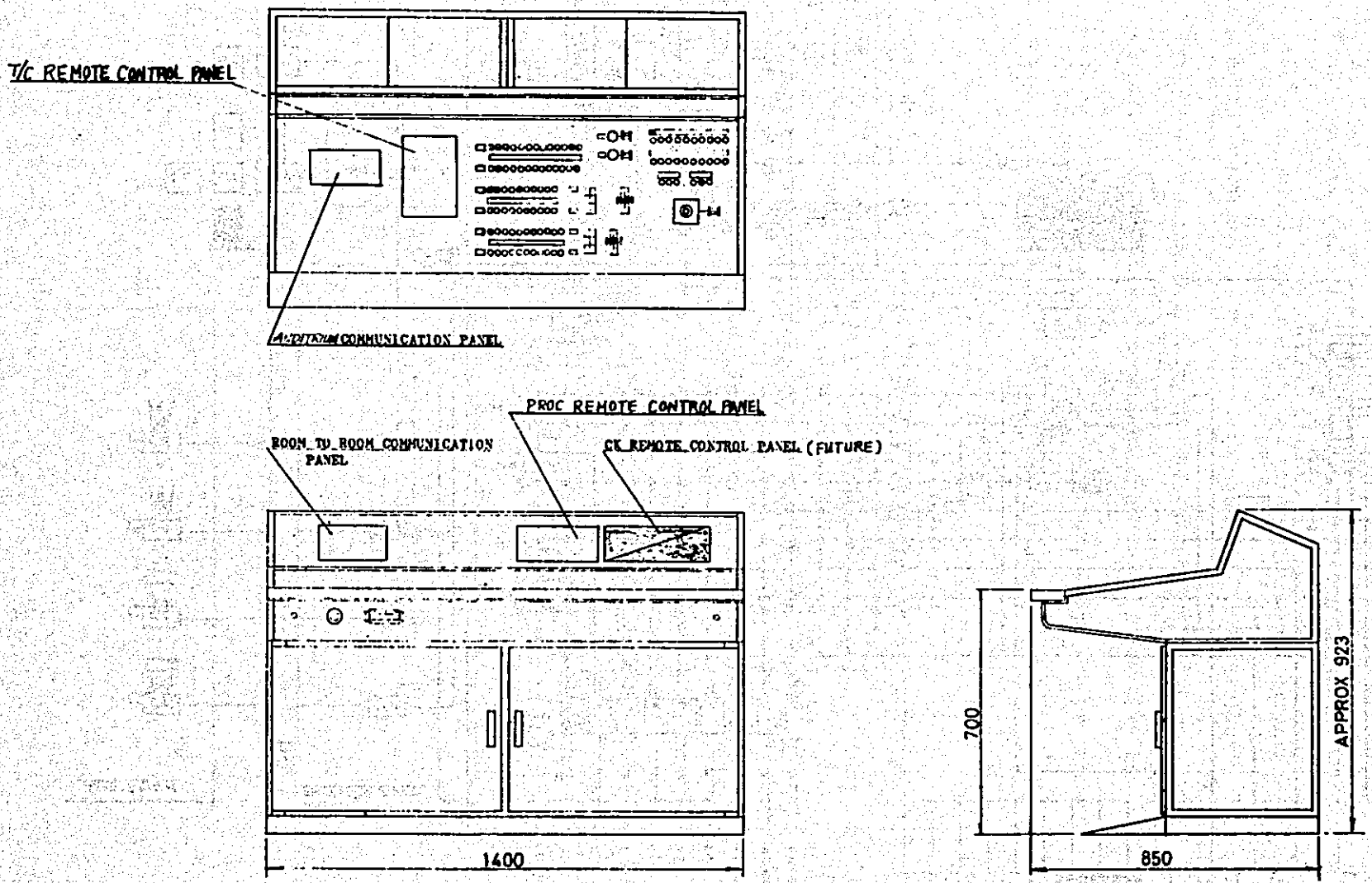


Fig. 8-2 Video Control Console

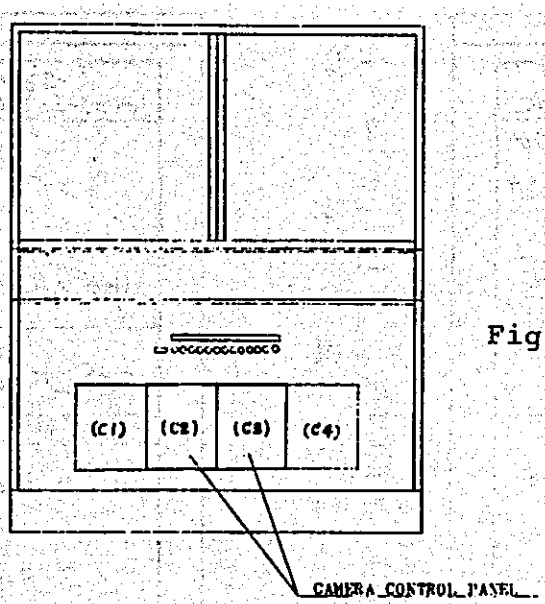
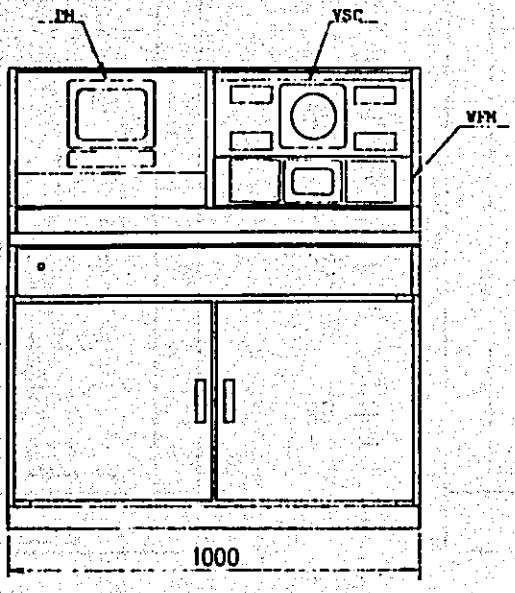
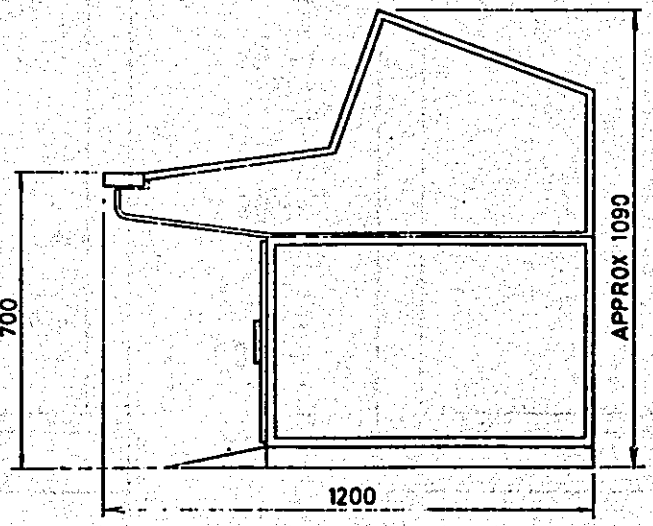


Fig. 803 Camera Control Table





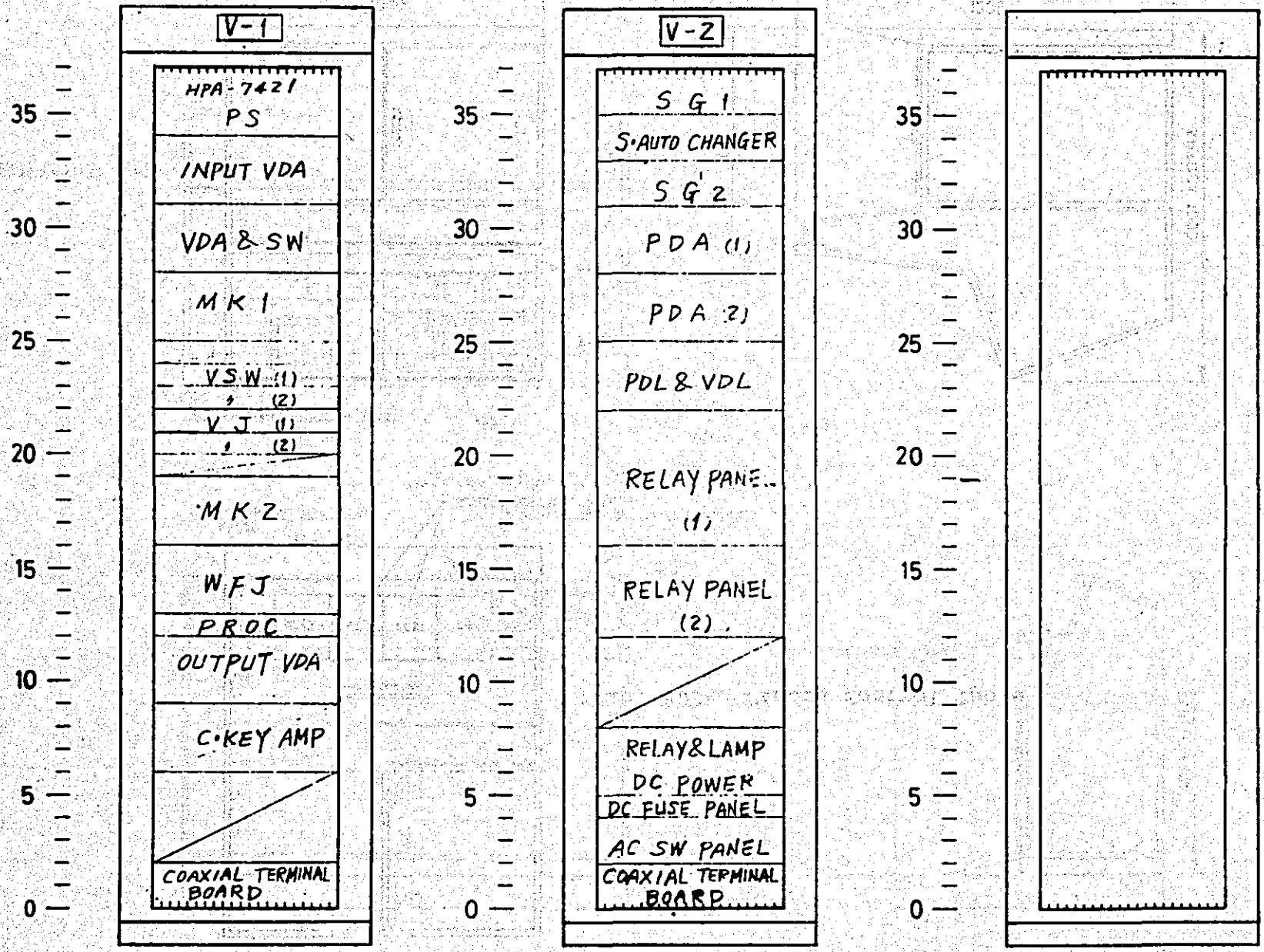


Fig. 8-4 Image Transmission Equipment Rack