REPORT OF SURVEY ON
FOODGRAINTS TRANSPORT AND STORAGE AND
FOODGRAINTS WAREHOUSES CONSTRUCTION SCHEME
IN
BANGLADESH

April, 1977

JAPAN INTERNATIONAL COOPERATION AGENCY

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Survey Period: 76.12.7 ∿ 17

CHAPTER I. PURPOSE OF THE SURVEY

The Bangladesh government has formulated the Scheme for Building Up a Reserve of Foodgrains (hereinafter called the "Scheme") with its final goal set at June 1978 in order to secure a stable supply of foodgrains and to cope with emergency situations resulting from natural disasters and so forth.

In view of the shortage of foodgrains warehouses necessary for successful implementation of the Scheme, the Bangladesh government is promoting the plan for improving and expanding such warehouses and requested Japan's and other countries' cooperation, in the execution of the plan.

In compliance with this request, the Japanese government sent a survey team to Bangladesh with the view to grasping the existing situation of storage and distribution of foodgrains in the country and confirming the details of the said foodgrains warehouse construction plan.

The team wishes to make it clear that it has not been empowered to hold consultations with or make any commitment to the competent Bangladesh authorities as an official representative of the Japanese government in connection with the request of the Bangladesh government for Japan's assistance in the foodgrains warehouse construction plan.

CHAPTER II. EXISTING STATE OF FOODGRAINS WAREHOUSES

2-1 Foodgrains Storage Warehouses and Their Classification

(1) Foodgrains Storage Warehouses

In Bangladesh, there are no warehouses corresponding to Japanese agricultural or commercial warehouses, and all government-owned foodgrains are stored in the government-controlled warehouses.

(2) Classification of Foodgrains Warehouses

As shown below, the foodgrains warehouses are classified according to their functions into Central Storage Depots (CSD), Local Storage Depots(LSD), and silos.

CSD : Located in large consumer areas for storage of imported foodgrains (rice, wheat, etc.) and their distribution to LSDs, as well as for storage of domestic rice and wheat from LSDs and their procurement from local producing areas.

LSD : Located in areas where no CSDs are established. Those in foodgrain producing areas are operated chiefly for procurement and storage of domestically produced rice and wheat, and those in consumer areas are used mainly for storage of imported foodgrains distributed from CSD.

Silo : Operated for storage and distribution of imported bulk wheat, and distribution of bagged wheat to CSD.

2-2 Storage Capacity of Foodgrain Warehouses and Silos

(1) Existing Storage Capacity

The total storage capacity of foodgrains as of December 1976 was 1,048 thousand tons, of which 371 thousand tons were covered by 12 CSDs, 452 thousand tons by 322 LDSs, and 225 thousand tons by 4 silos.

The scale of warehouse in one place is quite large for CSD which can hold a total of 11 to 66 thousand tons or an average of 31 thousand tons, whereas the scale of LSD is smaller with an average holding capacity of 1.4 thousand tons. Both CSD and LSD are mostly composed of a number of standard units called "Dacca type" each capable of holding 500 tons.

The storage capacity by district (administrative division similar) to province) is as shown below in Table 1.

Table 1.

Unit : Thousand ton

District	C.S.D.			L.S.D			Total Storage	Silo		Aggregate Total of
	No. of CSDs	NO. of Units	Storage Capaci-ty	No. of LSDs	No. of Units	Storage Capaci-ty	Capcity of CSD & LSD	No. of Silos	Storage Capaci-ty	Storage Capacity
Dacca	4	142	85.0	74	217	114.2	199.2	1	50.1	249.3
Chittagong	3	106	107.7	85	222	103.7	211.4	2	150.1	361.5
Rajshahi	2	64	50.5	81	343	137.5	188.0	1	25.0	213.0
Khulna	3	148	128.1	82	247	96.4	224.5	-	-	224.5
Total	12	460	371.2	322	1.029	451.8	823.1	4	225.2	1.048.3

Notes: 1. From the data of the Ministry of Food.
2. See attached reference data (4) for area-wise storage capacity.

(2) Usable Storage Capacity

Of the CSDs and LSDs having a total storage capacity of 823 thousand tons as shown in Table 1, about 200 tons storage warehouses are said to have been damaged during the Liberation War in 1971, although no data are available on the district- or area-wise distribution of damaged warehouses. Accordingly, the presently usable storage capacity stands at a total of 848 thousands, with warehouses accounting for 623 thousand tons and silos for 225 thousand tons.

The total quantity of rice and wheat handled by the government in the last three years and the stock of government owned rice and wheat as of December 8, 1976 are as shown below.

a. Annual quantity of government-handled foodgrains

1973	2,461.8 thousand tons
1974	2,029.9 "
1975	2,609.8 "
1976 (estimate)	2,700.0 "

b. Stock of government-owned foodgrains as of December 8, 1976

Rice	260.0 thousand tons
Wheat	189.0 "
Total	449.0 "

2-3 Outline of Surveyed Warehouses

The team conducted a field survey on three CSDs (Tejgaon, Narayanganj and Dacca) in Dacca area of Dacca district which is one of the main foodgrains consuming areas in Bangladesh, as well as on 2 CSDs (Halisahar and Dewanhat) in Chittagon area of Chittagon district which is the main imported foodgrains receiving area in the country.

(1) Location and Scale

All the survyed warehouses are located near consumer centres for easy collection and distribution of foodgrains. Each depot is substantially large in scale, with its storage capacity ranging from 10 to 62 thousand tons in total and about 32 thousand on the average, and is composed of a number of units of small warehouses each capable of holding 400 to 1,000 tons. The commonest of these small units of warehouses is the standard "Dacca type."

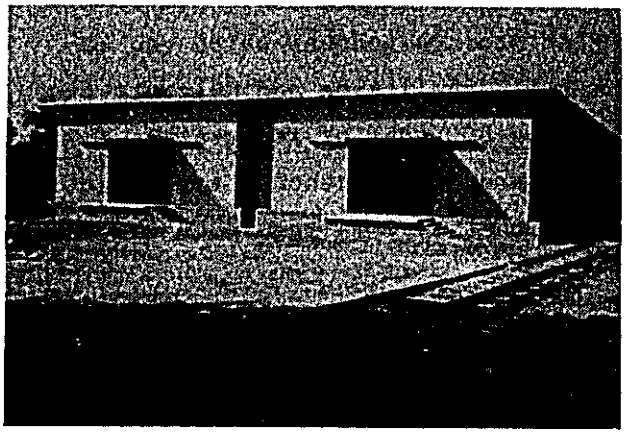


Photo 1 Dacca type (standard)

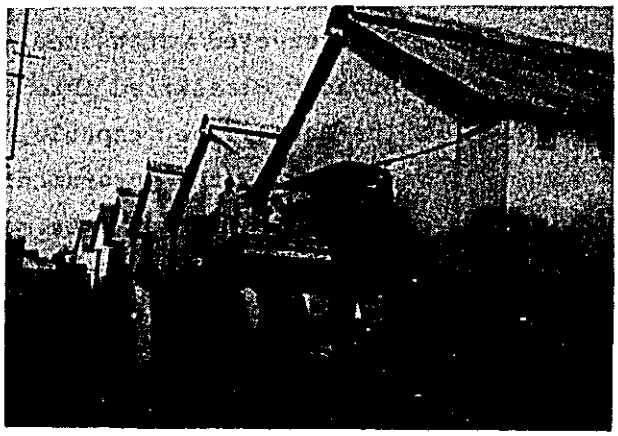


Photo 2 Calcutta type

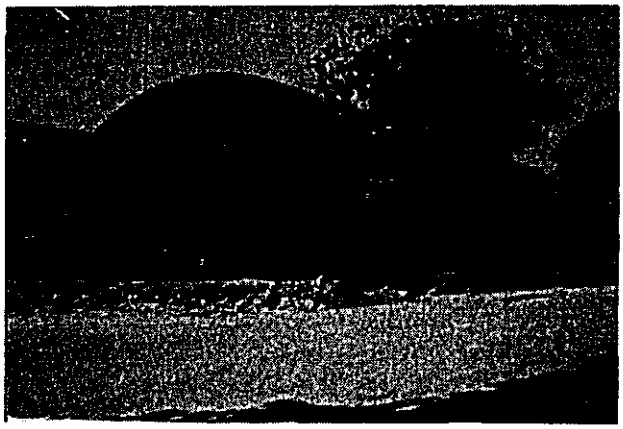


Photo 3 Pakistani type

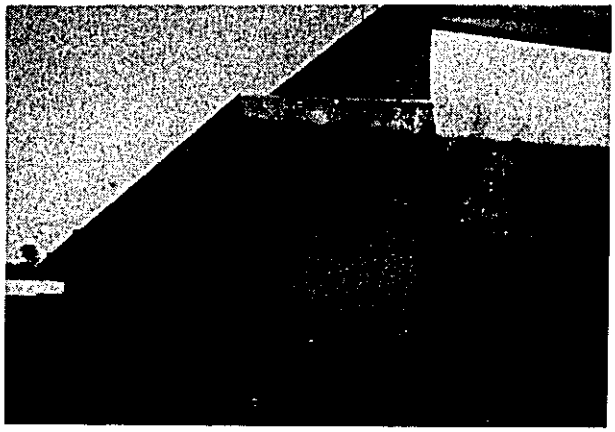


Photo 4 Dacca type (large)

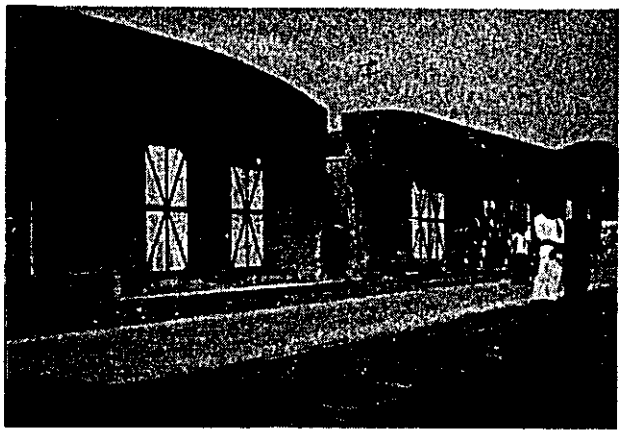


Photo 5 Shell type

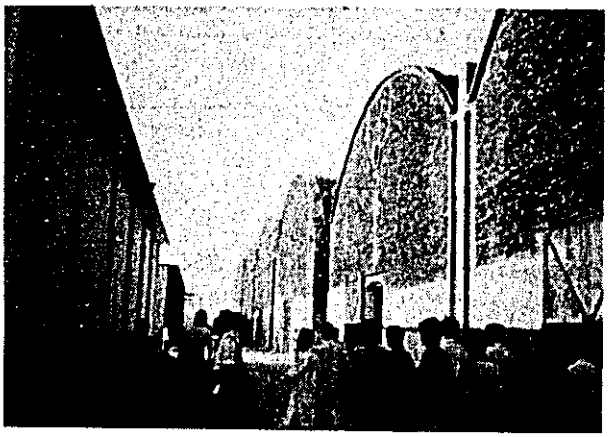


Photo 6 Jute factory warehouse of improved type

(2) Structure

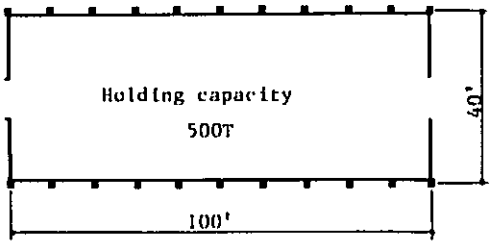
All surveyed warehouses are flat storage godowns which can be broadly classified into Dacca type, shell type and Calcutta type. The Dacca type, capable of holding 500 tons of foodgrains, is adopted by the government as the standard warehouse type, but several choices can be made with this type in regard to the dimensions of component parts.

(3) Storage Capacity and Stock of Foodgrains

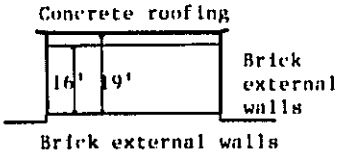
The storage capacities (as of December 1976), annual quantities of incoming foodgrains (1975/76), and stocks of foodgrains (as of the date of survey) of the surveyed CSDs are as shown in Table 2.

Fig. 1 Outline of Different Warehouse Type

1. Dacca Type (Standard type)

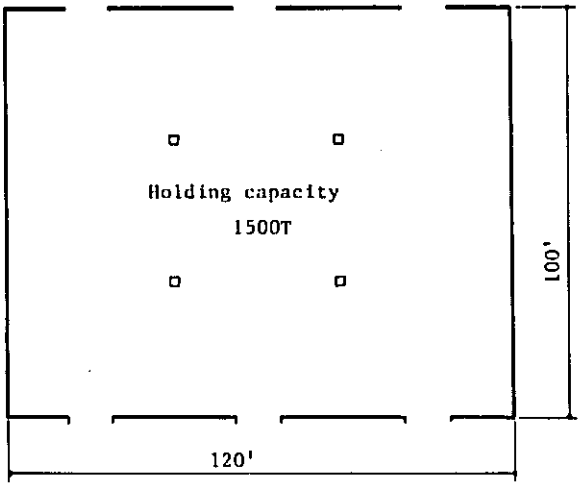


Floor Plan

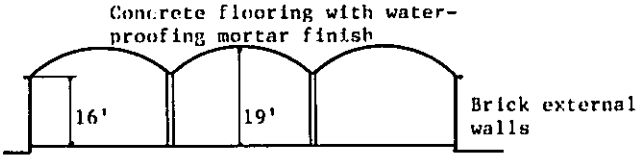


Concrete floor

2. Section View

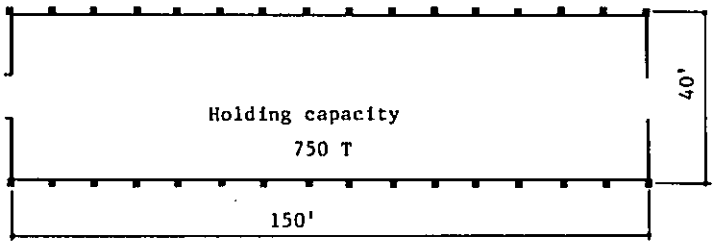


Floor Plan

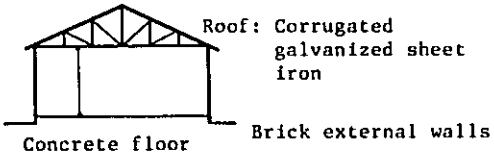


Sectional View

3. Calcutta Type (New type)

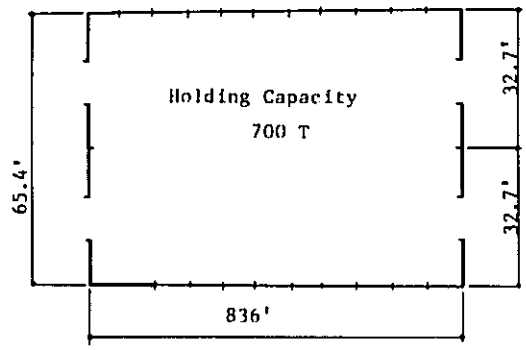


Floor Plan

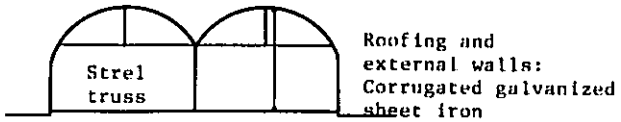


Sectional View

4. Pakistani Type (constructed during Pakistani rule)

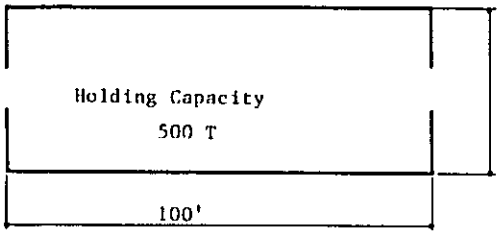


Floor Plan

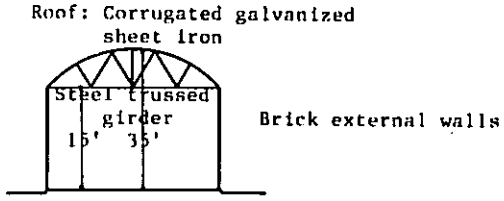


Sectional View

5. Improved Type Jute Factory

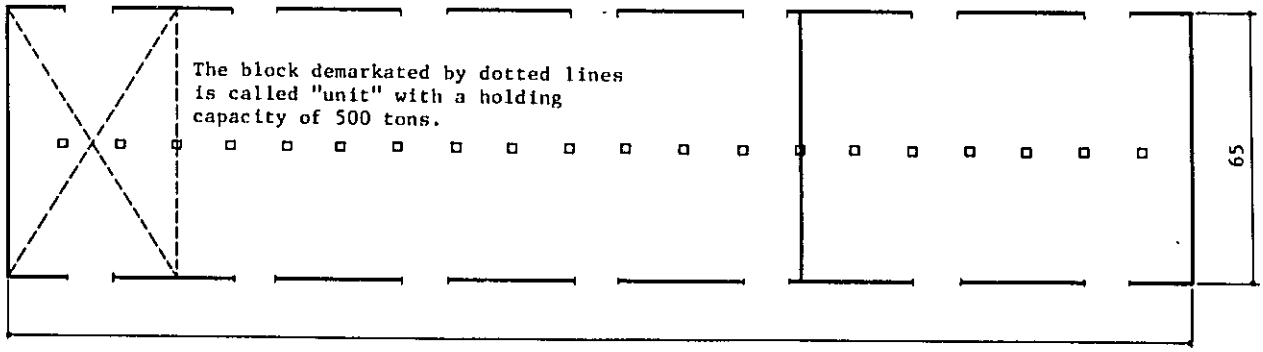


Floor Plan

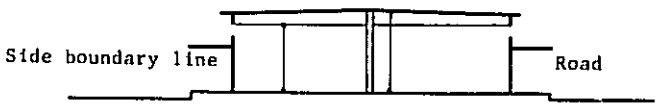


Section View

6. Dacca Type (Large) Large Dacca type as referred to in Bangladesh has a total storage capacity of 3,500 tons and consists of 7 units each holding 500 tons. In addition, those with a floor space of 65' x 353' and a holding capacity of 1,500 tons are also constructed.



Floor Plan



Sectional View

Table 2 - Storage Capacity and Stock of Foodgrains of Surveyed CSDs

C.S.D		Storage Capacity		Annual Quantity of Incoming Foodgrains	Number of Warehouse Rotations	Stock of Foodgrains			
		No. of Units	Storage Capacity			Total Stock	Stock Ratio	Stock of Rice and Wheat	Stock Ratio of Rice and Wheat
			(A) thousand t	(B) thousand t	(B)/(A)	(C) thou-sand t	(C)/(A)%	(D) thousand t	(D)/(C)%
Dacca Area	Tejgaon	43	34.9	260.8	7.5	13.6	39.0	7.6	55.9
	Narayanganj	34	20.8	118.4	5.7	15.4	74.0	12.8	83.1
	Dacca	17	9.5	148.3	15.6	5.6	58.9	3.4	60.7
	Total	94	65.2	527.5	8.1	34.6	65.6	23.8	68.8
Chittagong Area	Halishahar	57	61.5	100.2	1.6	21.3	34.6	17.3	81.2
	Dewanhat	36	32.0	75.8	2.4	22.3	69.7	12.9	57.8
	Total	93	93.5	176.0	1.9	43.6	46.6	30.2	69.3

The annual quantity of incoming foodgrains is subject to a considerable fluctuation depending on the increase or decrease of external procurement. The data for the last three years indicates that the fluctuation has been as large as 100 thousand tons in the case of Narayanganj CSD.

Table 3 shows the annual quantities of incoming foodgrains recorded at the surveyed CSDs in the last three years.

Table 3 - Annual Quantities of Incoming Foodgrains at Surveyed CSDs

(Unit : Thousand ton)

C.S.D	1973	1974	1975
Tejgaon	248.9	230.1	260.8
Narayanganj	242.7	86.2	118.4
Halisahar	71.3	122.6	100.2
Dewanhat	110.9	133.0	75.8

Notes: Data of Dacca CSD were not made available.

The stock of foodgrains at the surveyed CSDs is small with exception of Narayanganj and Dewanhat CSDs, and this is because of the bumper crops enjoyed since 1975/76 cropping season and resultant decline of import and also because the survey was conducted before the collection of Aman rice, the main domestic variety grown in Bangladesh, from LSDs was started.

The team was informed that all CSDs are loaded to the maximum holding capacity when the import of foodgrains increases, and noted that Halishar and Dewanhat CSDs are now short of storage capacity due to the successive entry of 3 to 4 foodgrains carriers in 1975.

The 24 thousand-ton stock of rice and wheat of the three CSDs in Dacca area shown in Table 2 is equivalent only to 0.6 month supply of average food rations in the same area in 1975/76.

The CSDs in this area register an annual average of 8 rotations which is considerably high. In particular, Dacca CSD makes 16 rotation a year. Thus, the CSDs in Dacca area are forced to make frequent stock turnover.

CHAPTER III. STROAGE CONDITION OF RICE AND WHEAT

3-1 Transport of Foodgrains to Surveyed Warehouses

(1) Transportation to Front of Warehouses

The greater part of rice, wheat and other grains transported to CSDs are the imported foodgrains landed at Chittatong port and Khulna port. For example, 80% of rice stored at Tejgaon CSD is transported from Chittagong mostly by freight trains (17 ton waggons) and partly by barges and trucks (See Photo 7). In the case of Narayanganj and Dacca CSDs, imported foodgrains are transported by 500 to 1,000-ton capacity carriers and domestic rice is carried by trucks or sailing ships, where as Dewanhat and Halishar CSDs resort to railways and trucks for foodgrains transportation.

In case collection and distribution base (or the landing river port) is close to the warehouse, the foodgrains are transported mostly by trucks or even by large carts if the distance is short (See Photos 8 and 9).

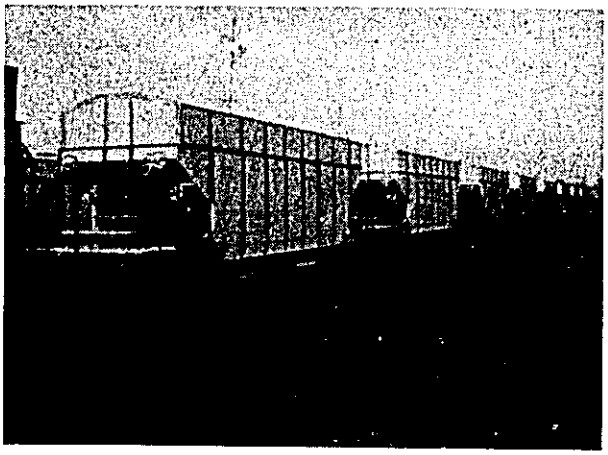


Photo 7 Freight train for bulk grains transportation

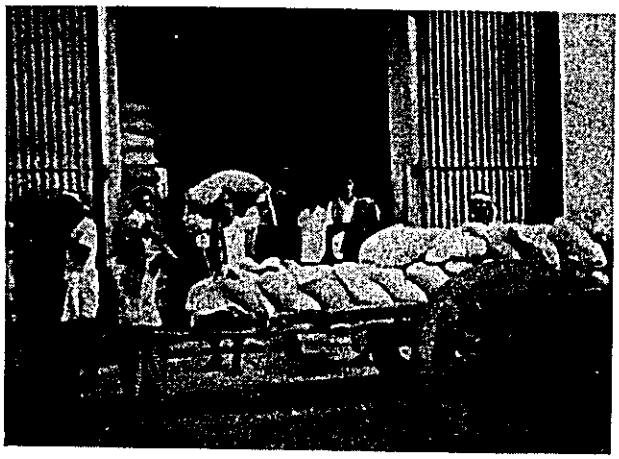


Photo 8 Large cart for bagged grains transportation

(2) Stacking

Grain bags are carried and stacked manually by labourers at all CSDs. Specifically, each of about 20 to 30 labourers carries 1 bag (heavy grains like imported wheat) or 2 bags (domestic rice) of grains on head from the door to the stacking place of each warehouse. The efficiency of stacking work is extremely low relative to the mechanical cargo handling using conveyors and other equipment (See Photo 10).

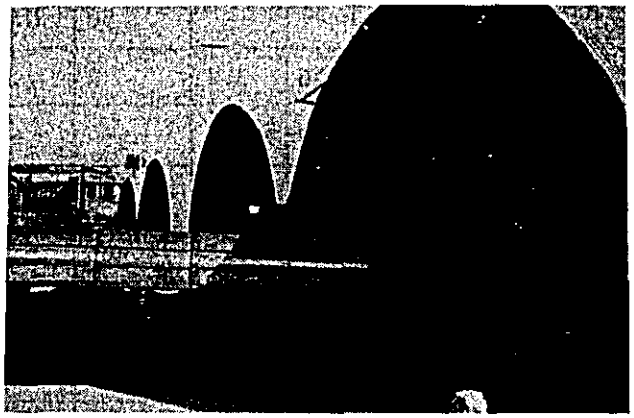


Photo 9 Truck for foodgrains transportation

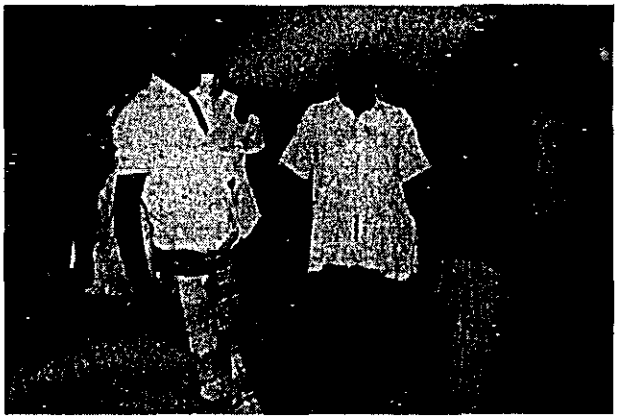


Photo 10 Manual handling of grain bags

3-2 Cargoes in Stock at Surveyed Warehouses

Table 4 shows the quantities of different items of cargoes found to be in stock at the surveyed CSDs.

Table 4 Item-wise Stock of Cargoes at Surveyed CSDs

(Unit : ton)

C.S.D. / Item	Tejgaon		Narayanganj		Dacca		Halisahar		Dewanhat	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
Milled Rice	2,270	16.7	11,034	71.8	1,910	33.9	16,410	76.9	11,611	52.0
Paddy	6	...	1,671	10.9	47	0.8	38	0.1	2	...
Wheat	5,306	39.0	141	0.9	1,587	28.1	929	4.4	1,243	5.5
Wheat Flour	-	-	180	1.2	27	0.5	-	-	50	0.2
Salt	285	2.1	312	2.0	140	2.5	676	3.2	2	...
Soybean Oil	2,556	18.8	1,346	8.8	429	7.6	499	2.3	-	-
Butterfat	1,561	11.5	450	2.9	-	-	929	4.4	1,265	5.6
Rapeseed	835	6.1	142	0.9	8	0.1	1,323	6.2	1,466	6.7
Powder Milk	784	5.8	-	-	-	-	3	...	-	-
Sugar	-	-	87	0.6	1,461	25.9	-	-	570	2.6
Feed	-	-	-	-	33	0.6	-	-	-	-
Others	-	-	-	-	-	-	533	2.5	6,124	27.4
Total	13,603	100.0	15,363	100.0	5,642	100.0	21,340	100.0	22,333	100.0

Domestic rice is collected in the form of parboiled rice, whereas imported rice is delivered as milled rice with the exception of Thai rice which is shipped in the form of parboiled rice. Hence, the greater part of rice stock is milled rice, with paddy accounting for an extremely small percentage.

Seen by item, the stock ratio is the highest for wheat, and rice maintains the next highest stock ratio at all CSDs through the year, although Tejgaon and Dacca CSDs recorded a low ratio on account of

large deliveries effected immediately before the survey. Following these two items come soybean oil and butterfat in that order.

There are observed many cases where rice is put in storage in mixture with salt or sugar. This is an extremely careless practice and should be discontinued as soon as practicable for satisfactory quality control because rice put in such storage condition is prone to absorb moisture quickly.

3-3 Warehouse Management Personnel

At each CSD are stationed 100 to 200 management personnel including a chief who are assigned to the storage management and operation. The said management personnel also include inspection officers who are in charge of quality control of stored foods. Table 5 shows the numbers and job division of management personnel stationed at Dacca, Dewanhat and Halisahar CSDs.

The number of management personnel stationed at these CSDs is extremely large when compared with that required for similar Japanese warehouses. Specifically, Dacca CSD has 122 personnel for 17 units (9.5 thousand tons), Dewahat CSD 186 for 36 units (32.0 thousand tons), and Halisahar CSD 154 for 57 units (61.5 thousand tons). Despite of this superfluousness of management personnel, 10 to 20 temporary workers are employed during the busy season at these CSDs.

Table 5 CSD Management Personnel

	Dacca	Dewanhat	Halisahar
Chief	1 person	1 person	1 person
Senior Inspection Officer	2	2	1
Inspection Officer	9	11	9
Assistant Inspection Officer	38	49	42
Tally Officer	25	47	41
Chief Clerk	1	1	1
Assistant Chief Clerk	1	1	1
Junior Clerk	6	4	5
Typist	2	1	1
Calendarer	1	1	1
Messenger	2	2	1
Messenger (outside service)	-	1	1
Night Guard	21	52	41
Cleaner	12	13	8
Cashier	1	-	-
Total	122	186	154

3-4 Package

Since jute is produced in Bangladesh, jute bags are used in all cases for packaging domestic rice. 65 kg bags are used for paddy, and 75 or 92.5 kg bags for parboiled rice.

Jute bags are also used for the greater part of imported rice and wheat, with rice packaged in 45 kg bags and wheat in 85 or 90 kg bags. Use of synthethic resin bags was observed only in very few exceptional cases.

3-5 Condition of Storage Control

(1) Base Logs

Base logs are laid on the floor at all warehouses. They can be classified into types: the square timbers (7.5 cm × 10 cm) or bamboos (approx 10 cm in diamter) laid in a single layer at intervals of about 45 cm, and the square timbers (approx. 7.5 cm × 10 cm) combined in a chequer pattern into a lot weighting 60 to 100 tons (See Photo 11).

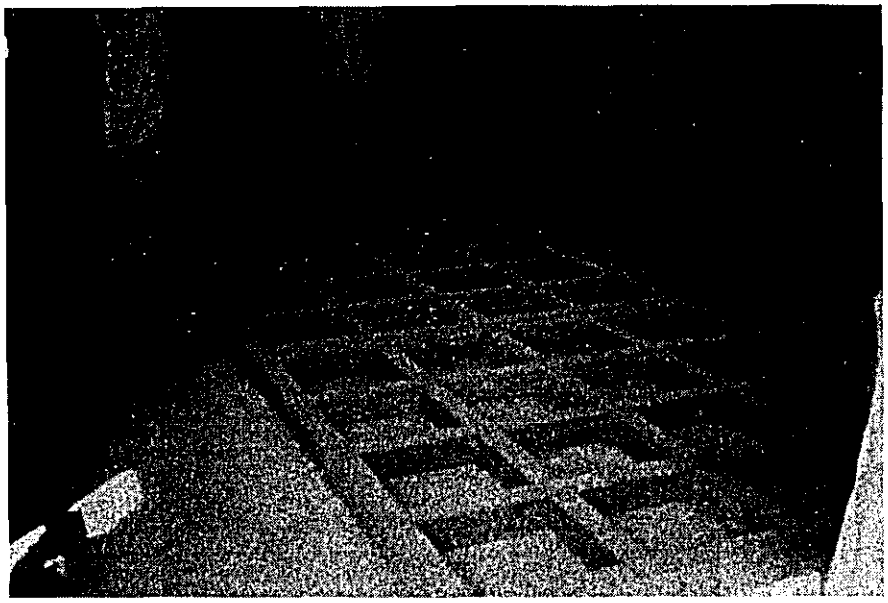


Photo 11 Base logs combined in a chequer pattern

Since the base logs combined in a chequer pattern are divided by the square framing, scattered rice grains are prone to remain on the floor face after cleaning to provide a habitat for insect pests and in addition, ventilation control is liable to be made difficult.

(2) Stacking

The fundamental stacking pattern employed in Japan is not practised, but grain bags are piled up in layers stacked alternately in directions normal to each other. Specifically, if bags of the first layer are in the lengthwise direction, the second layer is stacked in the breadthwise direction, and the third layer in the lengthwise direction, and so forth.

The number of layers is 17 to 18 in warehouses with a small beam height, but generally ranges from 20 to 24. At Narayaganj CDS, a lot of grain bags stacked in as many as 27 layers was observed.

The stacking technique is on an extremely high level, and the trapezoidal stacking method is employed to prevent fall-down accidents (See Photo 12).

Photo 12 Grain bags stacking condition

The passage ways are arranged in a cross pattern (+) in most of Dacca type (standard 500-ton type) and other similiar smaller warehouses, but those in some larger warehouses are arranged in a pattern of ⊤. The width of the main passage way ranges from 1.6 to 2.0 m and that of the branch passage way is about 75 cm, which is sufficient for manual warehousing and delivery work. To each lot of stacked foodgrain bags is affixed a "Stacking Card" showing the type of cargo, date of warehousing, quantity in stock, weight of each bag, date of delivery, etc.

(3) Temperature and Humidity Control within Warehouses

a. Temperature and Humidity within Warehouse

It appears that the temperature and humidity within the surveyed warehouses are subjected to the changes in outside climatic condition. The atmospheric temperature in Dacca area reaches its peak (38∿40°C) in summer (from March to May), ranges from 30 to 35°C in the wet season lasting from June to October, and drops to 25∿30°C in winter (from November to February). The relative humidity in the same area, which is high throughout the year, reaches its peak (90∿97%) in the wet season. It is believed that a similar pattern is presented in other areas.

Although no observation data were made available, the team was informed that the temperature inside the warehouses is higher than the outside temperature and often reaches to 40∿45°C. This is perhaps ascribable to the accumulation of radiation heat which becomes intense if sheet iron is used for roofing.

Data of humidity observation within warehouses were not available either. Considering, however, that the surveyed warehouses can structurally maintain poor air-tightness, it is probable that the humidity inside the warehouses is close to the outside humidity which is higher than 90%.

Measurement of grain temperature is not conducted periodically, and only one grain temperature indicator is installed in each warehouse. Since this makes it impossible to grasp the secular change of grain temperature, the cumulative total temperature to which stored foodgrains are subjected in a year (which should preferably be held within 2,500°C for satisfactory quality control) is not clear. Judging from the daytime temperature which maintains a high level for a long period in Bangladesh, it is quite likely that the value of cumulative annual grain temperature is exceedingly high.

The grain temperature at the serveyed warehouses in December when the survey was conducted is shown in Table 6. As seen in the table, the temperature difference between warehouse inside and outside is small in December.

Table 6 Inside and Outside Temperature and Grain Temperature at Surveyed Warehouses

Temperature / C.S.D.	Inside Temperature	Outside Temperature	Grain Temperature	Roof
Tejgaon	27.0°C	26.5°C	(Upper Layer) 27.5°C	Sheet iron
Narayanganj	27.5	26.0	(") 26.0	Concrete roof
Dacca	27.0	26.5	(") 26.0	Sheet iron roofing

b. Daily Temperature and Humidity Control within Warehouses

Although foodgrains in storage are subjected to the severe micro-climate described above, ventilation control necessary for preventing the adverse effect of high inside temperature and humidity in summer and wet season is not carried out.

At Halisahar CSD, it was noticed that the door was closed although the inside temperature stood at 30°C which was 5°

higher than the outside temperature. The team proposed to open the door for ventilation but was told that no particular attention was paid to ventilation by opening the door.
All units of warehouses at this CSD are therefore closed all day if no warehousing or delivery work is performed.

(4) Grain Moisture Control

For the quality preservation of foodgrains in warehouses, control of grain moisture content is just as important as that of grain temperature (which should be held as low as possible).
Keeping quality of foodgrains depends on the moisture content which varies by the kind of foodgrain.
The lower the minimum required moisture content, the easier becomes the quality preservation. This is because the low moisture content suppresses the respiratory activity and thereby declerates the pace of aging for one thing, and also inhibits the parasitism of microorganisms for another. Parboiled rice and imported rice storaged in Bangladesh have a moisture content of about 13%, whereas Japanese stored rice has a moisture content of 15∿16%, so that it can be said the former excel in keeping quality.

However, the humidity inside the warehouses in Bangladesh is considered to rise beyond 90% in the wet season when both atmospheric temperature and relative humidity are very high. Accordingly, rice grains with a low moisture content are forced to absorb moisture to attain an equibrium state. The humidity inside the warehouse should therefore be controlled by introducing dry air at suitable intervals in order to prevent the rise of grain moisture content beyond the balanced value. No consideration at all is given to such moisture control in the surveyed warehouses, nor are any of the warehouses structurally suited to moisture control (no opening/closing devices are attached to upper and lower vents).

(5) Quality Inspection of Stored Foodgrains

The quality of foodgrains in stock is checked by the inspection officers stationed at each depot. The inspection officer checks the quality of incoming foodgrains by sampling method and issues instructions for early delivery (marketing) of any lot which he finds to be inferior in quality.

For foodgrains already accepted in stock, however, the inspection officer does not conduct the quality check periodically but issues instructions for fumigation to control the occurrence of insect pests from time to time unless he is required to take special measures in such an emergency case where offensive smell resulting from the putrefaction of stored grains is detected.

(6) Disease, Inspect Pest and Rodent Control, and Fumigation

a. Disease Control

Diseases of stored foodgrains develop in most cases by the parasitism of microorganisms (fungi) which propagate actively in an environment favoured with high temperature (more than 20°C) and high humidity (more than 70%).

According to the chiefs and inspection officers the surveyed warehouses, putrefaction of imported foodgrains moistened by sea water occurs occasionally each year, but no disease damages have ever taken place with foodgrains in stock. This is perhaps because the CSDs are operated mainly for stock turnover in a short period of approximately three months, but it semed to the team that virtually no consideration was given to disease control in the initial parasitic stage of microorganism. During the survey period, the team conducted a partial examination on imported Californian rice which had been stored for 9 months as well as on the rice stored at Tejgaon CSD using a magnifying glass, and detected the presence of microorganisms on the tested grain surfaces. This fact cleary points to the need of conducting fumigation for fungas control in all warehouses.

In order to check the presence of parasitic microorganism on foodgrains stored for a short period, the team sampled some rice specimens from the surveyed warehouses and brought them back to Japan. The specimens ware put to laboratory tests at Food Research Institute of the Ministry of Agriculture and Forestry. In these tests, fluvus and penicillium islamdium which generate aflatoxin and luteoskyrin respectively and other pathogenic bacteria were detected from paddy and milled rice of Bangladesh varieties harvested in 1976 and in addition, many fungi which generate micotoxin were detected from the parboiled rice imported from Thailand.

b. Insect Pest Control

As described earlier, considerably strict control measures are enforced to prevent the occurrence of insect damages, and fumigation instructions issued by the inspection offier are carried out whenever the occurrence is detected. Insect pests whose occurrence was detected during the teams' survey in Bangladesh were rice weevil, Indian meal moth, and cockroach. The inspection officer interviewed by the team stated that the outbreak of mites also takes place occasionally, but none of these insects cause any serious damage because their outbreak is inhibited by fumigation control.

c. Rodent Control

Rodenticide was used at Dacca CSD which was inhabited by rats. The team was informed that other CSDs are not inhabited by rats, but it is rather doubtful that all other CSDs are free from rodent damages because rats were found outside of all warehouses. There are no wherehouses equipped with a Japanese type "Nezumi-gaeshi (rat preventive board)" in front of the door, but some warehouses have a pent-roof attached to the platform to prevent the intrusion of rats. However, not much control effect can be expected of this device because

the platform has a rough surface and is broken and cracked in many places.

d. Fumigation

Although the surveyed warehouses are generally poor in air-tightness, ordinary fumigation is conducted after sealing doors and windows in warehouses with a concrete floor, and partial vinyl covered fumigation is carried out for a cargo lot covered by a vinyl sheet in warehouses which have a sheet iron roof and cannot therefore be sealed from inside.

Fumigant used in almost all cases is phostoxin (tablet type insecticide, phosphuretted hydrogen) dosed at 3∿4 tablets per ton of rice and 4∿5 tablets per ton of wheat. Considering the control effect of this fumigant, the optimum dosage is 3 to 4 tablets per ton of rice or wheat, but no clear answer was given as to why the dosage was increased for wheat.

In some other warehouses, methyl bromide (liquid bromine fungicide-cum-insecticide filled in a pressure container) is used. Since the container has a high discharge pressure, use of this fumigant in warehouse with a poor air-tightness does not produce a very high control effect and is also prone to cause environmental pollution due to gas leakage. It is therefore advisable to use it for vinyl covered lot fumigation.

Fumigation is performed 3 to 4 times a year because the fumigant has no residual control effect and consequently gives rise to the occurence of insect pests in 1 to 2 months after application. However, considering the quality deterioration due to the chemical injury, it is both economical and rational for quality preservation to conduct the fumigation once a year or so and use insect control compounds such as phrethrum compound through the year.

(7) Cleaning of Warehouse Inside

Passage ways are kept well cleaned, but rice grains and particles and jute bag dust remain uncleaned below the base logs, providing a favourable habitat for insect pests.

3-6 Storage Period and Quality of Stored Rice

(1) Storage Period

Since the CSDs are located in consumer areas primarily for collection and distribution of foodgrains, the storage period of rice hardly exceeds 3 months. The only exception to this general practice is noticed with Narayaganj CSD where paddy is stored for 1 year and feed for 8 months.

At Dacca CSD, the average monthly quantity of incoming rice and wheat in 1975 recorded 12.4 thousand tons and that of outgoing rice and wheat in the sam year 11.8 thousand tons. Thus, the turnover rate is very high.

(2) Quality of Stored Rice

Milled rice is stored only for a limited period, but one can readily imagine that its quality is subjected to the progress of physico-chemical deterioration (increase of fatty acid, decomposition of vitamin B1, deterioration of amylum, etc.) during the storage period if one takes account of the poor keeping quality of milled rice and the severe micro-climatic condition within the warehouse. (The maximum period during which the quality of milled rice can be preserved in Japan in summer is only about 2 months)

The team noted that some lots of mille rice stored in the surveyed warehouses presented the loss of gloss or other symptoms of deterioration, although no fungous pollution was observed.

3-7 Damages of Cyclones and Natural Disasters

Damages of cyclones were not observed at any serveyed warehouses, nor were any warehouses found to have been afflicted with flood damages because all are constructed to have a floor height of about 3 feet above ground. The only exception was Halisahar CSD which suffered a flood damage when it was inundated above floor level.

3-8 Level of Storage Techniques

As will be clear from the above comments on the quality control throughout the storage period (including fumigation), both rice and wheat are living things and the fundamental role of storage services is to conserve their lives in the best possible manner. It is because of the lack of awareness of this role that no careful consideration is given to the physico-chemical deterioration of stored rice and whear, although measures are taken to prevent material loss due to insect pests and rats.

Judging from the fact that no observation is conducted on the grain moisture content, micro-climatic condition within the warehouses, and grain temperature fluctuation due to changes in such condition, which are all important for satisfactory quality conservation during storage, it is to be concluded that the level of storage techniques is still low.

CHAPTER IV FOOD MANAGEMENT MECHANISM AND DEMAND-SUPPLY SITUATION OF RICE AND WHEAT

4-1 Institution and Organization for Food Management

In order to secure stable supply of food for the people and stabilizes the basis of national economy, the Bangladesh government is enforcing an outright statutory rationing system in six major consumer cities (Dacca, Chittagong, Narayanganj, Khulna, Rajshahj, and Mangumachi), and a modified rationing system covering public servants, servicemen and plant workers in other areas. (Weekly rations supplied per person under the system, consisting of rice and wheat, is 6 pounds for adults and 3 pounds for children)

The rations are composed chiefly of foodgrains procured from external sources including those supplied under aid from donar countries, and partly of domestic rice and wheat which the government procures on a voluntary or compulsory basis.

Imported foodgrains and domestic rice and wheat are stored in the government warehouses in bags or in silos in bulk.

The warehouses storing bagged foodgrains are classified into two types by size: the Central Storage Depots (CSD) and the Local Storage Depots (LSD). The former are under the control of the Directorate of Movement and Storage of the Ministry of Food, and the latter are under the control of the Directorate of Supply, Distribution and Rationing of the same ministry. The silos are used for storage of imported wheat under the control of the Directorate of Silos.

4-2 Distribution Mechanism of Rice and Wheat

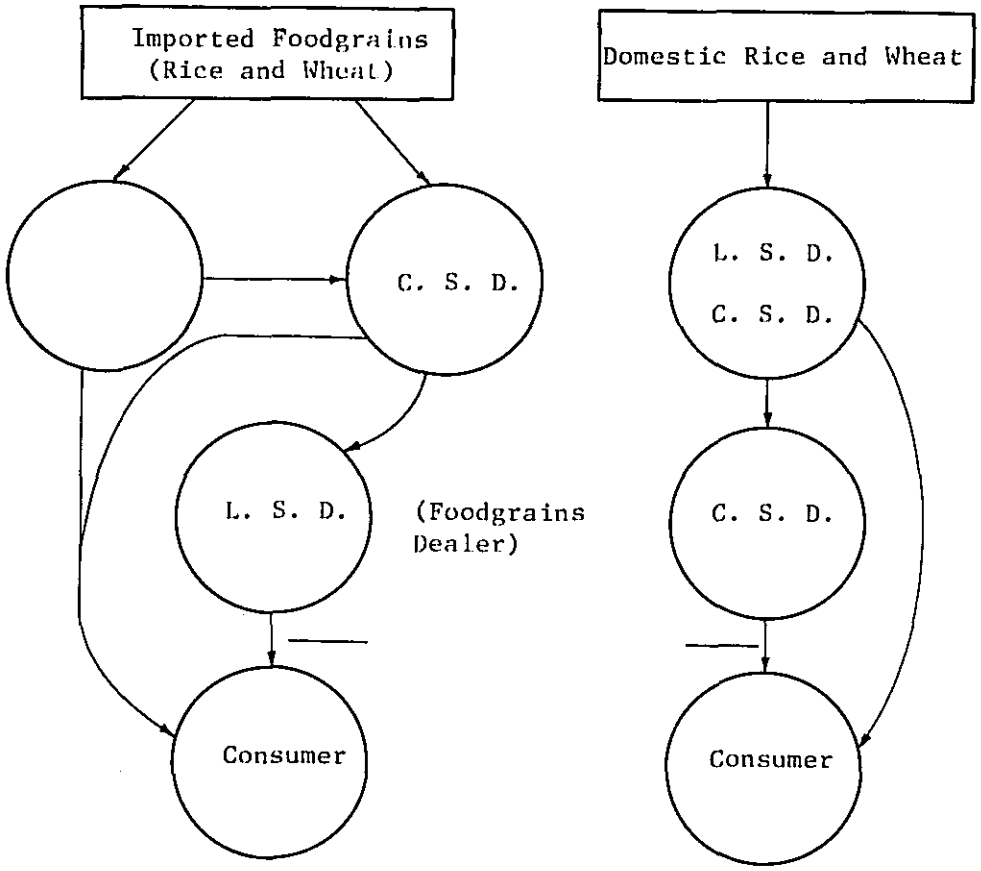
Since her liberation in 1971, Bangladesh has suffered a chronic shortage of food which had to be covered by import. The government purchases of domestic rice and wheat are limited (415 thousand tons of the total production of 12,802 thousand tons in 1975/76), and the greater part of domestically produced rice and wheat is consumed by

the farmers or supplied to general consumers through free distribution routes.

The government purchase of domestic rice and wheat is effected on the strength of the government purchase announcement (See the attached Reference Date (6)) after inspection at CSDs in 12 places and LSDs in 322 places. The domestic foodgrains thus procured by the government are partly rationed to the consumers and partly transported to other CSDs for rationing to general consumers.

The imported foodgrains landed at Chittagong port are moved out to different storage centres (silos, CSDs, or LSDs in certain cases) by the Directorate of Movement and Storage according to the programme drawn up in advance in consulation with the Directorate of Supply, Distribution and Rationing. Foodgrains moved out to CSDs and silos are partly rationed directly to consumers and partly transported to LSDs and then rationed to consumers.

Fig.2 illustrate the distribution mechanism described above.



4-3 Demand-Supply Situation of Rice and Wheat (1973/74 ∿ 1975/76)

Due to the deficient availability of the relevant government data, it is not possible to grasp the recent demand-supply situation of rice and wheat accurately.

Tables 7 and 8 showing the balance and control of demand and supply were prepared from the data made available by the Bangladesh Ministry of Agriculture and Ministry of Food.

Table 7 Balance of Demand-Supply of Rice and Wheat

(Unit : Thousand ton)

	1973/74	1974/75	1975/76
Rice Production Gross	11,210	11,483	12,532
Rice Production Net 1	10,089	10,335	11,279
Rice	86	250	397
Wheat	1,567	2,035	1,045
Total 2	1,653	2,285	1,442
Total Supply (1 + 2)	11,742	12,620	12,721
Total Demand (Consumption Requirement) 4	12,228	12,400	12,734
Balance 3 - 4	Δ486	220	Δ13
Net Supply	1,728	1,797	1,695

Notes) Net rice production was calculated by deducting 10% from gross production as seeds and processing loss.

As seen in Table 7, the rice production in Bangladesh is about 11,000 ∿ 13,000 thousand tons in gross tonage and about 10,000 ∿ 11,500 thousand tons in net tonnage, whereas the consumption requirement ranges from 12,000 to 13,000 thousand tons. The deficit which amounts to about 1,500 ∿ 2,000 thousand tons annually must be filled by import.

The area-wise control of demand and supply is estimated to be conducted as follows.

Rice is moved out to fill the shortage in other parts of the country from Dinajpur, Rangpur, Rajshahj and Bogra in Rajshahj district, Patuankhali and Barisal in Khulna district, Mymensingh in Dacca district, and Sylhet in Chittagon district. Areas short of rice supply and receiving rice from the said areas are Dacca in Dacca district, Chittagong and Comilla in Chittagong district, Khulna in Khulna district, and Pabna in Rashahj district. All these rice receiving areas embrace cities having a large consumer population or playing an important position in the nation's transportation network.

Table 8 Estimated Area-wise Control of Demand

(Unit: Thousand ton)

District	Area	Demand (A)	Ration (1975/76)			Purchase of Domestic Rice 1975/76(D)	Outgoing/Incoming Rice	
			Rice (B)	Wheat(C)	Ratio of Rice Ration % (B)/(A)		Outgoing (D)-(B)	Incoming (B)-(D)
Dacca	Dacca	441.5	159.7	281.8	36.2	4.5		155.2
	Mymensingh	112.7	34.6	78.1	30.7	52.5	17.9	
	Tangail	33.6	4.7	28.9	14.0	2.6		2.1
	Faridpur	69.1	10.6	58.5	15.3	3.3		7.3
	Total	656.9	209.6	447.3	31.9	62.9		
Chittagong	Chittagong	203.1	57.3	145.8	28.2	8.3		49.0
	Chittagong Hill Tracts	11.8	2.6	9.2	22.0	0.9		1.7
	Noakhali	62.7	12.9	49.8	20.6	11.6		1.3
	Comilla	108.0	19.4	88.6	18.0	10.1		9.3
	Sylhet	66.1	25.5	40.6	38.6	33.4	7.9	
	Total	451.8	117.7	334.1	26.1	64.3		
Rajahahj	Rajahahj	82.1	27.1	55.0	33.0	43.8	16.7	
	Dinajpur	36.8	20.6	16.2	56.0	77.9	57.3	
	Rangpur	89.8	24.8	65.0	27.6	42.0	17.2	
	Bogra	29.0	10.9	18.1	37.4	22.8	11.9	
	Pabna	58.9	14.3	44.6	24.3	7.8		6.5
	Total	296.5	97.7	198.8	33.0	194.3		
Khulna	Khulna	113.1	46.4	66.7	41.0	21.8		24.6
	Barisal	62.0	14.8	47.2	23.9	15.8	1.0	
	Patuakahali	18.8	4.5	14.3	23.9	26.3	21.8	
	Jessore	54.3	15.3	39.0	28.2	14.8		0.5
	Kushtia	41.9	11.3	30.6	27.0	8.2		3.1
	Total	290.1	92.3	197.8	31.8	86.8		
Grand Total		1,695.4	517.4	1,178.0	30.5	408.3		

Notes: Demand is the sum total of rations of rice and sheat.

4-4 Production and Government Purchase of Domestic Rice and Wheat (1975/76)

In 1975/76, Bangladesh enjoyed a bumper crop of more than 12,500 thousand tons of rice partly because the rice producing areas were blessed with favourable climate and partly because fertilizers were applied at slightly increased dosages.

Seen by cropping season, Aus rice (sown in April and May and harvested in July and August) recorded a yield of 3,200 thousand tons, Aman rice (sown directly in August or transplanted in August and harvested in November and December) registered 7,050 thousand tons, and Boro rice (sown in December and January and harvested in April and May) marked 2,290 thousand tons.

However, the government purchase of domestic rice was extremely small relative to the production and recorded only 410 thousand tons (mostly Aman rice) or 3.3 of the total production.

Production of domestic wheat in 1975/76 also increased to 265 thousand thanks to the favourable climatic condition, but the government purchase remained on the low level of 7 thousand tons (2.5% of total production).

The production and government purchase of rice by district and cropping season are as shown in Table 9.

Table 9 Production and Government Purchase of Rice

(Unit: Thousand ton)

	Production (A)				Government Purchase (B)				(B)/(A)
	Aus	Aman	Boro	Total	Aus	Aman	Boro	Total	
Dacca District	884.0	1,674.1	814.6	3,372.7	0.0	54.7	8.1	62.9	1.9%
Chittagong "	792.6	1,770.3	1,009.8	3,572.6	9.1	45.4	9.8	64.3	1.8
Rajshahj "	871.9	2,087.1	248.8	3,207.9	24.6	165.6	4.2	194.3	6.1
Khulna "	651.7	1,514.4	212.3	2,378.4	9.4	76.8	0.6	86.8	3.6
Total	3,200.1	7,045.9	2,285.6	12.531.6	43.1	342.5	22.6	408.3	3.3
(Ref.) Wheat	265				6.6				2.5

4-5 Government Food Policy

As described already, Bangladesh has been under the pressure of chronic food shortage which must be filled by import from external sources.

The government therefore gives top priority to self-sufficiency in food among its policies and is enforcing various promotional measures such as promotion of breeding, consolidation of irrigation facilities, improvement of farming techniques, and so forth. However, attainment of self-sufficiency in food in the immediate future is a matter of impossibility and the government is forced to import 1,500 to 2,000 tons of foodgrains from abroad.

The requirement of imported foodgrains for a particular year is determined with account taken of the estimated domestic production, consumption requirement and estimated deficit in that year. However, the government is trying to increase the purchase of domestic rice and wheat on a voluntary or compulsory basis for gradual reduction of external procurement. For this purpose, the government purchase of domestic rice and wheat is undertaken in support of the following policies.

a. Price support for rice and wheat producing farmers.

b. Equitable distribution in different areas of the country.

c. Stabilization of market prices.

d. Prevention of smuggling (especially in the 5 mile border belt).

The government purchase prices of domestic rice and wheat were as follows in 1975/1976.

Paddy	Tk. 74	per maund (approx. 37 kg)
Rice (middle grade)	Tk.120	"
Rice (lower grade)	Tk.118	"
Wheat	Tk. 72	"

Notes: Tk. 1 = approx. ¥20

CHAPTER V. PLAN FOR IMPROVEMENT AND EXPANSION OF FOODGRAINS WAREHOUSES AND REQUEST FOR JAPAN'S ASSISTANCE

5-1 Scheme for Building Up a Reserve of Foodgrains

Bangladesh was afflicted with severe damages of natural disasters consecutively for three years from 1972 when the country was hit hard by drought damage. In 1973, damages of cyclones were inflicted upon the whole country and in 1974, a flood heaviest ever recorded in the last 20 years attacked the nation and many people died of starvation.

From this bitter experience, the government has drawn up the Scheme to secure stable supply of foods and increase the government purchase of food so as to be able to cope with an emergency situation. The Scheme aims at a reserve of 900 thousand tons by the end of June 1977, and another reserve of 1,000 thousand tons by the end of June 1968.

5-2 Plan for Improving and Expanding Foodgrains Warehouses

The storage capacity of foodgrains warehouses required for the Scheme needs to be augmented to 1,200 thousand tons by June 1977 and further to 1,500 thousand tons by June 1978 if account is taken of dead space and storage of foodgrains other than rice and wheat. At present, however, the total storage capacity of foodgrains is only 623 thousand tons as stated in Chapter II.

Such being the situation, the Bangladesh government attaches high priority to the plan for improving and expanding foodgrains warehouses, and while exerting itself for the construction of such warehouses, it is seeking assistance of many countries in the implementation of the plan.

The warehouses improvement and expansion plan detailed below includes the construction of new warehouses under Danish aid and the rehabilitation of existing warehouse to be undertaken with British aid.

(1) Improvement and Expansion Plan Up to June 1977

Storage capacity required (A)	(A)	1,200	thousand tons
Usable storage capacity as of Dec. 76 (B)	(B)	623	
Storage capacity requiring improvement and expansion	(C) = (A) - (B)	577	
Of C, planned storage capacity	(D)	527	

Breakdown of (D):

Storage capacity to be newly secured by Bangladesh government (already planned)	156
New warehouse construction under Danish aid	25
New storage capacity to be secured by Bangladesh government and by British aid in the rehabilitation of existing warehouses	346

Total deficit in storage capacity	(E) = (C) - (D)	50	

(2) Improvement and Expansion Plan Up to June 1978

Storage capacity required	(F)	1,500	thousand tons
Storage capacity expected to be secured by June 1977	(G) = (B) + (D)	1,150	
Storage capacity requiring improvement and expansion (construction of new warehouses under future foreign aids expected)	(H) = (F) - (G)	350	

(Bangladesh Minister of Food Provisions)

5-3 Construction of New Warehouses by Bangladesh Government and with Danish Aid

The Bangladesh government has already decided on the construction of 8 CSDs (56 units with a total storage capacity of 28 thousand tons) and 136 LDSs (251 units with a total storage capacity of 128 thousand tons). In addition to these, 30 prefabricated LSDs (50 units with a total storage capacity of 25 thousand tons) are planned to be constructed with Danish aid.

These new warehouses are planned to be established in many large consumer areas.

Table 10 shows the new warehouse construction plan by district.

Table 10 New Warehouse Construction by Bangladesh Government and with Danish Aid

(Unit: Thosuand ton)

Location & Capacity \ District			Dacca	Chittagong	Rajshahj	Khulna	Total
Construction by Bangladesh Government	C.S.D	Location	2	2	1	3	8
		No. of Unit	17	6	9	24	56
		Storage Capacity	8.5	3.0	4.5	12.0	28.0
	L.S.D	Location	20	22	53	41	136
		No. of Unit	28	28	131	64	251
		Storage Capacity	15.2	14.8	65.1	33.1	128.1
	Total	Location	22	24	54	44	144
		No. of Unit	45	34	140	88	307
		Storage Capacity	23.7	17.8	69.6	45.1	156.1
Construction by with Danish Aid	L.S.D	Location	17	13	-	-	30
		No. of Unit	30	20	-	-	50
		Storage Capacity	15.0	10.0	-	-	25.0

Notes: 1. From the data of the Ministry of Food.

2. See the attached Reference Data (5) for area-wise construction of new warehouses and area-wise total storage capacity after their completion.

5-4 Request for Japan's Assistance in Warehouse Construction Plan

Of the 1,500 thousand tons of storage capacity required for attaining a reserve of 1,000 thousand tons of foodgrains by June 1978 under the Scheme, 350 thousand-ton storage capacity needs improvement and expansion. While assistance from many countries is sought in the improvement and expansion of this 350 thousand-ton storage capacity, Japan is requested to provide assistance in the construction of new CSDs in 24 places comprising 50 Dacca type units each capable of holding 500 tons to cover a 25 thousand-ton portion of the said deficient storage capacity.

The locations of new units Japan is requested to construct, which are shown in Table 11, are mostly in the rice producing areas in the northwestern part of the country near the Indian border.

During its stay in Bangladesh, however, the team was not provided with any concrete explanation on the need for constructing the new units in the said areas nor with any relevant materials.

Table 11 Area-wise Construction of New Units Requested to be Undertaken by Japan

District	Area	Location	Number of Units
Rajshahj District	Dinajpur	Bhajanpur	2
		Ranishankail	2
		Haripur	2
		Kaharole	2
		Khanshama	2
		Atwari	2
		Total	12
	Rangpur	Kakiwa	2
		Hatibandha	2
		Ratgram	2
		Joymonirhat	2
		Kishoreganj	2
		Total	10
	Bogra	Nandigram	2
	Rajshaj	Dhamoirhat	2
		Shibganj	2
		Gopalpur	2
		Hamatpur	2
		Nahole	4
		Total	12
	Pabna	Sujanagar	2
		Santhia	2
		Chatmohar	2
		Total	6
Khulna District	Kushtia	Daulatpur	2
		Sailakupa	2
	Jessore	Masheshpur	2
		Keshabpur	2
		Total	6
Grand Total		24	50

Notes: According to Mr. A.Z. Khan of the Ministry of Food, selection of warehouse construction sites is made according to the following criteria.

1) The site should be in a rice producing area.
(This criterion is adopted because the government was unable to purchase rice in some areas in 1975/76 due to the shortage of warehouses despite the farmers' willingness to sell rice on a voluntary basis)

2) It should be in an area short of food supply (e.g., consumer cities, etc.).

3) It should be convenient for transportation of incoming and outgoing cargoes.

4) It should be in an area where the necessary land can be secured with ease.

CHAPTER VI SUMMARY OF SURVEY RESULTS

6-1 Situation of Foodgrains Warehouses

(1) The storage capacity of foodgrains in Bangladesh is as follows.

Unit: Thousand ton

	Existing Warehouses	Warehouses under Construction	Total
CSD	371	28	399
LSD	452	153	605
Total	823	181	1,004

In addition to the above, there are silos capable of holding a total of 22,500 tons.

About 200 tons storage warehouses out of the existing 823 thousand tons warehouses need reapirs due to superannuation or war damages. Usable warehouses can therefore holdonly about 623 thousand tons.

(2) Under the Scheme for Building Up a Reserve of Foodgrains, the Bangladesh government is planning to increase the present reserve of 600 thousand tons of foodgrains to 1,000 thousand tons by the end of June 1978, and also aims at augmenting the government purchase of domestic rice to about 1,000 thosuand tons (Government purchase of 1975/76 domestic rice registered 408 thosuand tons only).

To attain this objective, a storage capacity of 1,500 thousand tons is required, of which 1,150 thousand tons capacity is expected to be secured by the construction of new warehouses by the Bangladesh government (Tk. 160 million) and with Danish aid (50 units with a total storage capacity of 25 thousand tons) as well as by the British aid for repair and rehabilitation of

existing warehouses (Tk. 160 million). To secure the remaining 350 thousand tons storage capacity, the government is seeking assistance from foreign countries including Japan.

6-2 Existing State of Warehouses and Storage Management

(1) CSDs are located in places expedient for collection and distribution of foods and performing the functions of food distribution bases.

(2) The warehouses can be structurally classified into a number of types such as Dacca type, shell type, Calcutta type, etc. Of these, Dacca type is recommended by the government as standard warehouse type (storage capacity - 500 tons). Even with this type, however, several choices can be made in regard to size, shape of the roof, floor space, size of the window, and necessity of ventilators.

(3) The warehouses are considerably large in scale. 17 to 57 units of small warehouses each capable of holding 400 to 1,000 tons are concentrated in a single place to constitute a CSD having a total storage capacity of 10 to 62 thousand tons (32 thousand tons on the average).

(4) At each CSD are stationed 100 to 200 personnel including a chief who are in charge of warehousing and delivery work and of quality control of stored foodgrains. The number of staffs is very large relative to the scale of CSD.

(5) As for the storage management, the level of stacking techniques is very high, but that of storage techniques is rather low. Specifically, there are many aspects needful of improvement for satisfactory quality preservation.

6-3 Demand-Supply Situation of Rice and Wheat

The demand-supply situation of domestic rice and wheat could not be fully elucidated due to limitations to the relevant government data.

As for rice, the greater part of domestic production (11,000 ∿ 13,000 thousand tons) is consumed by producing farmers themselves or supplied to general consumers through free distribution routes, so that the government purchase is on the order of 400 thousand tons annually.

As for wheat, the government purchase recorded only about 7 thousand tons against the total production of 265 thousand tons in 1975/76, and the resultant deficit had to be covered by external procurement to maintain the balance of demand and supply (import of rice and wheat from abroad ranges from 1,500 to 2,000 thousand tons annually).

The government therefore supplies rations of rice and wheat mostly to large consuming cities.

6-4 Plan for Construction of Warehouse under Japanese Aid

The Bangladesh government is hoping to construct, with Japanese aid, 50 units of new warehouses (total storage capacity : 25 thousand tons) in 24 places in major rice producing areas of Rajshahj and Khulna districts in the northwestern part of the country. The proposed structure of each unit of the warehouses is the standard Dacca type which is capable of holding 500 tons.

However, the team was not provided with a detailed explanation on how the construction sites and scale of the warehouses were determined, nor was it offered any materials relevant to this plan.

6-5 View of the Survey Team

Construction of new warehouses in the rice producing areas in Rajshahj and Khulna districts as desired by the Bangladesh government is effective in expanding the storage capacity for augmented collection rice from producing areas.

For reasons described below, however, it is considered more desirable to build the new warehouses in major consumer cities or surrounding areas as rice collection and distribution bases.

a. While the greater part of domestic rice and wheat is consumed in the producing areas either by farmers themselves or through free distribution routes, demand for food to be supplied to large consumer cities under the rationing system must be filled by imported foodgrains including those coming under aid from donor countries. This situation is likely to last for some time to come.

b. The transport network is in a poor condition, and all means of cargo traffic including food distribution is prone to be shut off entirely once a heavy flood disaster occurs, which makes it justifiable to increase the food storage capacity in major cities which is far short of demand.

6-6 Response of Bangladesh Government to Survey Team's Views

(1) As to the structure and scale of the warehouse, there is no objection to adopting a most suitable design other than the standard Dacca type which may be agreed upon by the experts of both countries, provided that the construction of the new type is feasible from the architectural point of view.

(2) As to the construction sites, there is no objection to the team's views, but considering the present state of transport network in Bangladesh, construction of warehouses only in major consuming cities will present the difficulty in foodgrain transportation from producing areas.

However, if the Japanese assistance is offered for construction of the warehouses, selection of the construction sites will be made after consultation between the two governments.

By reason of the existing state of transport network in Bangladesh, it is hoped that Japan will provide assistance in the consolidation and expansion of transport means including barges, coasters, trucks and freight trains.

As for the problems in storage techniques which are exactly as pointed out by the team, it is hoped that Bangladesh engineers and experts will be accepted to Japan for training in the advanced storage techniques.

CHAPTER VII. DRAFT PLAN FOR WAREHOUSE CONSTRUCTION

7-1 Construction Site

As stated in the foregoing views of the team, a depot serving as a foodgrains collection and distribution base will be constructed in or around a main consumer city (e.g., Dacca or Chittagong) having a deficient foodgrains storage capacity.

The site selection will be made to fill the following conditions.

1) The site is not in a lowland or swamp area, and is free from the fear of any natural disasters including flood damage.

2) The ground is rigid and has a sufficient bearing capacity.

3) The site is in an environment which will not be polluted by fumigant gas.

7-2 Structure

Bricks produced in Bangaladesh are the main construction material of all the five surveyed CSDs, and most of other materials are also manufactured in Bangladesh.

Bricks are suitable for construction of foodgrains warehouses. However, the surveyed warehouses do not exhibit their storage functions to the full because the doors, ventilators and other parts manufactured in Bangladesh are poor in quality.

The following is the structural plan of the warehouse mapped out with account taken of the need for improving the said parts.

(1) Scale of Warehouse per Unit

a. Floor Space

The Bangladesh standard is 100 ft x 40 ft per unit. In order to reduce the unit construction cost and raise the heat-insulation effect, it is desirable to increase the floor space per unit and decrease the outer wall ratio. Accordingly, the standard floor space per unit (2 rooms) will be taken at 100 ft x 80 ft, and the use of flexible joints will be considered depending on the topography of the site for the possible further increase of the floor space.

b. Height of Beam in the Warehouse

The Bangladesh standard is 16 ft. Since the temperature in the warehouse is higher in the upper part than in the lower part, stacking cargoes close to the beam is not advisable for satisfactory storage control. The Bangladesh stacking techniques are on a very high level, so that cargoes can be piled up high.

With these points taken into consideration, the beam will have a height of 19 ft.

(2) Outer Walls

In Japan, warehouses of stone construction or those of timber structure with earth walls are considered most suitable for storage of foodgrains, and this is evidenced by calculations of heat capacity and heat load of such warehouses.

The Bangladesh standard is 10-inch brick wall but the Japanese standard is 12 inches. Although use of thicker bricks is desirable, 10 inches thick brick wall will be

adopted to the present Bangladesh standard in consideration of the ground condition and the construction cost which does not permit the use of the next thicker bricks 15 inches.

(3) Roof

Double roofing or single roofing with insulating material is usually adopted in Japan. The insulating effect of the Bangladesh standard design is extremely poor relative to outer walls. Considering, however, that the high maintenance cost which will be required for an improved roof of complicated structure, the concrete roof of the standard design will be adopted with heat insulating material increased.

(4) Floor

The Bangladesh standard floor which is elevated 3 feet above ground is necessary to cope with the flood damage in the wet season and permit the use of trucks or large cart for grain transportation to the warehouse.

If sand is used for banking, moisture instrusion due to capillary action can be prevented and the floor bearing capacity increased.

The floor face will be concrete-placed, with polyethylene films laid at its lower end to increase the moisture-preventive effect.

(5) Door

As described already, the Bangladesh doors are not commendable from the viewpoint of air-tightness and crime prevention, and have no screen.

a. Air-tight Door

Resultant pairs swing doors will promise good air-tightness but they are subject to frequent malfunction which calls for skill to repair. Considering the situation in Bangladesh, therefore, durable sliding doors will be used, although they do not promise so good an air-tightness as resultant pairs swing doors.

b. Screen

The standard screen used for food warehouses in Japan will be adopted.

(6) Rat Trap

The rat trap is provided not in front of the door but at the extreme end of the platform in the surveyed warehouses. The Bangladesh rat trap will be installed and in addition, the cooper-made Japanese standard trap will be installed.

(7) Ventilation System

The ventilation system of Bangladesh warehouses has no opening/closing devices and resorts to natural ventilation which cannot be controlled.

For this reason, the Japanese standard ventilation system consisting of upper and lower vent ports and ventilators will be installed so as to control ventilation with the above-mentioned screen.

(8) Base Logs

At the newly built Tejgaon CSD, base logs are combined in a chequer pattern and fixed to the floor, but since this arrangement is considered to make it difficult to clean the floor surface, base logs will be laid down as practised in Japan.

7-3 Scale of Warehouse

Although neither the construction site nor its area are known at present, it is advisable to make the scale of each warehouse as large as practicable in order to reduce the construction cost and the operational cost.

7-4 Ancillary Facilities

For satisfactory warehouse operation and management, the following ancillary facilities must be provided, although the extent of necessity of such facilities varies by the construction site and scale of warehouse.

1) Staff office.
2) Labourers' pool.
3) Miscellaneous goods store.
4) Power supply system (excl. warehouse inside).
5) Water supply system.
6) Drainage system.
7) Pavement work.
8) Gates and fences.
9) Dormitory for staff.
10) Others.

7-5 Rough Estimate of Construction Cost

(1) Prerequisites to Estimate

1) Number of units : approximately 15.
2) Construction site : neighbourhood of Dacca.
3) Construction in 1 ∿ 2 different sites considered.
4) Conclusion of construction contract : July 1978.
5) Construction period : 15 months (12 months if all 20 units are to be built in a single site).
6) Customs duty on construction materials and machinery disregarded.
7) Japanese staffs and workers to be offered necessary privilleges including tax exemption.

(2) Estimated Construction Cost per Unit

71,530,000 yen (10% price up incl.)

(3) Area-wise Index of Construction Cost in Bangladesh

Base = 100 (Dacca)

Chittangong	107	Rajshahj	110
Sylhet	107	Bogra	110
Jessore	110	Dinajpur	115
Kushtia	110	Rangpur	115
Pabna	110		

7-6 Cost of Design and Construction Supervision

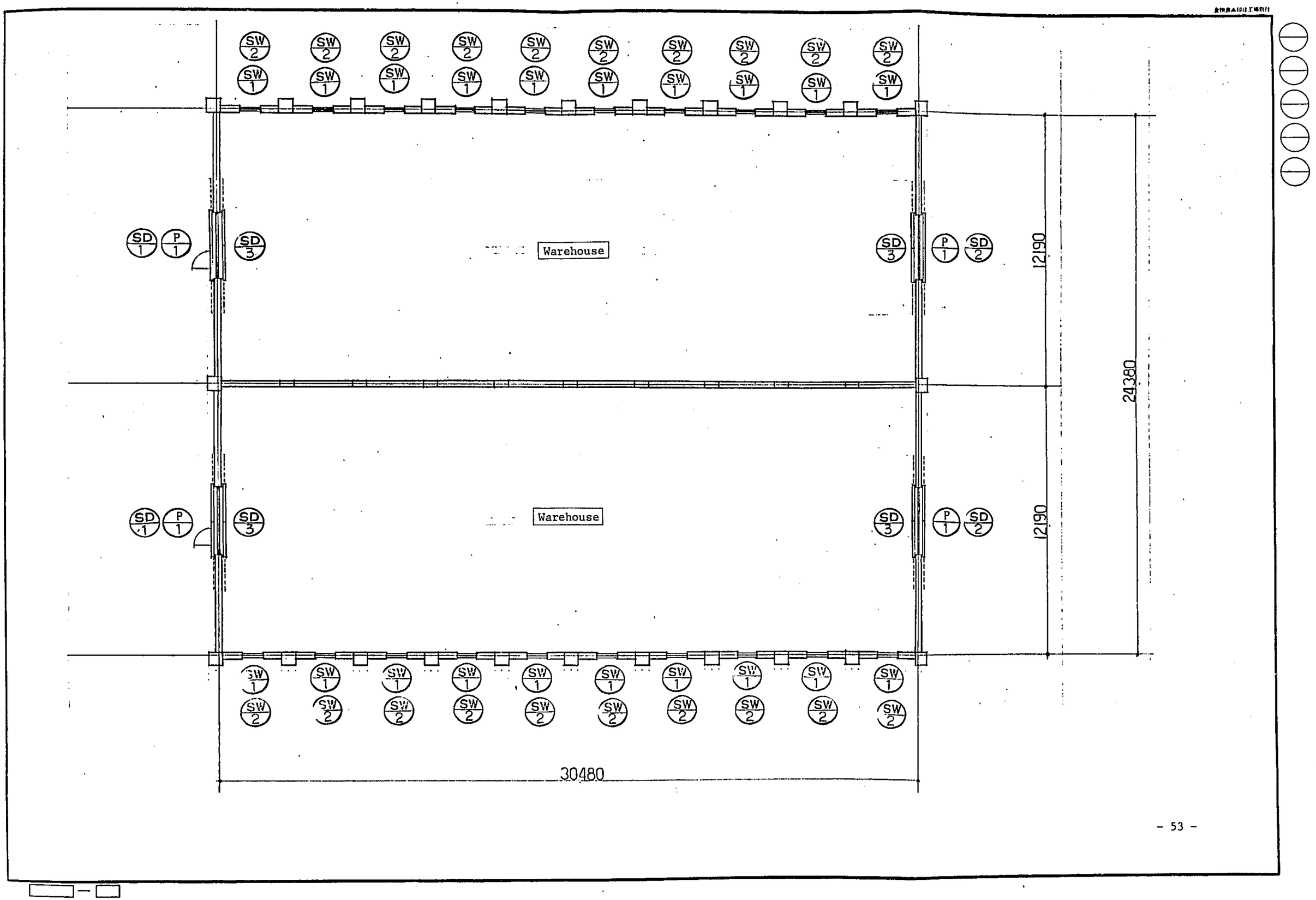
The total cost of design and construction supervision as calculated according to the prerequisites shown in Section 7-2 and 7-5 is as shown below.

Design and Survey Cost	:	¥20,000,000
Construction Supervisory Cost	:	¥53,300,000
		¥73,300,000

(10% price up included)

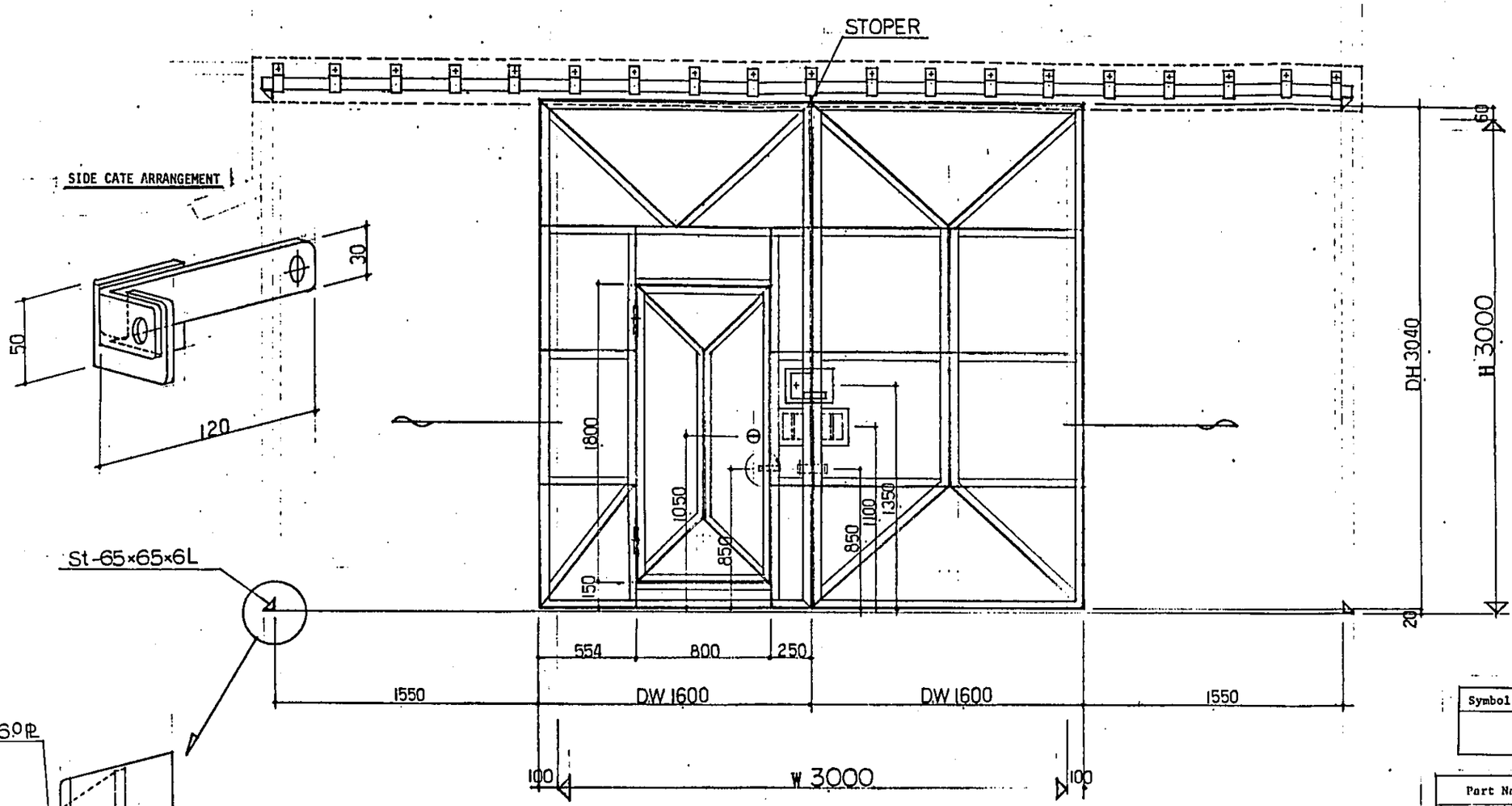
Notes: 1. Cost adjustments are required in the case of additional construction not covered in 7.5.

2. Cost adjustments are required in the case of additional surveys and personnel not covered in 7.2.


SW 2
SW 1
SD 1
P 1
SD 3
Warehouse
SD 3
P 1
SD 2
12190
24380
12190
30480

SD 1

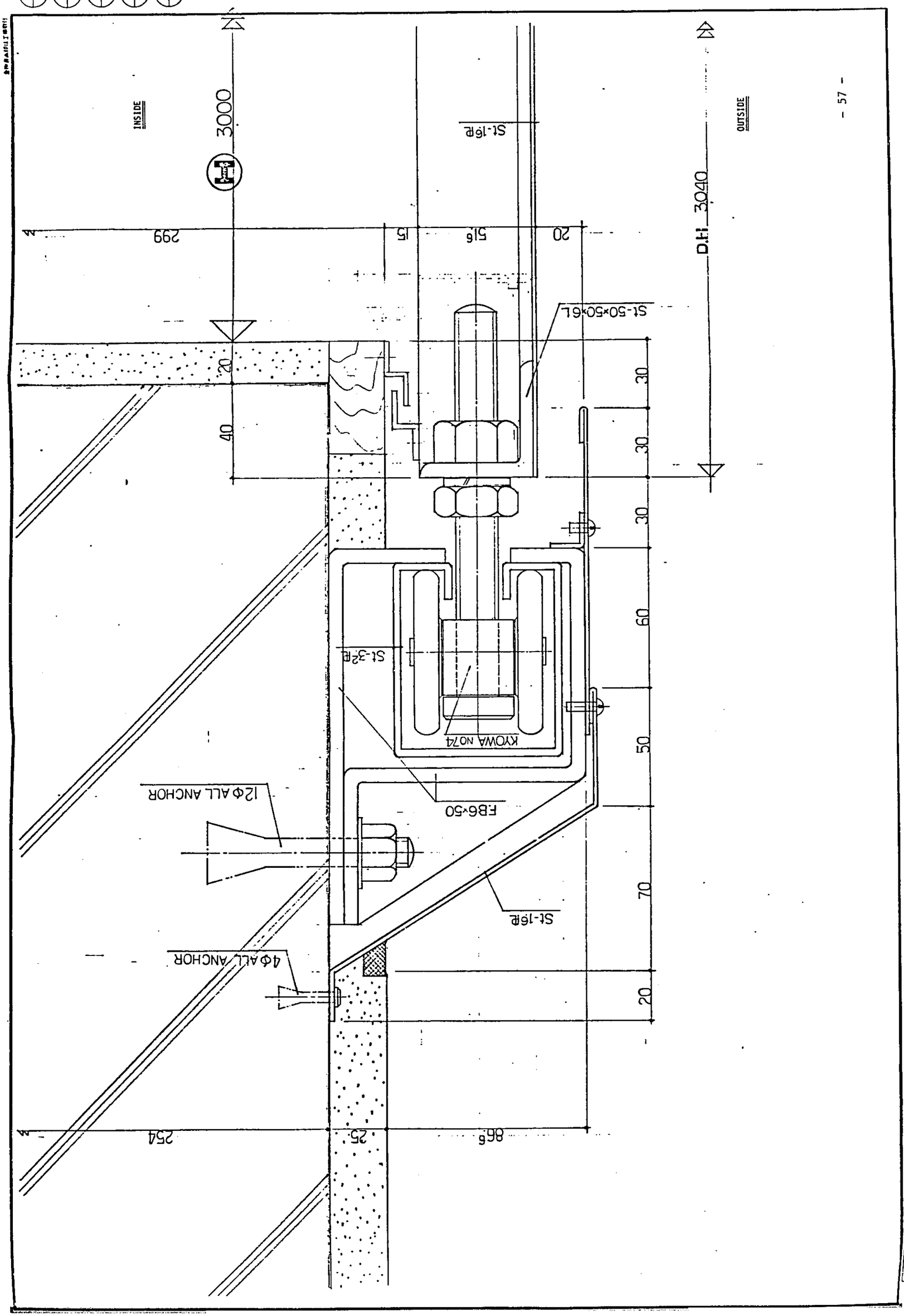
INSIDE VIEW



Symbol		Size	Q'ty	Fitting Place
	W	3,000	2	
	H	3,000		

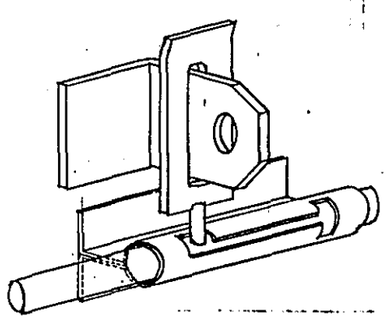
Part Name	Manu-facturer	Type	Q'ty
Sash pulley	Kyowa	74#	8
Saga type latch	Sanwa		2
Padkock			2
Outside pull			4
Inside pull			4

Double case handle			2
Hasp			2
Stainless steel hinge butt			4

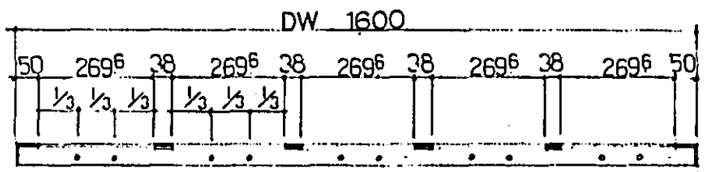

INSIDE
OUTSIDE
3000
D.H 3040
299
15
516
20
St-16R
St-50×50×6L
20
40
30
30
30
60
50
70
20
St-32R
KYOWA NO74
12φ ALL ANCHOR
FB6×50
St-16R
4φ ALL ANCHOR
254
25
865

SN 3

INSIDE VIEW

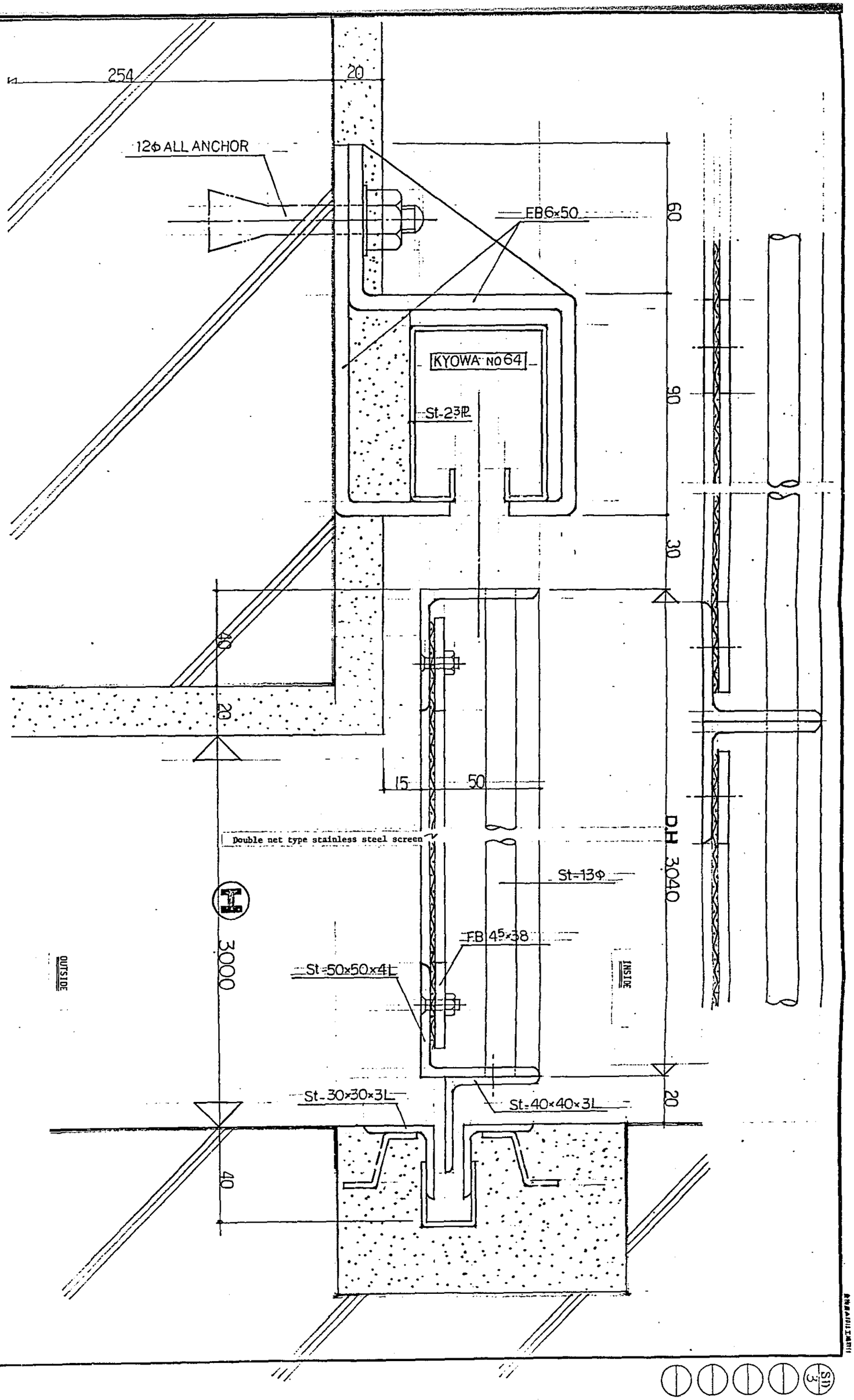


SIDE LATCH ARRANGEMENT



Symbol	Size		Q'ty	Fitting Place
	W	3,000	4	
	H	3,000		

Part Name	Manu-facturer	Type	Q'ty
Sash Pulley	Kyowa	64ϕ	16
Saga type latch	Sanwa		4
Side latch			4
Padkock			4
Outside pull			8
Inside pull			8
Flush bolt			4


254
20
12φ ALL ANCHOR
EB6×50
KYOWA NO64
St-2³R
60
90
30
40
20
15
50
Double net type stainless steel screen
St-13φ
P.H 3040
FB 45×38
3000
OUTSIDE
INSIDE
St-50×50×4L
St-30×30×3L
St-40×40×3L
20
40

Symbol		Size	Q'ty	Fitting Place
SW 1	W	900	20	Top light
	H	600		

Part Name	Manu-facturer	Type	Q'ty
Hinge			40
Overhanging arm			20

OUTSIDE VIEW

INSIDE VIEW

OUTSIDE

INSIDE

St-30×30×3t

St-13φ

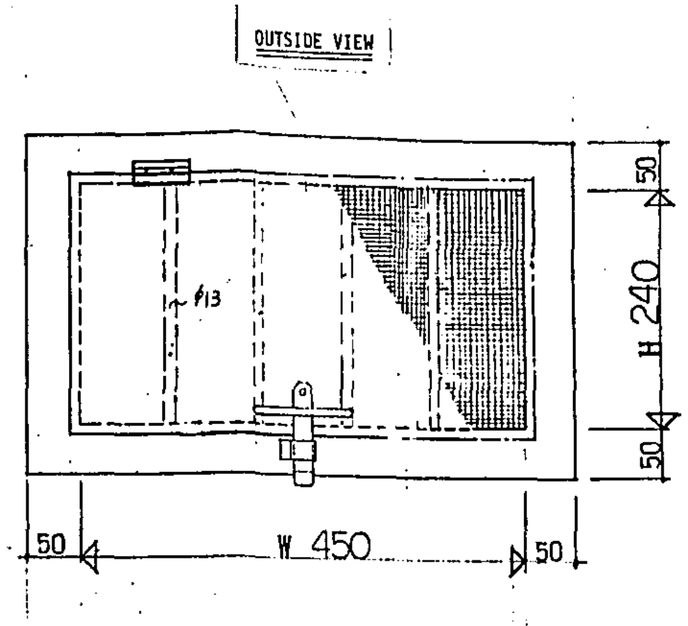
St-16φ

St-1.6

ALL ANCHOR

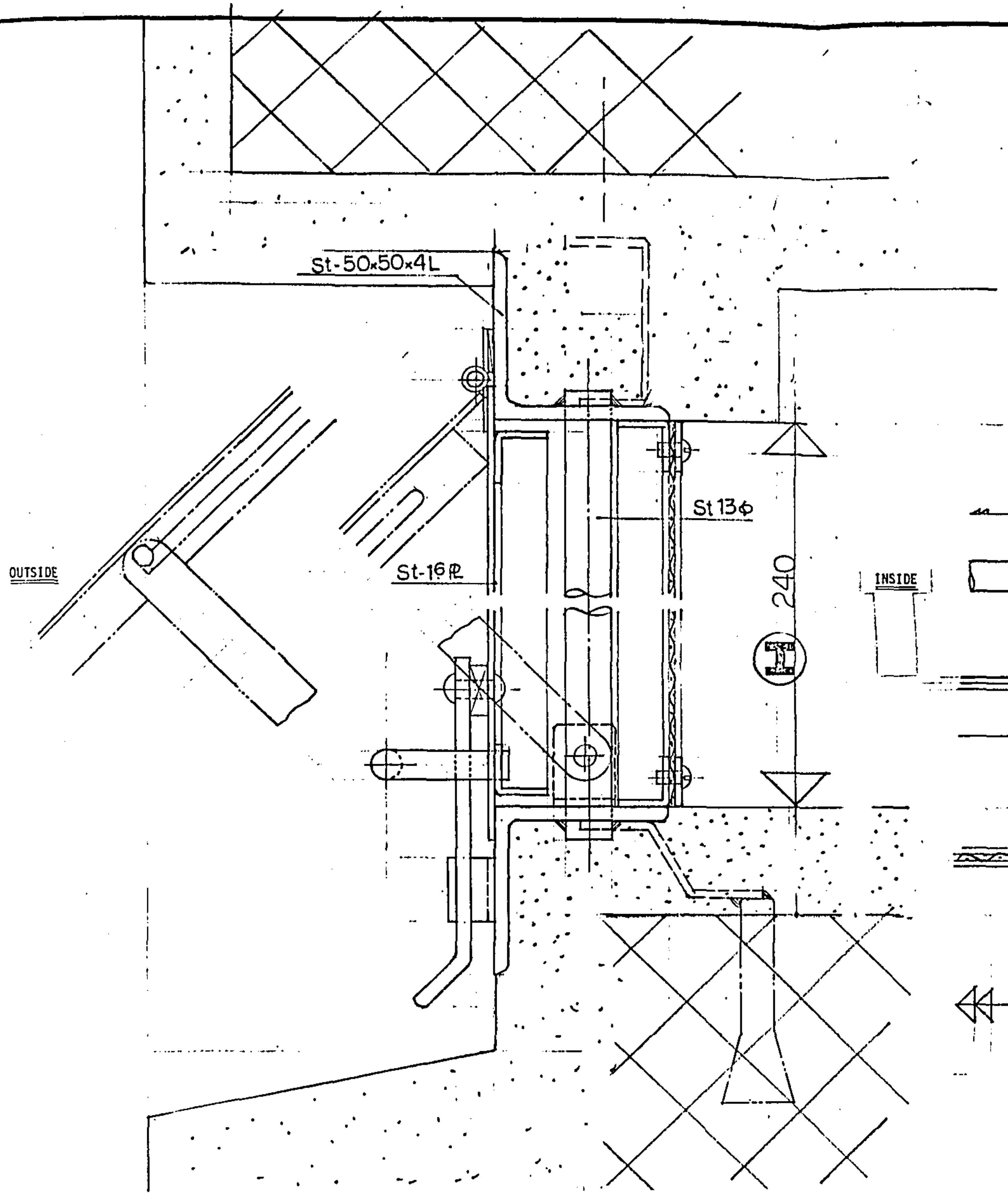
Single net type stainless steel screen

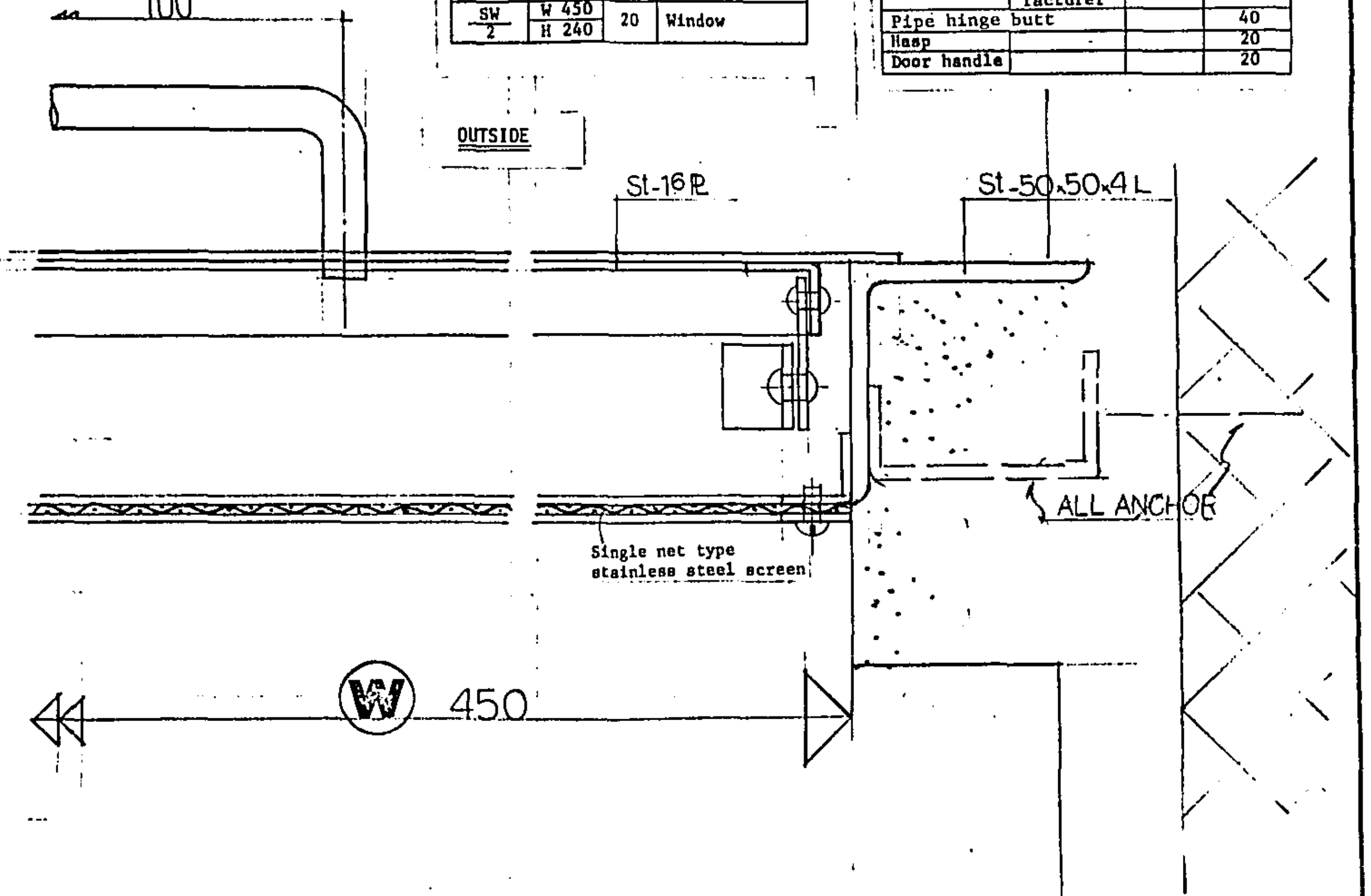
INSIDE

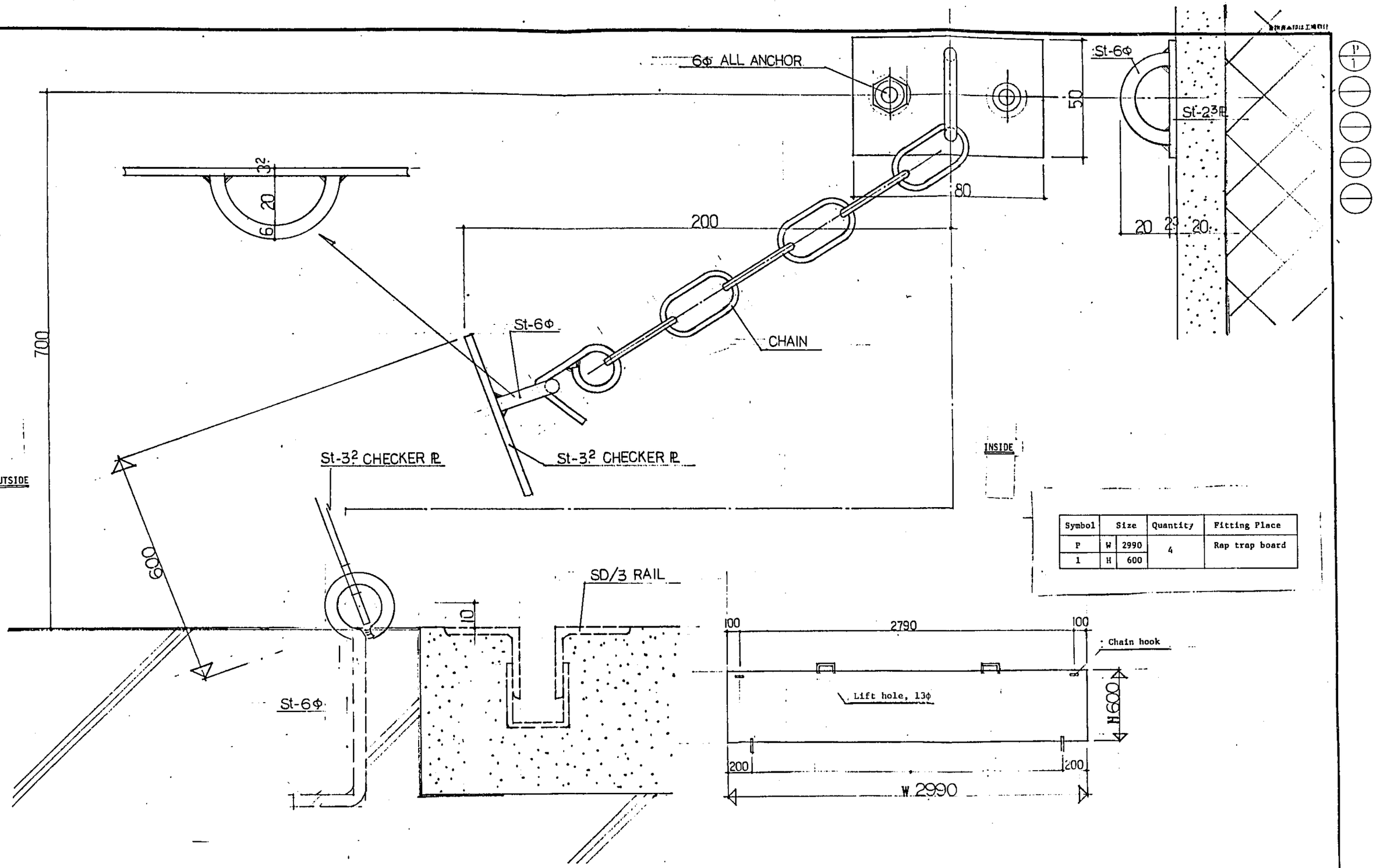


Symbol	Size	Q'ty	Fitting Place
SW/2	W 450 H 240	20	Window

Part Name	Manu-facturer	Type	Q'ty
Pipe hinge butt			40
Hasp			20
Door handle			20







Symbol	Size		Quantity	Fitting Place
P	W	2990	4	Rap trap board
1	H	600		

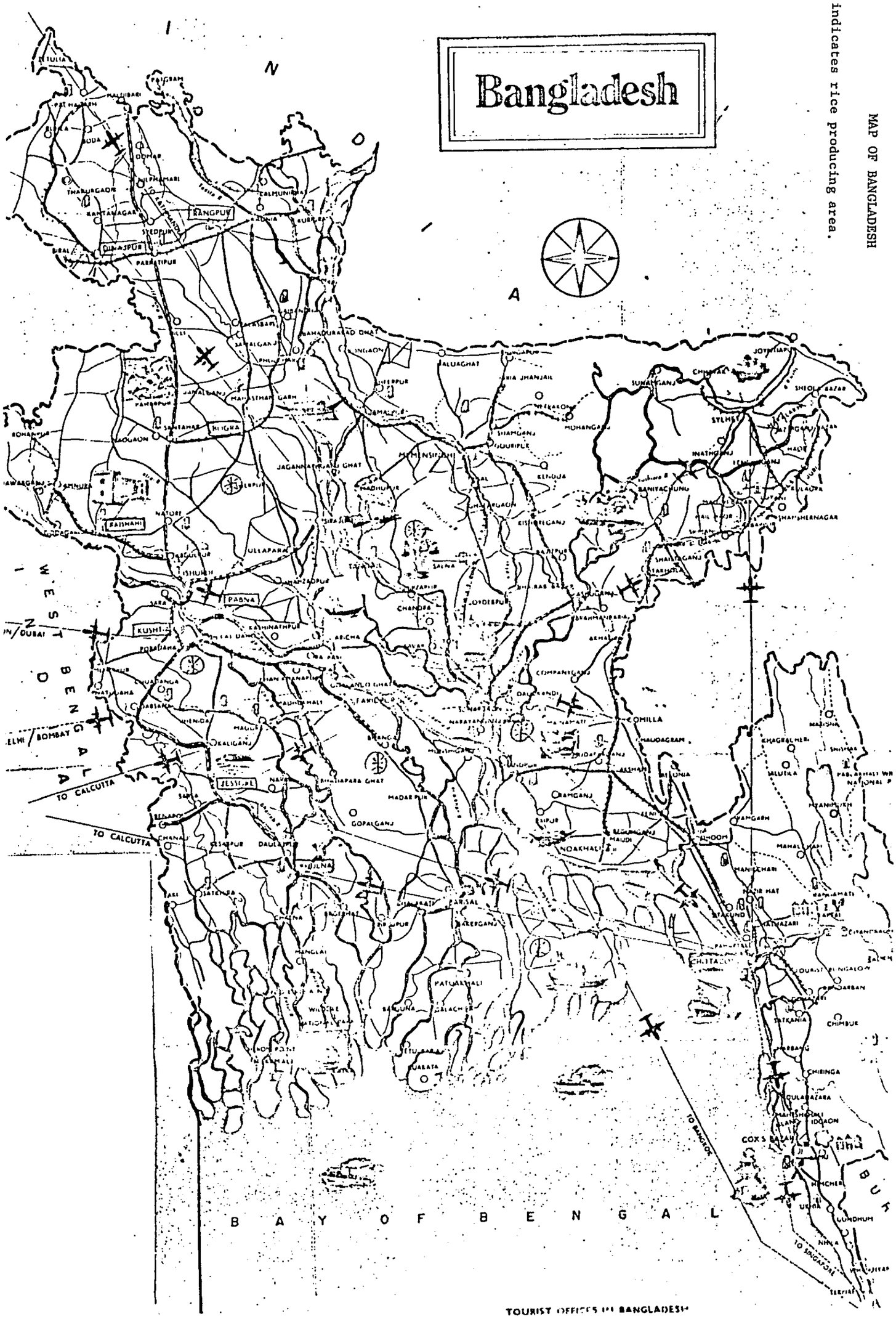
Centre
End
Length & width
Length & width
Length & width
Length & width
Slab
Lime concrete
Insulating material, 10 cm
Insulating Material
Wire glass window with grating
Top light
To be operated from inside
Brick wall
Centre of main reinforcement end (top and base)
Additional bar
Stirrup
Plaster finish
Brick wall
Plaster finish
Outer End
Centre
Inner End
Top
Additional bar
Base
Stirrup
Window (bottom)
Main reinforcement
Hoop
Hoop
Mortar finish
Plaster finish
Elastite (expansion joint)
Mortar finish
10 D @ 200 (both length & width)
2 layers of polyethylene film film (0.1 mm)
Brick wall
Window (bottom) To be operated from outside
Banking (sand)
Mortar finish
Side ditch
Main reinforcement (top and base)
Hoop
Brick wall
2 layers of polyethylene film (0.1 mm)
Main reinforcement (top and base)
Hoop
Saga latch
Stainless steel screen
Detail Drawing of Screen
Mortar finish
Detail Drawing of Air-tight Door (One side of front of small type d door only)
Mortar finish
Terrazo work up to 800 from floor
Platform
Detail Drawing of Door
Plaster finish
Additional beam Common to outer and inner walls
Main reinforcement (top and base)
Additional bar
forcement
Mortar finish
Air-tight door
Mortar finish Screen
Terrazo work
Mortar finish
Notes: Figures in metres except otherwise specified.

Improved Dacca Type Warehouse, 1,000 T Capacity

Detail Drawing 1: 30

MAP OF BANGLADESH

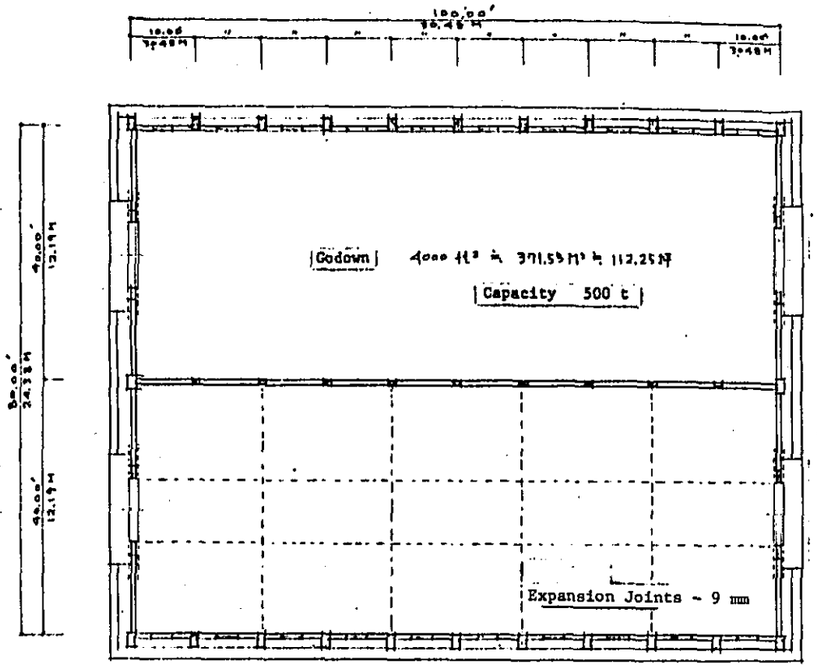
indicates rice producing area.

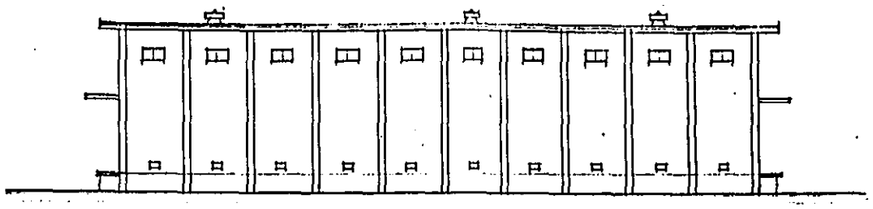


GENERAL SPECIFICATION

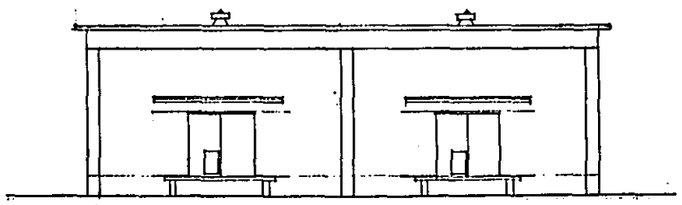
Exterior	Roof	4" (10 cm) concrete roofing with 4" (10 cm) lime concrete placed on it, with 6 ventilators (Oriental Metal) installed in each building.
	Outer Walls	10" (25 cm) brick walls with 1/2" (1.25 cm) mortar finish, having 20 each of window (top and bottom) in ridge direction.
	Doors	4 air-tight outer doors (of which 2 are of small type) and 4 inner screens, each provided with a Saga type latch.
Interior	Ceiling	Concrete floor embodying 4" (10 cm) insulating material.
	Walls	Brick walls with 1/2" (1.25 cm) plaster finish.
	Floor	Concrete floor with mortar finish.

FLOOR PLAN

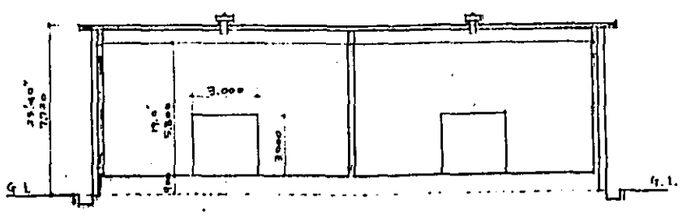




SIDE ELEVATION

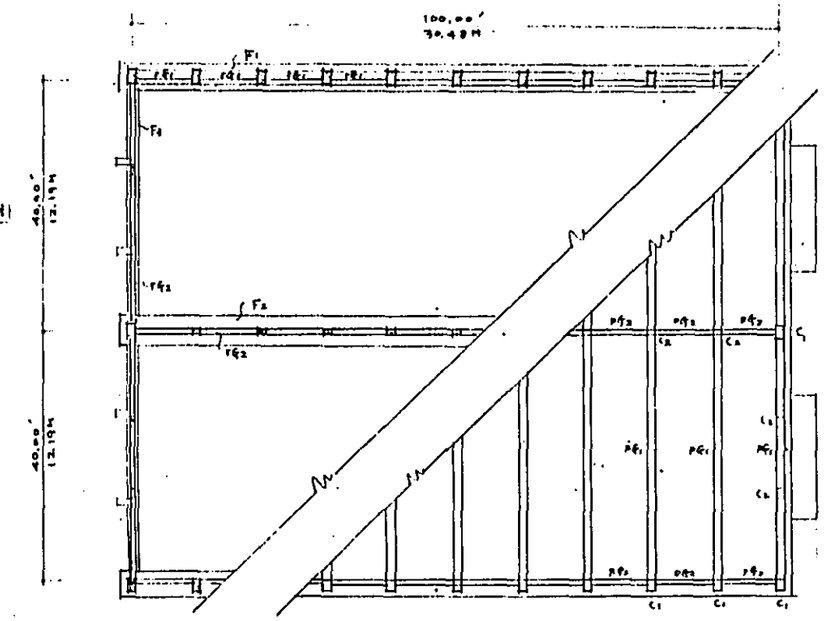


FRONT ELEVATION



SECTIONAL VIEW

FOUNDATION PLAN



BEAM PLAN

Notes: 276 sills, 100 x 75 x 4,700

Improved Dacca Type Warehouse, 100 T Capacity

GENERAL DRAWING 1: 200

Round type Oriental Ventilator with damper (natural circulation type), with an effective port diameter of 350 mm

Material: Oriental Color Super Metal (C.S.P.M.), 0.5 mm

Color Super Metal, 0.5 mm (C.S.P.M.)

Eyebolt, 20A

Electroplating

Wire

Detail Drawing "a"

Wire

Section A-A

Lime concrete

Concrete

Insulating Material

12 screws (6φ) to be driven on the periphery at site

Flathead washer

Detail Drawing "d"

Electroplating

Detail Drawing "b"

Caulking

Cap washer and packing

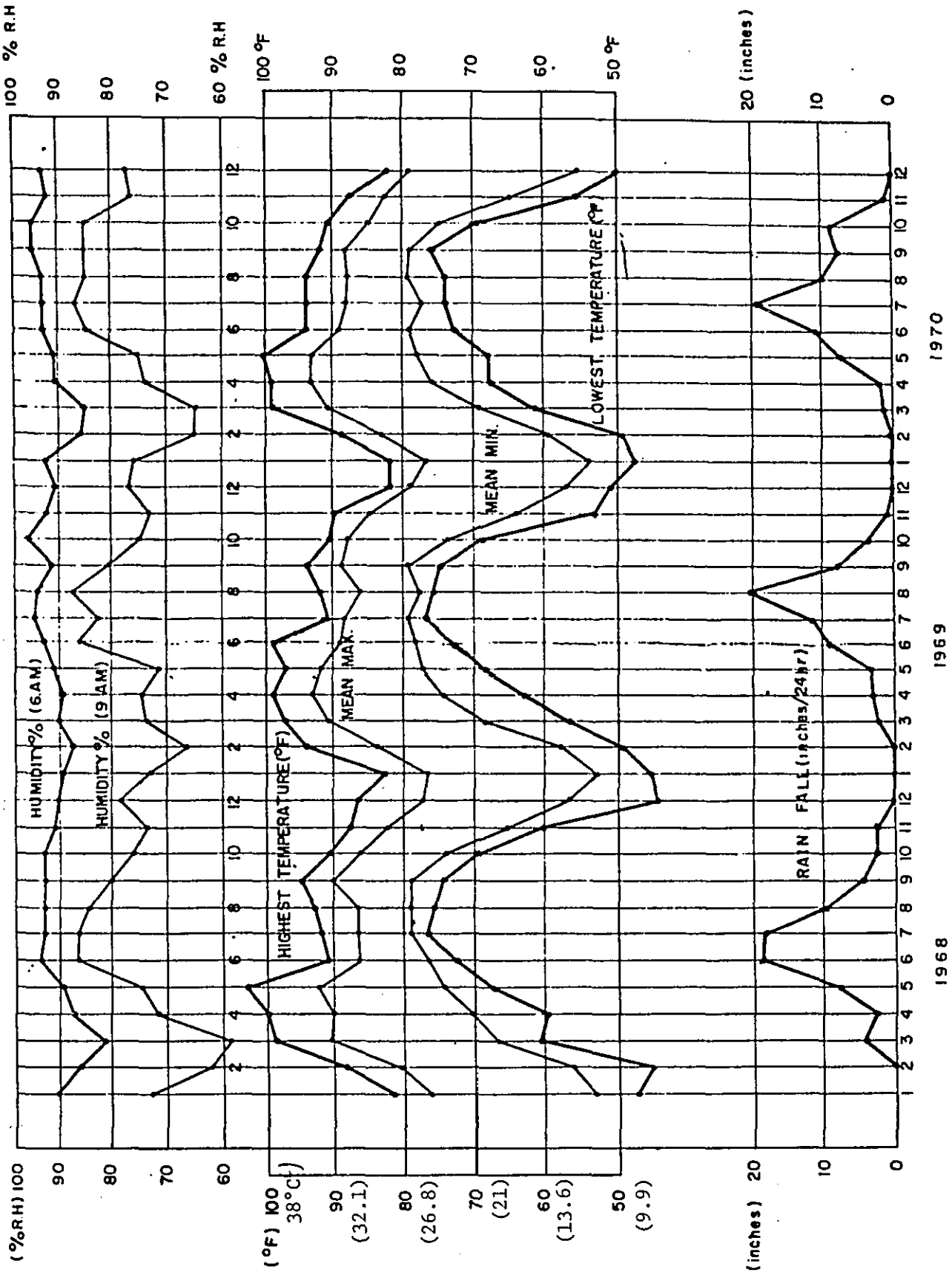
12 screws (6φ) to be driven on the periphery at site

4 anchor bolts to be driven on the periphery

Detail Drawing "c"

Detail Drawing - Ventilator

Reference Data (1) Monthly Temperature, Humidity and Rainfall (Dacca)



Reference Data (2) DIRECTORATE OF FOOD

1. System of Food Storage Management

(a) Institution and Organisation

Foodgrains imported from external sources and procured domestically are stored in bags in the Government godowns and in Silos in bulks. The Silos are administered by the Directorate of Silos, the biggest baggedgrain storage Centres are called Central Storage Depots (CSDs) which are under the administrative Control of the Directorate of Movement & Storage and the smaller baggedgrain Storage Centres are called Local Storage Depots (LSDs) and they are unter the administrative Control of the Directorate of Supply, Distribution & Rationing.

Total location and storage capacity of the Silos, Central Storage Depots and Local Storage Depots are shown in Appendix 'A'.

(b) Different stages of procurement & Distribution

Bangladesh is deficit in food and this deficit has to be met by import from external sources. Although internal procurement does not meet food deficit of the country, we undertake such procurement for a number of reasons, some of which, are enumerated below :-

(a) Internal Procurement is undertaken to serve as a price support measure to the Farmers.

(b) It helps equitable distribution in the different areas of the country.

(c) It also helps is stabilizing market prices

(d) It serves as an anti-smuggling measure specially in the 5 mile border belt.

The extent of requirement of foodgrains to be imported from abroad for a particular year is determined taking into account the estimated production within the country, the consumption requirement and extent of deficit.

Foodgrains are procured from external procurement either by purchase from our own efforts or with aid from donor countries. Internal Procurement is undertaken either on Voluntary basis or on compulsory basis. Before harvesting of food crop Govt. Takes decision as to the modality of Internal Procurement of the particular crop. In that decision amongst others, Govt. also decides as to the prices at which rice/paddy will be procured from within the country.

As for External Procurement from our own resources, purchases are made by inviting quotations from registered International Grain Suppliers. Supplies coming under aid are received at our ports from the respective donor countries and moved out to the different storage centres - Silos, Central Storage Depots, Local Storage Depots by the Directorate of Movement & Storage against programmes drawn in advance in consultation with the Directorate of Supply, Distribution & Rationing.

2. Estimated demand and supply of foodgrains in future (from 5 ~ 10 years) :

It is difficult to assess the actual extant of demand and supply for the next five to ten years as demand and supply depend on a number of factors, such as harvesting position of food crops in the country, price trend and availability of foodgrains within the Govt. for distribution. However, the estimated requirement of foodgrains may be taken at 2 million tons per year. Local production, consumption requirement, Import and actual quantity distributed from Govt. sources during the last three years are indicated as under :-

Production :	73 ~ 74	Gross	1,12,10,000	tons.
		Net	10089000	"
	74 ~ 75	Gross	1,14,83,000	"
		Net	1,03,35,000	"
	75 ~ 76	Gross	1,27,65,000	"
		Net	1,14,08,000	"
Consumption requirement :	73 ~ 74		1,22,28,000	"
	74 ~ 75		1,24,00,000	"
	75 ~ 76		1,27,34,000	"

Import :		Rice	Wheat	Total	Ton
	73 ~ 74	86,233	15,66,591	16,52,824	"
	74 ~ 75	2,50,166	20,35,365	22,85,531	"
	75 ~ 76	3,97,475	10,45,332	14,42,807	"
Distribution :	73 ~ 74	1,23,299	16,4 ,323	17,27,622	"
	74 ~ 75	1,79,878	15,77,191	17,97,069	"
	75 ~ 76	5,09,218	11,57,216	16,66,434	"

3. Districtwise demand and supply of foodgrains for last 3 years :-

It is not possible to give the detailed report for the present. Demand and supply of six Rationed Towns for the last three years is shown below :-

73 ~ 74	1,07,087	3,87,157	4,94,244	tons
74 ~ 75	1,19,949	3,51,089	4,71,038	"
75 ~ 76	2,12,673	1,35,489	3,48,162	"

4. Total quantity of foodgrains handled by Govt. during last three years and estimated quantity for future :-

1973	24,61,750	tons	
1974	20,29,939	"	
1975	26,09,752	"	
1976	27,00,000	"	(Expected)

5. Any scheme for Emergency stock :-

There is a scheme for building up a reserve of 9 lac tons foodgrains by the end of June '77 & one million tons by end of June '78 to meet any emergency.

6. Present condition of foodgrains storages in Bangladesh :-

a) The flat storage godowns numbering over 900 were constructed 17/18 years age. Inspite of routine maintenance major repair works calling for rehabilitation of both the storages and the ancillaries have become over due. Rehabilitation of 800 godowns was to be undertaken prior to the War of Liberation. Due to various factors including resource constraints very little progress could be made in this direction. During the Liberation War in 1971 some more godowns were damaged or destoryed. After the Liberation War some 180 godowns (capacity 90,000 tons) have been fully/partly rehabilited. Govt. have taken in hand a revised scheme for rehabilitation of 712 godowns at an estimated cost of Tk. 160 million in 216 L.S.Ds and 12 C.S.Ds. including Halishahar C.S.D. and Maheshawr Pasha C.S.D. which were originally omitted from the scheme as being the responsibility of the then Central Govt. of Pakistan. Due to resource constraints only 19 million Taka could be spent on the project. During the current year budg'et provision for Taka 20 million only has been allocated against this scheme.

Present capacity of each storage district-wise may be seen in the enclosed list.

b) Organisation and management system of storage in Bangladesh has been described at point one above.

i) No. of employees (Officers and others)

Silo	- No. of Officers -	32
	No. of Staff -	316
CSDs	- No. of Officers -	513
	No. of Staff -	944
LSDs	- No. of Officers -	373
	No. of Staff -	2038

ii) System of Inspection :-

There is a separate Directorate namely Directorate of Inspection, Control and Training which has Officers and staff in each district, who periodically inspect the godowns, examine quality of stocks in storage, give necessary recommendation for disposal, take pest control measures and see to the hygienic maintainance of stocks in godowns. Godowns/Silos are also inspected by the senior supervising officers of the respective Directorate.

c) Districtwise monthly movement :-

Same as at 3 above.

Reference Data (3) - Production, Government Purchase and Rations of Rice in 1965/76

(Unit : Thousand ton)

Area		Domestic Rice Production				Government Purchase of Domestic Rice				Rations		
		Aus	Aman	Baro	Total	Aus	Aman	Baro	Total	Rice	Wheat	Total
Dacca District	Dacca	152.1	357.9	216.2	726.1	-	4.3	0.2	4.5	159.7	281.8	441.5
	Mymensingh	466.4	910.8	458.9	1,836.1	0.0	44.6	7.9	52.5	34.6	78.1	112.7
	Tangail	93.6	161.2	78.8	333.6	-	2.5	0.0	2.6	4.7	28.9	33.6
	Faridpur	171.9	244.1	60.7	476.8	0.0	3.3	0.0	3.3	10.6	58.5	69.1
	Total :	884.0	1,674.1	814.6	3,372.7	0.0	54.7	8.0	62.9	209.6	447.3	656.9
Chittagong District	Chittagong	137.9	383.4	188.0	709.2	0.1	8.0	0.2	8.3	57.3	145.8	203.1
	Chittagong Hill Tracts	43.7	39.8	15.0	98.5	-	0.9	0.0	0.9	2.6	9.2	11.8
	Noakhali	166.3	320.8	170.0	657.1	-	11.3	0.3	11.6	12.9	49.8	62.7
	Comilla	193.0	481.9	218.9	893.9	0.0	8.8	1.3	10.1	19.4	88.6	108.0
	Sylhet	251.6	544.5	417.9	1,214.0	9.0	16.3	8.0	33.4	25.5	40.6	66.1
	Total :	792.6	1,770.3	1,009.8	3,572.6	9.1	45.4	9.8	64.3	117.7	334.1	451.8
Rajshahj District	Rajshahj	163.5	454.8	10.06	720.0	3.1	37.7	3.1	43.8	27.1	55.0	82.1
	Dinajpur	178.3	420.7	10.2	609.2	14.0	63.9	-	77.9	20.6	16.2	36.8
	Rangpur	327.6	702.8	41.0	1,071.3	2.1	38.8	1.1	42.0	24.8	65.0	89.8
	Bogra	97.2	292.4	38.8	428.3	4.6	18.2	-	22.8	10.9	18.1	29.0
	Pabna	105.4	216.4	57.3	379.1	0.9	6.9	0.0	7.8	14.3	44.6	58.9
	Total :	871.9	2,087.1	248.8	3,207.9	24.6	165.6	4.2	194.3	97.7	198.8	296.5
Khulna District	Khulna	45.6	481.8	28.7	556.0	0.4	21.3	-	21.8	46.4	66.7	113.1
	Barisal	167.7	380.0	115.2	662.8	0.1	15.5	0.1	15.8	14.8	47.2	62.0
	Patuakhali	36.5	299.1	43.4	379.1	0.3	26.0	-	26.3	4.5	14.3	18.8
	Jessore	275.9	291.5	21.2	588.5	5.9	8.4	0.5	14.8	15.3	39.0	54.3
	Kushtia	126.0	62.1	3.9	192.1	2.6	5.6	-	8.2	11.3	30.6	41.9
	Total :	651.7	1,514.4	212.3	2,378.4	9.4	76.8	0.6	86.8	92.3	197.8	290.1
Grand Total :		3,200.0	7,045.9	2,285.6	12,531.6	43.1	342.5	22.7	408.3	517.4	1,178.0	1,695.4
Ratio		25.5%	56.2%	68.2%	100.0%	10.5%	83.9%	5.6%	100.0%	30.5%	69.5%	100.0%

Note : 1. Production - from the data of the Ministry of Agriculture.

2. Government purchase and rations - from the data of the Ministry of Food.

Reference Data (4) - *Foodgrains Storage Capacity by Area*

As of December 1976

Unit : Thousand ton

Area		C.S.D			L.S.D			Total Storage Capacity	Silo	
		No. of Locations	No. of Units	Storage Capacity	No. of Locations	No. of Units	Storage Capacity		No. of Locations	Storage Capacity
Dacca District	Dacca	3	108	66.0	21	71	33.9	99.9	1	50.1
	Mymensingh	1	34	19.0	25	72	38.0	57.0		
	Tangail				6	23	10.3	10.3		
	Faridpur				22	51	32.1	32.1		
	Total :	4	142	85.0	74	217	114.2	199.2	1	50.1
Chittagong District	Chittagong	1	56	61.5	15	40	20.0	81.5	1	100.0
	Chittagong Hill Tracts	1	39	34.0	12	13	6.1	40.1		
	Noakhali				17	46	22.8	22.8		
	Comilla				19	69	33.7	33.7	1	50.1
	Sylhet	1	11	12.2	22	54	21.1	33.3		
	Total :	3	106	107.7	85	222	103.7	211.4	2	150.1
Rajshahj District	Rajshahj				21	70	27.9	27.9		
	Dinajpur				20	65	33.2	33.2		
	Rangpur				21	136	38.8	38.8		
	Bogra	1	32	20.0	12	32	19.8	39.8	1	25.0
	Pabna	1	32	30.5	7	40	17.9	48.4		
	Total :	2	64	50.5	81	343	1,375	188.0	1	25.0
Khulna District	Khulna	2	129	110.1	17	41	21.3	131.4		
	Barisal	1	19	18.0	22	70	25.6	43.6		
	Patuakhali				17	41	15.5	15.5		
	Jessore				17	65	20.9	20.9		
	Kushtia				9	30	13.1	13.1		
	Total :	3	148	128.1	82	247	96.4	224.5		
Grand Total :		12	460	371.2	322	1,29	451.8	823.1	4	225.3

Note : 1. From the Ministry of Food.

2. Discrepancy between calculated total storage capacity and indicated total/grand total is due to counting of fractions of more than 0.05 of each capacity as 0.1 and disregarding the rest.

Reference Data (5) - Area-wise Construction Plan of CSD and LSD

(Unit : Thousand ton)

	Area	Present Storage Capacity			Construction by Bangladesh Government							Construction with Danish Aid			Total Storage Capacity		
					C.S.D			L.S.D				C.S.D					
		C.S.D	L.S.D	Total	No. of Locations	No. of Units	Storage Capacity	No. of Locations	No. of Units	Storage Capacity	Total Storage Capacity	No. of Locations	No. of Units	Storage Capacity	C.S.D	L.S.D	Total
Dacca District	Dacca	66.0	33.9	99.9	1	5	2.5	3	3	1.5	4.0	(76) 3	5	2.5	68.5	37.9	106.4
	Mymensingh	19.0	38.0	57.0	1	12	6.0	9	12	6.9	12.9	(76) 10 (77) 4	18 7	9.0 3.5	25.0	57.4	82.4
	Tangail		10.3	10.3				4	7	3.8	3.8				-	14.1	14.1
	Faridpur		32.1	32.1				4	6	3.0	3.0				-	35.1	35.1
	Total :	85.0	114.2	199.2	2	17	8.5	20	28	15.2	23.7	17	30	15.0	93.5	144.4	238.0
Chittagong District	Chittagong	61.5	20.0	81.5	1	3	1.5	1	2	2.0	3.5	(76) 2 (77) 2	3 3	1.5 1.5	63.0	25.0	88.0
	Chittagong Hill Tracts	34.0	6.1	40.1	1	3	1.5	4	4	2.0	3.5				35.5	8.1	43.6
	Noakhali		22.8	22.8				4	6	3.3	3.3				-	26.1	26.1
	Comilla		33.7	33.7				2	3	1.5	1.5	(76) 2	5	2.5	-	37.7	37.7
	Sylhet	12.2	21.1	33.3				11	13	6.0	6.0	(76) 4 (77) 3	4 5	2.0 2.5	12.2	31.6	43.8
	Total :	107.7	103.7	211.4	2	6	3.0	22	28	14.8	17.8	13	20	10.0	110.7	128.5	239.2
Rajshahj District	Rajshahj		27.9	27.9				17	41	21.3	21.3					49.2	49.2
	Dinajpur		33.2	33.2				13	47	22.1	22.1					55.3	55.3
	Rangpur		38.8	38.8				10	15	8.0	8.0					46.8	46.8
	Bogra	20.0	19.8	39.8				9	19	9.3	9.3				20.0	29.1	49.1
	Pabna	30.5	17.9	48.4	1	9	4.5	4	9	4.5	9.0				35.0	22.4	57.4
	Total :	50.5	137.5	188.0	1	9	4.5	53	131	65.1	69.6				55.0	202.6	257.6
Khulna District	Khulna	110.1	21.3	131.4	2	12	6.0	8	10	5.0	11.0				116.1	26.3	142.4
	Barisal	18.0	25.6	43.6	1	12	6.0	10	16	9.0	15.0				24.0	34.6	58.6
	Patuakhali		15.5	15.5				7	14	7.0	7.0					22.5	22.5
	Jessore		20.9	20.9				10	12	6.3	6.3					27.2	27.2
	Kushtia		13.1	13.1				6	12	5.9	5.9					19.0	19.0
	Total :	128.1	96.4	224.5	3	24	12.0	41	64	33.1	45.1				140.1	129.5	269.6
	Grand Total :	371.2	451.8	823.1	8	56	28.0	136	251	128.1	156.1	21 9 30	35 15 50	17.5 7.5 25.0	399.2	604.9	1,004.1

Notes : 1. From the Ministry of Food.

2. Figures in parentheses in the column of Danish aid indicate the years of construction.

SPECIFICATION FOR CONSTRUCTION OF GODOWNS (DACCA TYPE)

The godowns will be of brick structure having 20 inch by 20 inch pillar at 10 feet, 5 inches on centers, 10 inch brick wall of cement mortar, and reinforced concrete floor. There will be provision for ventilation both at the top and bottom of the walls for effective ventilation.

1. Size : 40' x 100' (clear inside dimensions)
2. Capacity : 500 tons
3. Plinth : Three feet above ground level with overlapping edges as a rat control measure.
4. Height from plinth to roof : 10' to under side of roof and 16' up to under side of beams.
5. Floor : Reinforced concrete with a layer of bitumen to act as a moisture barrier.
6. Doors and Ventilators : Doors will be sliding type in angle iron frames and precaution will be taken to prevent rain water from getting inside the buildings.

APPENDIX C

ANCILIARY BUILDINGS FOR LOCAL STORAGE DEPORTS (LSDs)

Ancillary Buildings :

The ancillary buildings include quarters for the O/C LSD, quarters for the tally clerks and darwans for the duty or Procurement, Distribution and Rationing. The ancillary buildings are part and parcel of the scheme for construction of foodgrains storage godowns in Bangladesh. Construction of godowns will be useless without ancillary buildings, because without the presence of the godown staff within the close civinity of the godowns, the functioning of the godowns will be found to suffer in time of emergency.

Quarter of : O/C L.S.D. :

There should be 3 rooms with store, kitchen, bath and verandas (inner and outer). The total area of the floor should be 870 sq. feet.

Specification :

(1) Earthwork in execavation of foundation trenches

(2) Rammed earth filling side of treenches plinth

(3) 3" brick soling in foundation

(4) 4" R.C. Forting

(5) Brick work in foundation, damp proof course

(6) Brick work in super structure

(7) Cement Plaster in super structure

(8) White washing in 3 coats

(9) Cement Plaster in plinth

(10) 10" x 10" R.C. Column

T/C quarters, Specification :

(1) Earthwork in excavation of foundation trenches

(2) Brick flat soling in foundation

(3) Cement concrete in foundation with Jhana Chips, including laying, remming, breaking chips, etc.

(4) Sand filling in plinth and sides of foundation trenches with best local sand, including watering, ramming etc.

(5) 4" thick R.C.C. roof slab with picked jbama clips

(6) 4" Lime terrain with lime, Surki and brick Khoa proportion over R.C.C. roof slab, etc.

(7) 1/2 cement plaster inside and outside of wall up to 6"

(8) White washing inside including plinth for all walls.

Darwan Sheds, Specification of Twin Darwan quarters :

(1) Earthwork in excavation in foundation

(2) Single layer brick flat soling in foundation

(3) Sand filling in floor with best local sand

(4) 5" thick brick work in cement mortar

(5) Lime terracing over roof

(6) 1/2" to 3/4" cement plaster on walls

BUILDING MATERIALS REQUIRED FOR GODOWNS

(1) Cement
(2) Bricks
(3) M.S. Road
(4) Sand

Quantity required for each godown of 500 tons capacity each :-

Cement -	75 tons	75 tons
M.S. Road -	15 "	15 "
Coal (for manufacture of bricks)		70 "

Present food stock as on 8-12.76

Rice	2,60,000	tons (in terms of rice)
Wheat	1,89,000	"
Total :	4,49,000	tons
Say:	4,50,000	"

Present available storage :-

Flat Ware house	80,0000	tons
Silos	2,25,000	"
	10,25,000	tons
Unserviceable	(-) 200000	"
Useal	8,25,000	tons
New	1,56,000	"
Total =	9,81,000	tons