different stages, making first-in first-out delivery possible. To introduce this system, use of a forklift is a precondition, however, the system does not use power, thus maintenance and control is easy and also it is possible to store products for each line in a highly organized way. The above contents were explained to the Mongolian side and as a result, it was decided to plan the basic design with the intention of introducing this system. In addition, since the amount of accommodation differs depending on the season, the refrigerated storage area will be subdivided into two parts and in the off season operations will stop in the vacant room so that operating costs can be reduced.

a. Moving to refrigerated storage

When products are moved to refrigerated storage, boxed cut-meat regularly spaced to increase the freezing efficiency and piled up on a cart is reloaded on to a pallet at high density to increase accommodation efficiency. Since this work needs to take place before products are placed in refrigerated storage, an anteroom cooled to a temperature of around ±0°C will be provided between the freezing and preservation processes. If attention is paid only to ensuring that the flow of goods are not hindered in this space, it is also possible to use this space as the passage when storing in and taking out products to/from the rapid freeze room and refrigerated storage. The contents of this idea will be studied in addition to the construction plan.

b. Delivery

Products will be taken out of refrigerated storage by forklift and then delivered from the delivery room. The room temperature of this delivery passage will be ±0°C and it will be connected to the existing delivery passage. Its location and shape were studied in the construction plan by analyzing the results of a survey of the current conditions of each of the above mentioned function and the existing facilities.

⑤ Linking between each function

Among the above functions, regarding the functions which are included in the range of functions performed from carcass chilling to loading on pallets before placing the product in refrigerated storage, the existing meat processing facility and parts devoted to related functions, a total area of 1,350m^2, shall be removed by the Mongolian side, then those areas will be renovated and the appropriate equipment will be installed. The storage,

delivery function and machine room will be expanded by providing links to this renovated part.

It is necessary to secure the route in the existing facilities that takes the product from the slaughter and dismembering facility to the cut-meat processing room through the existing refrigeration facility. This route can be secured by converting the existing multi-purpose storage to chilled storage for cut-meat thereby obviating the need for the installation of a hanger rail. Also, the special route, from the cut-meat processing room and the rapid freeze room, to be provided by repairing the existing rapid freeze facility, and the connection part, from refrigerated storage to the delivery room which provides access to the railroad, will be secured by removing and repairing existing meat processing related facilities.

6) Study of the necessity for technical cooperation

As explained before, ammonia used as the refrigerant for the existing refrigeration facilities is in Japan designated under the High Pressure Gas Control Law as a combustible toxic gas, thus the renovation construction for the facilities is very dangerous because it requires mainly cutting and welding work that is accomplished with the use of open fire sources. This condition is the same for maintenance control after the Project is completed, thus great care needs to be taken in maintenance construction and a system to secure the safety of the project environment must be put into place.

It is therefore necessary to secure the technological level and construction management ability of the Darkhan Meat Plant throughout the Project. It is possible within the scope of Japan's Grant Aid Program to accomplish technological transfers. As a way of secure safety in maintenance control and maintenance construction after the completion of renovation construction, if Mongolia's facility engineers make use of Japan's system to accept technical trainees and receive adequate technical training, it must be effective.

7) Basic policy of the cooperation implementation

The Project has been judged reasonable to implement under Japan's Grant Aid Program because its effect, urgency, necessity and the implementation ability of Mongolian side have been confirmed by the above study and the effects of the Project match to that defined in the Grant Aid Program. Therefore, on condition that Japan's Grant Aid Program is used, the contents of the plan is studied in the following pages and the basic design will be implemented. The reasons for certain partial changes in some requested items were stated in the study of the

contents of the comprising elements and the facilities and equipment requested for the Project.

3-3 Outline of Project

3-3-1 Implementation organization and system of operation

(1) Implementation organization

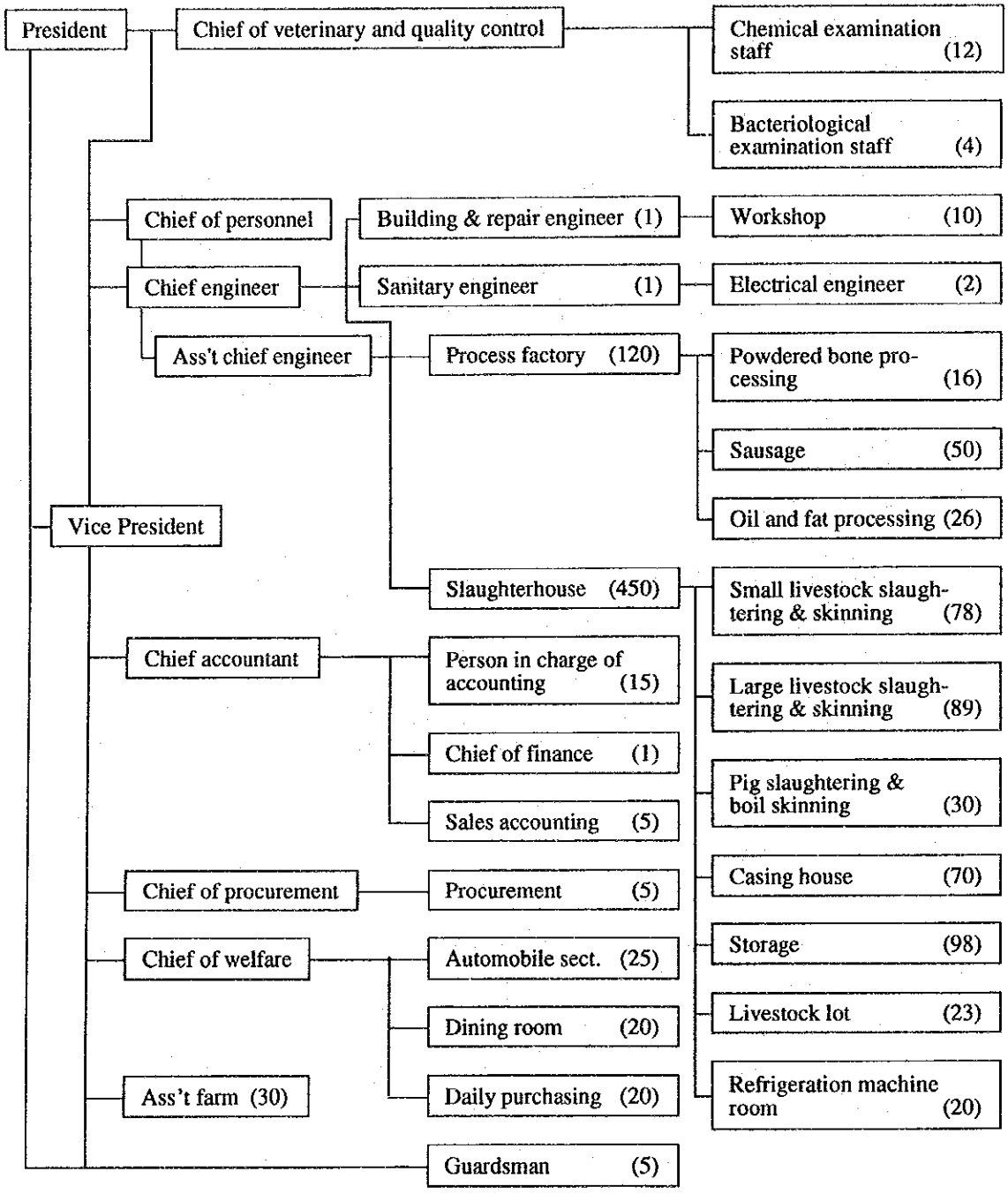
The project implementation organization is the Darkhan Meat Plant under control of the Ministry of Food and Agriculture. The total number employed at the Darkhan Meat Plant is 730, which can be broken down into the following classifications : 45 engineers, 69 clerical workers, 121 clerical work assistance and 495 workers. 76 employees are classified as special and 419 as seasonal workers.

A clear understanding of the maintenance and control system is important for the smooth operation of the Project. In particular, improvement in maintenance technology related to refrigeration equipment and pipe laying work minimizes deterioration due to obsolescence of the facility and equipment and is quite effective in maintaining their performance. Therefore, making use of technical transfers with the implementation of the Grant Aid Program or a system to accept technical trainees, it is important to improve technologies as well as to secure systems such as for the arrangement of personnel, including the counterpart side, and the procurement of spare parts.

(2) Personnel plan

Personnel who will need to be assigned for this Project consist of about 25 workers for cut-meat processing, 5 workers for boxing operations, 5 workers for initial placement in storage and subsequent retrieval and reloading work, for a total of about 40 people. Among them, 50 workers who are currently in charge of sausage in the existing meat processing section will be assigned to cut-meat processing. The reasoning behind this is that cut-meat processing for storage of cattle is limited to the period when cattle are slaughtered and dismembered so workers can be assigned to meat processing during other periods. Also, since the implementation of the construction plan of the meat processing section to be transferred has not yet been finalized, it is possible to assign workers to the Project prior to others for the time being. Regarding freight movement work, since there is no change in the amount of animals slaughtered in a day, if the 98 existing refrigeration freight workers master how to operate freight machines including forklifts, it will be possible for them to perform both jobs. Therefore, it is not necessary to increase the number of staff for the Project.

[System diagram of Darkhan Meat Plant]



Numbers in ( ) indicate the number of personnel.

However, as explained above, it is important before implementation to enrich the maintenance control system for the Project through technology transfer, and it is necessary to specifically structure the system including personnel arrangement, such as ensuring that there are "counterparts" in place who understand the overall plant operation and technological details, and that there are 2 of each of the

following: personnel in charge of the maintenance control construction, that is, refrigerant pipes and heat insulation coating, and personnel in charge of the operation of the refrigeration machines to be expanded and their maintenance control (so that each can work in both the existing and new machine rooms).

3-3-2 Business plan

Renovation of pipes, unit coolers and defrosters in the existing refrigeration systems will contribute to reduced ammonia leakage, restored cooling ability, an improved working environment and will ease deleterious effects on stored meat.

The production of cut-meat, which is currently only for the production of processed meat products, is changed to production focused on improved storage and distribution efficiency. Cut-meat production shall be 20 tons per day operating 130 days a year during the slaughter and dismembering period and producing 2,600 tons of cut-meat from 3,600 tons of cattle carcass, which is about 2/3 of the total processing volume. As a result, about 1,000 tons of the 1,600 tons of storage lacking in the existing storage facilities, and the remaining 600 tons, can be covered by expanding cut-meat storage, thus the required 5,000 tons of storage can be secured. During periods other than the slaughter and dismembering period, cut-meat processing for pigs, for which the slaughter and dismembering period is different from other livestock, shall take place, and cut-meat processing of thawed cattle or horse carcasses for sausage production can take place on the condition that the meat processing section is transferred and refined. However, in Japan, cattle and pigs are not processed in the same facility for sanitary control reasons.

The operation cost required for the above contents will be covered by sales of cut-meat and the setting of realistic sales prices is possible according to calculations based on maintenance control expenses explained later. Thus, large gains can be expected in the operation of the Darkhan Meat Plant.

However, though the Project can be expected to provide direct effects on the operation of the plant, there are many problems left in regard to improvement of the overall operation of the plant. Accompanying the transition to a market economy system, it is thought that future consumption demand will be more diversified and the classification, standardization and sanitary control of meat will be increasingly expected. On the other hand, the plant's facilities and equipment are extremely old, thus a large amount of investment is necessary for improvement and innovation of the facilities and equipment in order to respond to the above requests. When looking at the details of past business performance, while the net working rate of the plant dropped sharply in 1992, the business profit rate increased a large amount. The intent of the 1993 business plan is to

suppress the net working rate and secure the profit rate. This management trend can be highly rated in terms of the necessity for investment in facilities and equipment. However, in order to adapt to the progress of the market economy system in the future and promote a stable supply of meat to urban areas, it is necessary to improve and refine the meat distribution structure including national scale meat livestock production. Therefore, the continued efforts of concerned organizations, including the Ministry of Food and Agriculture, international support organizations and supporting countries, and reinforcement of the management structure and support for meat processing plants are essential.

3-3-3 Location and conditions of the site

Darkhan City is made up of 3 distinct areas, old and new areas and a new industrial area. Located at the south of the city, the new industrial area, which is under development, has facilities including the Darkhan power station, a cement plant, leather processing plant and agricultural machine repair plant and others. Also, a small scale ironworks in which waste iron is refined and processed to reinforcing rod, which is being constructed with the cooperation of a private Japanese company. The central area is the new area where many cultural facilities including sports facilities and museums, and also apartment complexes, are situated. Gradually, new apartment complexes are constructed and a modern city structure strongly influenced by the former Soviet Union is being formed. The old area, where the Project site is found, is located at the north end of the city and has key facilities such as City Hall, a post/telegram/telephone office and flour mill complex and construction materials plant, and houses are arranged in such a way that they surround those facilities. The meat processing plant is located in the north of the old area. The site is adjacent to the railway and a paved road connecting from Ulan-Bator, the capital of the country, and Irkutsk in the Russian Federation of States. Since the site has a railroad spur, this condition is appropriate for acceptance of procured equipment and materials and delivery of products after the Project is implemented.

The Darkhan Meat Plant site is approximately 94,000m^2, consisting of an approximately 4,000m^2, four story administration building, meat processing facilities (14,500m^2), a livestock lot (9,800m^2), 2,300m^2 of attached buildings accommodating the equipment repair facility and general employee welfare facilities, and a 450m^2 sewage treatment plant. Inside the site, infrastructure such as 6kv high-voltage power supply, waterworks, district heating and hot water and telephone have already been prepared, and the vehicle passage area has been paved with concrete. Therefore, regarding the water supply and hot water supply necessary for the Project, the most economical and effective way will be used, that is, divergence or extension of existing

facilities. However, regarding electricity, it is necessary to bring in a new high-tension power line independently.

Also, the refrigeration facilities must be expanded to a location which does not disturb the functions of the existing facilities and through which the refrigeration function can be fully used. The meat plant is located between the administration building and livestock lot, and is a rectangular shape extending east to west. It has a platform connected to the railroad spur at the south side and a platform for trucks at the north side facing the courtyard. Major functional classifications are the slaughter and dismembering facility at the east side, freeze and processing facilities in the center and refrigerated storage facilities on the west side. Between sections are north-south running delivery passages. For this reason, expansion of the facility to the south side of the freeze facility is not effective because it is possible that the railroad spur function may be impaired. Therefore, the meat freeze facility at the north side of the facility which is the subject of the transfer plan will be remodeled to encompass the cut-meat processing function and, functionally linked to this, refrigerated storage will be expanded at the north side of the processing facility. (Refer to the attachment for a schematic of the existing plant.)

3-3-4 Outline of facilities and equipment

As a result of the study, the following facilities and equipment have determined appropriate for the conditions of Japan's implementation of the Grant Aid Program.

We obtained a list of requested renovation materials during the field survey but accessories including pipes, machines and tools, inspection instruments, safety measure tools (ventilation fan, winch, gas mask, etc.) for construction are not included. Therefore, as a result of discussions, the construction range has been decided as follows it will be necessary for the Japan side to prepare equipment and tools (inspection instruments) within this range. Since the aforementioned tools and equipment are necessary for maintenance control after the implementation of the Project, they were studied as the subject of the Grant.

(1) Range of renovation construction plan (refer to the list of existing equipment)

① Removal and renovation of all cooling pipe from the outside of the machine room to each unit cooler (cooling water and drain piping is excluded),

② Removal and renovation of all unit coolers in the cooling rooms and refrigerated storage (including changes in the number of unit coolers depending on the defrost system used),

③ Installation of the new defrost system according to the drain system (including the control panels and related electrical wiring which have been installed discursively/in various locations),

④ Renovation of the evaporator condensers, and

⑤ Renovation of the refrigerant circulation pumps.

The following maintenance tools have been found in the existing facilities but none of them seem useful for the construction at this time. Therefore, these tools need to be prepared.

[Maintenance tools found at existing facilities]

- One electric welder (made in the former Soviet Union)
- Pipe saw : Up to about 150mm (made in the former Soviet Union)
- Metal polishing machine (made in the former Soviet Union, not used because the grindstone is missing)
- Grooving lathe for gears (made in the former Soviet Union)
- Electric drill (made in Hungary)
- Lathe (made in the former Soviet Union, has never been used since it was introduced because of a lack of parts)
- Lathe (made in Hungary)

Major materials and equipment required for renovation construction are the pressure steel pipes for the refrigerant, heat insulation materials, joints between pipes having different diameters, various types of valves, unit coolers, secondary side control equipment and wiring. Also, tools and inspection instruments required for maintenance control after removal and renovation construction and the implementation of the Project are as follows : welders, cutters, grinders, diestock, pipe saws, drills, chain blocks, air compressors, vacuum pumps, vacuum pressure gauges, ammonia detectors and pressure proof hose.

(2) Structure of facilities with respect to cut-meat production and storage

Each comprising functions of the facilities and the major contents with respect to cut-meat production and refrigerated storage are as follows.

① Chilling facility : Utilization of existing room / change of the use, partial repair of the heat proof door.

② Cut-meat processing room : Overall repair of existing facility, installation of equipment, air-conditioning and heating, installation of storage area for packing materials.

③ Inner organ packing room : Overall repair of existing facility, installation of storage area for packing materials.

④ Cut-meat delivery passageways : Overall repair of the existing facility, +5°C

⑤ Rapid freeze room : Overall repair of existing facility, 24-hours rapid freeze, 10 tons accommodation, 4 rooms, –40°C.

⑥ Anteroom : New installation, reloading freight

⑦ Refrigerated storage : New installation, 600 ton accommodation, 2 rooms, use of gravity-fed pallet rack system, –20°C

⑧ Products delivery passageway : New installation, tie-in between existing and new facilities

⑨ Power substation : Installation of a power substation facility for the renovated facility section.

⑩ Machine room : New installation, installation of underground water tank for defrost, installation of location for outdoor compressor

Among the above, ① ~ ⑥ and ⑨ will be installed by repairing about 1,350m^2 of the existing facilities. Also, the extension to accommodate ⑦, ⑧ and ⑩ shall be about 800m^2.

(3) Content of scale of facilities

Each facility function mentioned in (2) can be classified as pertaining to either the cut-meat processing, rapid freeze and storage related functions. Elements related to facility scale settings have been decided according to these classifications.

1) Cut-meat processing scale

The average carcass weight per head of cattle processed in the Darkhan Meat Plant is 125 kg and the average cut-meat weight is 90 kg. The Mongolia side has requested the capability the process 30 tons daily. This amount is equivalent to 42.5 tons of carcass weight which, based on average carcass weight, yields a per-day production figure of 340 slaughtered large sized livestock. This amount is based on the management policy of the implementation organization that all currently shipped cattle carcasses are to be switched to shipment in the form of high value added meat. However, since horse is included in large sized livestock and some meat will still be shipped in carcass form in the future, it was judged that the total amount is unrealistic and is not within the Project scope. As a result of discussions, 2/3 of average daily large sized livestock

carcass production shall be the target of the Project, thus processing of 20 tons of cut-meat has been selected.

The amount of processing can be calculated depending on the processing method using the time required for a processing series and the number of lines. Therefore, according to such survey results as a processing capability of 800 kg per person per day, with a group size of 8 ~ 9 people, and a processing series taking up 8 hours/day, 3 lines have been selected based on estimates technical ability of workers in the existing facilities engaged in cut-meat processing for processed products, and the scale of facility to accommodate processing of 20 tons of cut-meat will be calculated, followed then by the selection of the necessary equipment.

2) Scale of rapid freeze related facilities

Assuming that there are four rapid freeze rooms, during operating hours in each day, one room can operate fully as a rapid freeze storage area and products are stored in and removed from the other three rooms in order. Therefore, one storage/removal product cycle equals 10 tons, equivalent to 1/3 of the 30 tons of cut-meat and organs processed each day.

Since a product weight of 20 kg or less is better in terms of freezing efficiency and effective freight transport work, a cardboard box 30cm × 60cm × 15cm has been selected. From those conditions, the load weight per cart can be calculated at 480 kg from the shape of the cardboard box and the unit weight, the cart shape (about 70cm × 150cm × 150cm), and the loading arrangement (4 boxes × 6 stages), which allows for spaces between boxes in order to increase freezing efficiency. From the above load weight per cart and the amount of unit stored, the number of accommodated carts can be calculated to be 21.

3) Scale of storage related facility

Expansion of 1,000 tons storage capacity has been requested. Since the existing storage capacity is 3,400 tons, 1,600 tons are inadequate against the currently required storage of 5,000 tons. Those figures are based on the storage of meat in the form of carcass, thus the volume can be reduced in the form of cut-meat.

If 20 tons of cut-meat is processed each day, 2,600 tons of cut-meat is produced in 130 days of operation. The amount of carcasses used for this cut-meat processing reaches 3,600 tons. It is possible to store 1,400 tons of carcasses, calculated by subtracting 3,600 tons from 5000 tons, and the remaining 2,000 tons of cut-meat is stored in existing refrigerated storage.

Therefore, the storage capacity for cut-meat needs to be expanded 600 tons. As a result, the expansion of the storage which can store 600 tons of cut-meat has been set-up against the requested storage capacity of 1,000 tons.

Assuming that a standard sized pallet with a dimension of 1.2m × 1.2m is used, the load weight per pallet of 48 boxes has been calculated at 960 kg based on the shape of the cardboard box and its unit weight, and the pallet shape and load height, (about 1m) which takes into consideration prevention of falling off of boxes. By adding the use of a gravity-fed pallet rack system, the accommodation capacity per storage room has been determined to be 12 pallets × 7 rows × 4 stages × 2 rooms. The shape of storage will be determined by taking into consideration the accommodation form, space required for forklift operation and arrangement of refrigeration equipment. In addition, the loading form on a pallet shall not have spaces, thus the unit weight in terms of forklift capability has been determined to be 1 ton or less.

(4) Contents of major equipment

The major equipment required for cut-meat production and storage is as follows.

1) Carcass conveying equipment

A fixed amount of carcasses are conveyed from the chilled carcass storage via the hanging rail installed in the cut-meat processing room. The weight of carcasses to be cut is measured by the carcass weigher to determine yield, then the carcasses are dropped by the dropper to move to cutting processing. A fixed amount of trolleys used to transport carcasses are returned to the slaughter and dismembering facility by cart.

[Major equipment] : Hanging rail, carcass weigher, dropper

2) Cutting processing equipment

A carcass placed on the carcass table is divided using a rough chopping saw, then cut into cut-meat using a knife on a work table equipped with a cut conveyer with chopping block. The knife is continually honed using a grinding rod or knife grinder and is sterilized after use.

[Major equipment] : Rough chopping table, cut conveyer, chopping block, knife, grinding rod, knife grinder, sterilizing water tank

3) Packing equipment

Processed cut-meat is moved from the work table to the turn table and classified. Cardboard boxes and polyethylene bags stored on shelves in the

cardboard box stock room are assembled and conveyed to the boxing work table by a free roller conveyer. After boxing cut-meat with the meat holder, the weight is measured and the weight and item name are recorded in hand. Packing of organs is done using the same procedure used for cut-meat after classification.

[Major equipment] : Turn table, boxing work table, meat holder, weigher, material shelf, free roller conveyer

4) Rapid freeze and storage equipment

Boxed cut-meat and organs are loaded on the cart for delivery to the rapid freeze room. Frozen cut-meat and organs are reloaded from the cart to the special pallet in the anteroom, then are conveyed to refrigerated storage by forklift, then are accommodated in the gravity-fed pallet rack system. Manual lifting is used to put away empty pallets.

[Major equipment] : Cart for delivery to rapid freeze rooms, pallet, manual type lift, forklift

(5) Maintenance control plan

The costs of maintenance control for the Project will be covered under the existing budgets for personnel and the operating budget of the business organization. Expenses required for the maintenance control of the Project are calculated as follows.

[Trg = Tugrag]

Personnel expenses	: 6,050 persons/day (35 p × 130 days + 5 p × 300 days) × 180 Trg/person/day	=	1,089,000 Trg
Light and heat expenses	: Amount of power use (cut-meat production) 119,500kWh × 6.75 Trg/kWh	=	806,625 Trg
	: Amount of power use (cut-meat freezing) 826,100kWh × 10.29 Trg/kWh	=	8,500,569 Trg
	: Amount of power use (chilled storage) 530,700kWh × 10.29 Trg/kWh	=	5,460,903 Trg
	: Amount of water used 7,900m^3 × 20 Trg/m^3	=	158,000 Trg
	: Amount of steam used 324,000 kg × 1.40 Trg/kg	=	453,600 Trg
	: Compressor oil 100l × 225 Trg/l	=	22,500 Trg
Replacement parts	: 15,600,000 Trg	=	15,600,000 Trg
Packing materials	: 75 Trg (box 55 Trg + bag 20 Trg) / 0.02 ton × 2,600 tons	=	9,750,000 Trg
Total	:	=	41,841,197 Trg
Cut-meat production unit price	: 41,441,197 Trg ÷ 2,600 tons	=	16.09 Trg/kg
Cut-meat cost	: (Cattle) standard carcass shipping price 50 Trg/kg + yield 0.7	=	71.43 Trg/kg
Set cut-meat standard shipping price	: 16.09 Trg/kg + 71.43 Trg/kg	=	87.52 Trg/kg
Reference cut-meat shipping price (as of Sept. 1992)	: Cattle fillet meat	=	95 Trg/kg

According to the above calculation, if the average shipping setting price of cattle cut-meat is 88 Trg/kg or higher, the maintenance control expenses can be covered. It is possible to implement the setting of prices at this level because ① workers for the Project can be obtained by reshuffling existing personnel, thus the above personnel expenses can be reduced, ② the construction includes replacement parts for about the first couple of years of operation following completion of the Project and ③ profit is increased by utilizing by-products of cut-meat production such as bone and fat.

The amount of carcass used for cut-meat production accounts for about 30% of total yearly carcass production. If the above setting value, i.e. 88 Trg/kg is adopted, the yearly sales of cattle cut-meat becomes 228.8 million Trg, accounting for 41% of the total sales value of 552.2 million Trg described in the business plan for 1998. Also, it is possible to add 15.6 million Trg for replacement parts expense to the yearly profit for at least another few years, accounting for 19% of the yearly planned profit of 82.5 million Trg in said business plan. Therefore, implementation of the Project will greatly affect expansion of the Darkhan meat processing plant. The meat price has been liberalized, thus the smooth operation of the plant and

When looking at the balance of the whole plant, while the net working rate of the plant dropped to 39.2% in 1992 from 56.5% in 1990, the business profit rate increased more than 8 times. This can be thought of as the result of improvement of management through conversion from a government-run corporation to a joint-stock corporation. In the 1993 business plan, since this management trend is seen, it is expected that the profit will continue to be secured. However, the plant's facilities and equipment are extremely old and large scale repair or renovation is necessary in the near future. To do this, a large amount of investment capital is necessary. Therefore, securing profit is essential but it is difficult for the plant to bear all of the investment in facilities and equipment on its own. It is therefore necessary to have a long-term improvement plan and management control plan with the cooperation of concerned organizations such as the Ministry of Food and Agriculture with which the said plant is controlled from the standpoint of national meat policies.

(6) Technical cooperation

The Darkhan Meat Plant employs about 30 maintenance control engineers and claims that there is no problem in repairing refrigeration facility piping. However, repair of the ammonia pipe is dangerous, thus advanced construction technique and accuracy and sufficient safety measures are necessary. Therefore, for the implementation of the Project and the operation maintenance control after the implementation of the Project, we believe it is necessary for Japan to accept the following technical trainees:

Job description	Number of trainees	Period required
Heat insulation coating and pipe laying	1 or 2 engineers	About 3 months
Welder	1 or 2 engineers	About 3 months

CHAPTER 4

BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Design Policies

In the formulation of a concrete plan for the said facilities, structures, machinery, etc., in addition to an understanding of the services provided by the facilities and machinery as revealed through examination of the plan configuration components described in Section 3-2-4, the basic policies of this Project have been determined through examination and contemplation of the environmental/societal conditions and current state and difficulties of construction and procurement in the concerned country, as well as the special characteristics of this Project as per the descriptions in this section.

4-1-1 Policy regarding climatic and geological conditions

Due to the harsh conditions prevailing during the Mongolian winter season, outdoor construction operations are limited to the period from mid-March to mid-November. In addition, the ground at the site of the Darkhan Meat Plant may freeze to a depth of 3.6m during the more severe winters. Precipitation, generally 300mm or less, is low, with 60 to 70 percent of the total being carried by summer thunderstorms. Although snowfall is on the order of 300mm, the snow does not melt until spring due to the fact that it becomes packed. In spring, gales and sandstorms gusting at top speeds of roughly 27m/sec are occasionally experienced. Seventy percent of the nation of Mongolia lies atop earthquake-prone stratum, and, in accordance with the fact that the district of Darkhan is designated as a 7 on the 12-tiered earthquake scale prepared by the Mongolian Ministry of Construction, minimum earthquake-proofing measures are required in the erection of structures there.

The design policy that forms the most elemental basis for addressing the local climatic and geological conditions cited above is the shortening of the construction period. The construction component that requires the most outdoor construction time is the laying of the foundation. This being the case, to reduce the amount of foundation work, a floor plan that reduces the floor area encompassed by the section of facility to be added on must be formulated and the overall weight of the structure must be reduced. With respect to construction, three methods were submitted for screening: ① pre-fabricated reinforced concrete construction—a construction method used widely throughout the

region, ② cast-in-place reinforced concrete construction, and ③ steel frame construction. Of these, ②, cast-in-place reinforced concrete construction, required the longest construction time, and difficulties were anticipated in the procurement of material for assembling the concrete-shaping forms. Moreover, although ①, the pre-fabricated reinforced concrete construction method, enjoys wide-spread use throughout the area and, with a large Russian-based fabricating factory located in Darkhan, no technical problems exist. Because current conditions in the Republic of Russia have a large impact on the Mongolian society, imports of material such as steel bar are sluggish, and the outlook for reliable procurement of necessary articles at the required times is dim. In comparison with the two construction methods described above, ③, the steel frame construction method, produces lighter structures and permits rapid Japan-based procurement and processing of materials—it being the method that most effectively reduces construction time. Based on the arguments cited above, the construction method selected to be employed is the steel-frame construction method. Forces applied by accumulation of snow, barometric pressure differences and seismic activity are considered as applicable conditions in the structural plan and lightning protection devices are examined in the electrical plan. In addition, sufficient consideration will be directed to measures for preventing frost damage.

4-1-2 Policy regarding construction considerations

The Ministry of Construction and Urban Development enforces and monitors construction related laws and regulations and sets the legal requirements for construction companies from various nations that are operating in Mongolia. Foreign enterprises performing construction work in Mongolia are required to submit a design blueprint (draft) and obtain approval from the said ministry. Although regulations concerning estimating and execution of construction work exist, they are currently in the process of being re-formulated. Accordingly, the laws and regulations of Japan shall, in principle, be employed as the design criteria of this plan. These criteria shall then be adapted to accommodate local requirements and conditions and approvals thereof shall be obtained from the relevant governmental overseeing authorities.

Although more than 300 construction companies operate in the nation, other than the Ulan-Bator Construction Company with approximately 1,000 employees and a single Russian-based construction company, the vast majority of construction companies are small-scale outfits employing from 5 to 200 employees. A number of these companies specialize in fields related to building construction and equipment, but they are all small-scale affairs, being either individually owned firms or special worker cooperatives. Because, historically, most specialty and large-scale projects have been carried out with the cooperation of foreign countries, including performance of the

basic construction techniques required therefor, the performances of companies possessing the comprehensive execution and management capabilities to construct these types of facilities show little promise. Moreover, the 21 domestic companies that supply construction materials produce only basic building materials such as sand, crushed stone, cement, concrete, brick, tile, paint, and lumber, while imports are relied upon for most industrially-produced construction products such as steel rebar. Other than heavy construction machinery, a wide variety of construction equipment exists; however, these are antiquated equipment from the former Soviet Union and states of Eastern Europe for which procurement of replacement parts has become problematic. The business situation at these construction related companies, including in the design offices, is discouraging due to the economic crisis and investment freeze.

Due to the construction considerations cited above, with the chief exceptions of materials such as crushed stone and concrete to be used for constructing the foundation and, in the existing sections slated for renovation, brick and concrete block to be used for partition walls that require no insulation, ensuring a consistent level of quality within the limited construction time period required by this Grant Aid Program necessitates the procurement of various building materials from Japan or a third country. Moreover, because the level and quality of the local labor force vis-a-vis the special features of the facilities and the requirements of construction materials to be used limit the extent to which local construction companies can be employed, implementation in the Japan-based general contractor firms of construction management and personnel dispatch systems must be completed. With regard to local sub-contractors, rather than utilize them in technical fields, the possibility exists that they will be employed in negotiating adjustments in the governmental approval procedures.

Although, based on the requirements and construction time period constraints cited above, it is believed that materials from Japan will account for a large percentage of the total, local material shall be employed to whatever extent is possible.

4-1-3 Policy regarding maintenance and management capabilities of executing organization

The Mongolian People's Republic is currently in the midst of an economic crisis, with insufficient reserves of foreign currency funds and an extremely high rate of inflation. As a result, firms are experiencing formidable difficulties in procuring imported materials and machinery. Accordingly, durability and low energy consumption, items which directly impact running expenses, are considered in the selection of the facility design, material, and machinery through proposing the employment of a simple system and reducing the inventory of spare parts. With regard to spare parts, note that the required number thereof will be considered.

4-1-4 Policy regarding the scope and level of facilities and equipment

With regard to the existing refrigeration facilities, the scope of this plan covers, on the low pressure side, removal and upgrading of all refrigerant lines and their heat insulating sheathing from outside the machine room to the various refrigerated storage rooms as well as the unit coolers and defrosters inside the rooms, and, on the high-pressure side, removal and upgrading of a number of pumps installed outside the equipment room. It also covers the provisioning of inspection devices and tools required to maintain the equipment cited above.

As indicated in the basic design chart, the scope of the existing facility renovation with respect to the cut-meat processing and rapid freezing facilities covers a roughly 1,350m^2 section, and, with the exception of the refrigerated storage room, etc., and the floor, columns, roof, and partition walls surrounding the said section, the Mongolian side shall be entrusted with the removal of all functional aspects of the facilities. After completion of removal operations, all construction and equipment provisioning and mounting operations covered by the renovation plan shall be provided for by the Grant Aid Program. With regard to the scope of facility expansion, the refrigerated storage rooms and delivery passageways, refrigerated storage facilities, including those of the existing section to be renovated, and their machine rooms and initial power receiving and transformer substation equipment (power substation equipment) shall be covered; the above expansion includes supply and mounting of machinery such a gravity-fed pallet rack system, forklifts, and pallets to boost the efficiency of the construction and delivery operations. Note that in the selection of the equipment and machinery, rating is set based on criteria for similar equipment in Mongolia and criteria for similar equipment prescribed by Japan's Grant Aid Assistance program, and equipment and machinery that are easy to operate and maintain, and for which the number of replacement parts can be reduced will be employed.

4-1-5 Policy regarding construction schedule

As elaborated on above, climatic conditions limit the time period in which construction activities can be performed outdoors to the period from mid-March to mid-November. Moreover, disassembly and removal of existing facilities and upgrading of refrigerant pipelines and so on is limited to the period, from January to July, in which no slaughtering or dismemberment is performed. Thus, employment of a construction method that satisfies the requirements of both renovation and facility expansion within a short time frame is required. To elaborate, required is ① a reduction of the overall weight of the building to reduce the number of construction operations and shorten the time required to construct the foundation, ② the employment of steel frame construction with the goal of shortening the time required to construct the upper sections of the

structures, ③ the employment of the drywall construction method using exterior surfacing materials and insulating materials with the goal of shortening the time required to perform interior and exterior surfacing and reducing building weight, and ④ the employment of a construction and equipment system that optimally utilizes the existing related facility infrastructural equipment, and, at the same time, minimizes the number of construction operations. Note that, in order for the building and equipment system to function adequately, it has been judged reasonable to include additional renovation of related facility infrastructural equipment within the scope of the Project.

Taking into consideration the conditions cited above, the construction time frame has been divided as shown below.

[Phase 1] Renovation of existing refrigeration facilities
Removal and upgrading of pipe lines, unit coolers, and defrosters of existing refrigerated storage facilities

[Phase 2] Installation of cut-meat production and refrigeration facilities
Renovation of cut-meat processing room, front anteroom, material storage rooms, inner organ packing room, conveying passageways, substation room, rapid freeze room and anterooms, provisioning and mounting of equipment related to cut-meat processing and conveying

[Phase 3] Construction of machinery room, installation of refrigeration machinery, and construction of meat storage facilities
Construction of refrigerated storage rooms, delivery aisles
installation of loading equipment

4-2 Examination of Basic Design Requirements

In examining the requirements of the basic design, attention was directed to aspects that both minimized facility maintenance expenses and were able to support the facility services to be implemented by this Project. The operating expense that accounts for the largest single maintenance expense is electrical power usage fees. Moreover, an expense that increases with the passage of time is that expended for maintenance and repair of building facilities and equipment and the machinery upgrading expenses required periodically over the life of the facility. Taking these concerns into consideration, a concrete plan incorporating the following requirements shall be drawn up.

① Regarding renovation of existing refrigeration equipment: the maximum extent of the renovation, including procurement of replacement parts and maintenance capabilities, has been clarified. Moreover, the extent to which Japan can assist under the Grant Aid Program with respect to the requirements imposed on

procurement of machines and parts therefor, construction schedule and general outlays, and implementation technology and liability guarantees has been finalized. Regarding items in which the conditions of the Grant Aid Assistance program proscribe Japan from performing, as provided for in the plan, Mongolia will continue to utilize technology transfers and Japan's technical training program to complete work in these areas.

② Regarding the section of the existing facility that is to be renovated: while striving to limit the scope of renovation to its irreducible minimum, the extent of the renovation will be clarified, and a method to preclude adversely affecting the functioning of facilities outside the targeted scope shall be employed.

③ Regarding the additional refrigerated storage facilities to be installed: the capabilities of the equipment shall be minimized to the extent possible, and an efficient equipment and structural arrangement aimed at producing a design that maximizes functionality shall be selected.

④ In order to reduce electrical consumption, the most efficient insulation and moistureproofing measures shall be applied to the rooms that require refrigerated storage facilities from the aspect of equipment functionality.

⑤ Conditioned upon the continuance of sufficient durability under the harsh weather conditions endured by the site, the building configuration shall permit construction of facilities within a short period of time.

⑥ In maintaining the facilities and reducing repair expenditures, the buildings shall employ a configuration that is sturdy and easy to clean. Moreover, in anticipation of occurrences in which repair or refurbishment is required, stress shall be laid on materials and fabrication methods that permit on-site repair work to be minimized and performed without undue hardship.

⑦ In selecting equipment and machinery, in conjunction with minimizing disparity in machine types to preserve interchangeability and reduce the number of spare parts, a system that simplifies maintenance shall be employed.

⑧ Taking into account the development of production and distribution facilities, a system that supports ready future expansion and/or addition of facilities and structures, as well as equipment, shall be designed.

⑨ In determining the scale and specifications of the detailed project plan, the basic design requirements based on the aforementioned design policies have been compiled upon examination not only of factors related to establishing detailed facility specifications such as the cut-meat processing capacity and processing method and the frozen storage capacity and storage method, size determination

criteria and layout of furnished machinery, but of conditions applicable to basic criteria (building, strength and other standards) and equipment installation system as well. In conjunction with these conditions, the number of personnel and arrangement of machinery shall be examined to clarify the calculation basis for the floor area, and the final draft drawn up.

4-3 Basic Plan

4-3-1 Renovation plan of existing refrigeration facilities (Phase I construction)

The system and functions of the existing refrigeration equipment were ascertained and assimilated through the field survey, and their antiquated condition, the causes therefor, and the feasibility of renovating them from the standpoint of maintenance ability were examined. This renovation feasibility study determined the scope of renovation through examination of the said feasibility from the aspect of the effectiveness of project implementation, including the procurement of machinery and replacement parts, maintenance skills, the relative difficulty of construction, time constraints, the impact on the system as a whole, and the feasibility of parts renovation. Operation prioritization and the scope of Grant Aid Program were determined through additional examination of both the suitability of the Grant Aid Program and the urgency and effectiveness of its application to facilities determined to lie within the scope of renovation. Consideration must be directed to the fact that these studies and determinations were conditioned upon three requirements: 1) performance of renovation must be possible within the framework of the Grant Aid Program, 2) the scope of the construction liability guarantee must be clear, and 3) the ability to clearly evaluate the effectiveness of the renovation work must be manifest. Accordingly, even when the existence of serious need has been established and the effectiveness of renovation clearly revealed, application of Grant Aid Program to renovation of facilities impossible to perform within the framework of plan implementation provided by the Grant Aid Program shall be denied, and the details and reasons therefor duly explained to the Mongolian representatives.

[Scope of removal and upgrading operations]

- All refrigerant pipe lines from the machine room on the low-pressure side to the refrigerated storage rooms and the insulating sheathing for the lines, and the unit coolers and defrosters for each room
- Evaporator condensors installed outside the machine room on the high pressure side
- Provisioning of inspection devices and tools required to maintain

[Upgrading materials]

• Pressure steel pipes for refrigerant lines	20 mm to 300 mm	(diameter)
• Insulation sheathing for the above	One set	
• Step-up/down couplings	20 mm to 300 mm	(diameter)
• Refrigerant shut-off valves	10 mm to 250 mm	(diameter)
• Refrigerant pressure regulating valves	10 mm to 250 mm	(diameter)
• Refrigerant check valves	12 mm to 50 mm	(diameter)

[Construction equipment]

- Welder, high-speed cutter, grinder, gas cutter, pipe threader, power pipe saw, electric drill, concrete drill, block and tackle

[Tools and materials to inspect]

- Ammonia sensor, air compressor, vacuum pump, vacuum pressure gauge, nitrogen gas, pressure-resistant hose

4-3-2 Site layout plan

As stated above, additional cut-meat refrigerated storage facilities are to be constructed. Accordingly, concerning the layout of the said facilities, the field survey ascertained the site terrain, ambient environment, locations and descriptions of existing facilities and maintenance condition of the existing infrastructure in determining the most suitable location to build this facility. Basic items to which attention was directed with regard to site utilization included not only ready access from existing and planned facilities, the layout feasibility of each set of meat production facilities, and the relationship between product distribution and the railway spur and freight car lines, but also future expansion of facilities and the relative ease of facility preparation entrusted to Mongolia. Thus, the site layout plan was formulated in accordance with the following requirements.

- Optimize utilization of existing facility capabilities, and produce a facility layout that optimizes use of the expansion facility functions
- Design a layout that takes into consideration the areas that should be tied in closely with existing facilities (Appendix)
- Design a layout in which the administrative, auxiliary and other such facilities can be readily accessed from the main on-site road
- Design a facility layout that supports the ready import, export, and distribution of raw materials, processed materials, and finished products.
- Considering maintenance and spatial efficiency, design a facility layout in which equipment pipe lines are concentrated
- Design a facility layout in which no conflicts with the electricity, water or gas from existing facilities exist.

As a result of the above examination, it was determined that expansion to the north of the existing facility was most effective.

4-3-3 Structural plan

This section shows the structural plan with regard to cut-meat processing and refrigerated storage, excluding the renovation of existing refrigerated storage facilities.

(1) Floor Plan

Regarding cut-meat processing, the chilled carcass storage room, the cut-meat processing room, the auxiliary stockroom, the inner organ packing room, the cut-meat delivery passageway, the rapid freeze rooms, and the anterooms will be prepared through renovation of existing facilities. The portion of the existing facilities targeted in these rooms is the meat processing area that is planned to be transferred by the Mongolian side. As previously stated, the sound implementation of this transfer plan is premised on renovation of the relevant sections, and the scope of renovation determined by the conditions thereof. The meat processing area of the existing facility is located midway between the slaughter and dismembering facility and the chilled storage facility on the north side of the refrigeration equipment, which is the optimum location for processing cut-meat. With a square area of approximately 1,350m^2, an area that accommodates the services provided by the cut-meat processing facility, including related rooms, can be secured, and, from the aspect of securing the floor area yielded from the required scale calculations, a floor layout that can most effectively utilize the existing capabilities of the services provided by cut-meat processing has been planned.

The cut-meat carcass conveying passageway will employ hanger rails running from the existing chilled carcass facility to the multi-purpose refrigerated storage room. This multi-purpose refrigerated storage room will be refurbished to be converted for use as a chilled carcass storage room. The area adjacent to this room will be the cut-meat processing room, and sufficient machinery and facility area will be secured to have a daily processing capacity of 20 tons of cut-meat. To transport dressed carcasses to the cut-meat room, a rail spur with an attached dropper will be taken to the hanger rail from the chilled room.

The cut-meat processing room will occupy three existing spans, and three meat processing lines in the "beam" direction will be installed. Packing will be performed at the ends of the lines. Packing containers will be prepared from a one-span wide stockroom bordering the cut-meat processing room. The corner area bordering this stockroom and the cut meat processing room will be utilized as the inner organ packing room. Packing containers and inner organs will be transported

directly from the existing passageway, and workers will enter and exit the cut-meat processing room through the front anteroom.

The packed cut-meat and inner organs will be introduced to a rapid freeze room via the delivery passageway. A row of four rapid freeze rooms occupying the four-span width possessed by the cut-meat processing and inner organ packing rooms will be constructed. The frozen cut-meat and other frozen meat products will be put on to pallets in the transfer anteroom, the width of which will be, at four spans, the same as the total width of the rapid freeze rooms. This area is the section that will join the new refrigerated storage facilities to the existing facility, including the existing truck dispatch room. The power receiving/transformer substation room will be built by renovating of the existing product stockroom.

A refrigerated storage area, delivery passageways, and a machine room will be added on. The design policy with regard to the refrigerated storage area specifies that its floor area be minimized and for it to be well-insulated. In addition, it has been divided into two rooms to accommodate seasonal variations in the quantity of stored product. Premised on the use of the gravity-fed pallet rack system, the height of the ceiling in this area was calculated to accommodate a stack of four fully-loaded pallet racks based on a the maximum height that a fork lift can lift a pallet rack. The depth of the planned area is a four-span length identical to that established in the existing facility in order to create turnaround space at either end for the forklifts, and its width was calculated based on the requirement for a storage capacity of 600 tons. The rooms will each be able to accommodate seven pallet rack system rows. The delivery passageway shall be able to accommodate two forklifts passing each other in opposite directions, and two delivery doors through which products can be loaded directly to trucks have been planned. Note that, for rail delivery, these delivery passageways shall be joined to the existing truck dispatch room such that delivery can be performed using the existing delivery route. The width of the machine room (refrigeration equipment room) shall be identical to that of a single span in the existing facility, and it shall possess a floor area deemed sufficient to accommodate the required equipment. The defroster water tank shall be located underground.

[Basis For Building Size Calculations]

①	Renovation work [Phase 2 construction]			
	Removal of existing meat processing-related facilities		To be performed by Mongolian side	1,350m^2
	Chilled carcass storage room	Use existing multipurpose refrigerated storage room (partial renovation required— insulated doors, etc.)	Existing facility used: 220 head × 4 dressed carcasses ÷ 3.5 dressed carcasses/m^2 = 251m^2	252m^2
	Cut-meat processing room	Renovation work : Temperature control, hung carcass rail, etc.	1.5m (W) × 2 passageways + 2.1m (W) workbench + 0.45m (W) × 2 steps = 6m (W) × 21m × 3 (line length × no. of lines) = 378m^2	378m^2
	Front anteroom	Renovation work : Restroom, cloakroom, passageway	3m (W) × 6m (L) = 18m^2	18m^2
	Stockroom	Renovation work : Calculated from equipment layout	6m wide × 10m long = 60m^2	60m^2
	Inner organ packing room	Renovation work : Calculated from equipment layout	6m (W) × 8m (L) = 48m^2	48m^2
	Delivery passageways	Renovation work : Temperature control, freezer cart passageway, columns	3m+1m (W) × 24m (L) = 96m^2	96m^2
	Power substation	Renovation work : Calculated from equipment layout	6m (W) × 10m (L) = 60m^2	60m^2
	Rapid freeze rooms	Renovation work : Temperature control, 4 rooms, accommodates 21freezer carts	21 trucks × 1.7m^2/truck = 35.7m^2 36 m^2 × 4 rooms = 144m^2	144m^2
	Delivery room	Renovation work : Temperature control	Forklift passageway + delivery room: (4m + 3m (W)) × 24m (L) = 168m^2	162m^2
	Existing tie-in areas	Areas not covered above	Existing passageways, renovation of truck dispatch room, secondary work	126m^2
②	Added facility			804m^2
	[Phase 2 construction]			108m^2
	Machine room (refrigeration equipment room)	Steel frame construction Calculated from equipment layout:	6m (W) × 18m (L) = 108m^2	108m^2
	[Phase 3 construction]			696m^2
	Long-term refrigerated storage	Steel frame construction, temperature control, pallet rack equipment installation See the detailed calculations to the right.	228m^2× 2 rooms = 576m^2 4m (W) × 2 forklift psgwys + 16m (L) pallet rack equip. = 24 × 11m + 1 (width of pallet rack equip. + columns) = 288m^2	576m^2
	Delivery passageways	Steel frame construction, temperature control	4m + 1m (W) forklift psgwy + columns × 24m (L) = 120m^2	120m^2

(2) Cross-section plan

With regard to the cross-section plan for renovation of existing facilities, ceiling heights have been established based on the requirement to reduce to a minimum the scope of renovation and the volumetric capacity of rooms requiring temperature

control. Based on the height required for the suspended carcass hanger rail, the ceiling height of the cut-meat processing room shall be 3.6m, and the height of the inner organ packaging room shall be identical. Because of the great weight of the unit coolers in the rapid freeze rooms, they shall be installed on steel frame platforms. Because of this, the ceiling height of the rapid freeze rooms will extend to the 5m high central girder, which is the maximum height reached by the building. The height of the entrances to the meat transfer anteroom shall be 2.5m to accommodate the height of the forklifts, and the height of its ceiling shall be 3m to accommodate installation of motor. Regarding areas not covered above, the stockroom and the power receiving/transformer substation room shall both have flat ceilings, and height of the ceilings of the delivery passageways and front anteroom shall be 3m.

With regard to flooring in the existing facilities, in the low-temperature rooms, insulation material and protective concrete are installed to a thickness of 200mm on the slab of concrete, and, in other rooms, an identical cross-sectional area is occupied by a raised slab of concrete. Because it is assumed that the performance of the insulation is damaged due to aging, the area above the slab shall be removed by the Mongolian side during renovation construction, and new insulation material and protective concrete installed in its place.

The floor height of the refrigerated storage area and delivery passageways to be added shall be 1.2m above ground level as is the case with the existing floors to accommodate the delivery and reception of goods. The floor height of the machine room shall be 300mm.

The ceiling height of the refrigerated storage area shall be 7.5m to accommodate the addition of installation space for unit coolers to the height occupied by the maximum number of pallet rack stacks. The ceiling height of the delivery passageways shall be 3m, the same as that of the delivery room.

(3) Structural plan

A building of excellent safety and durability has been drawn up by means of a structural plan that provides for the impact of environmental and site conditions on local structures as noted below. From a climatic standpoint, the time period in which ordinary concrete construction is feasible is limited to the five-month period from May to September, and, during the harsh winter months, various restrictions apply to other construction activities as well. Thus, the most serious issue facing the execution of this Project under the auspices of the Grant Aid Program is the shortening of the construction period. Because foundation construction lies at the

initial stage of building construction and requires a relatively large allocation of time, reducing the overall weight of the building and the amount of foundation construction leads directly to a shortening of the overall construction period. Providing the irreducible minimum of durability and considering a structure that is well planned and economical leads to a reduction in the overall weight of the building as well as the ability to either procure and process or simply process the materials in Japan and perform steel frame construction on site, which has proved to be the most effective method to reduce the time required for construction.

There are several types of structure foundation including direct, pile, and caisson. Of these, the direct foundation method is most advantageous from the aspects of construction period and expense; however, a sufficient soil bearing capacity is required at a relatively shallow surface depth. With regard to the quality of the soil at the site upon which the Darkhan Meat Plant is located, results of examination of soil quality test samples reveal that beginning at a depth of approximately 1.2m from the surface is a layer of gravel that provides sufficient soil bearing capacity. Although it is possible to use this layer as the bedrock layer, because the ground freezes to a depth of 3.6m, the foundation must be extended to this depth. Also, the underground water level is –1.2m. Accordingly, the perimeter foundation section of the expansion section shall be raised rubble non-reinforced concrete extending to a depth of 3m from the bottom of the foundation.

Structural calculations to yield the structural strength with respect to load capacity and external forces (earthquakes and wind force) were performed on the basis of calculation criteria of the Japan Construction Association based on the strength and quantity of external forces and materials gathered by the field survey. Note that, although the City of Darkhan is located in a district requiring a minimum earthquake-proofing design, because the force exerted by gusting winds at 28m/sec (equal to 49kg/m^2) is stronger than the force exerted by earthquakes, wind-resistance was accorded the greater weight in the calculations.

(4) Facility equipment plan

From a functional standpoint, the refrigeration storage equipment of the cut-meat processing facility occupies an extremely important position. Accordingly, in order for all functions of the facility to be effectively demonstrated and to contribute to the improvement of facility administration, this plan recognizes it can be maintained in good working order. To realize this, directing sufficient consideration to operability, maintenance costs, and ease of operation, maintenance control and refitting of machinery and equipment, a system that stresses economical

considerations such as energy conservation and labor savings, as well as reliability and interchangability with respect to upgrading of machinery has been designed.

1) Refrigeration equipment

Refrigeration equipment is indispensable for the preservation and storage of meat. There are two methods by which refrigeration equipment perform refrigeration: wet type (saturation method) and dry type (direct expansion method). The existing facilities employ a wet type system using an ammonia refrigerant; based on the results of the survey conducted at the site on the operation and maintenance conditions of the existing equipment and the maintenance skills and technical strength, it has been decided to employ a system similar to the existing as the refrigeration system of the newly-constructed facility as well.

An ammonia and a freon (CFC) would to be used as the refrigerant; however, with regard to freons, an international agreement which will completely ban R-12 and R-502 freons is currently in effect and a production of R-22, etc., the HCFC with the most applications, is to be abolished by the year 2020. Moreover, application of the replacement product, HFC R-134a is limited to motor vehicle air conditioning systems, and no gas is developed for ordinary refrigeration systems. Accordingly, ammonia shall be used in this Project as well. As the energy source for condensation there exists air-cooling and water cooling; but, for large refrigeration units like those of this Project, a water-cooled system is employed due to the need for stabilized operation.

Although the system is designed by assembling refrigeration devices performing various functions according to the layout and requirements of the refrigeration system, as a means of providing backup at time of failure, through the installation of multiple shared units, a method by which the systems reciprocally complement each other is being considered. Because electricity is the principal type of power used for the refrigeration equipment, attention must be directed reducing power consumption through the precise calculation of equipment performance based on appropriate sizes and conditions as stated above, as well as through an efficient, compact design. In addition, considering a control system that matches the abilities of the personnel required for maintenance, an easy plan that promotes favorable operation management over an extended period of time, including the supply system for consumables (i.e., oil for refrigeration units, refrigerant, pulley belts, etc.), shall be implemented. The performance of the cooling systems shall be premised upon the

requirements of each system, such as the meat processing capacity, storage capacity, set temperatures, insulation performance, operation system, etc.

In accordance with the design policy outlined above, the design requirements of the refrigeration equipment with regard to the expanded building section and the renovation of existing facilities shall be as noted below.

[Load requirements] Outside air conditions in the Darkhan district

- Summer : 33.0 °C
  Entropy : 13.3 kcal (relative humidity: 30%)
- Winter : 37.6 °C
  Entropy : –8.7 kcal

[Ventilation requirements]

- Summer : 22.8 °C
  Entropy : 11.3 kcal (relative humidity: 55%)

Based on the existing system, the refrigeration system shall be a flooded refrigeration system using ammonia as the refrigerant, and a control system in which few failures occur due to such phenomena as electrical blackouts shall be employed. The unit coolers shall be air blast type unit coolers; the defrosting system in the rapid freeze room shall employ a sprayed water defrosting system; and the units in the other rooms shall employ a hot gas defrosting system. The principal refrigerated room temperature requirements are listed below.

Rapid freeze rooms	–40°C
Refrigerated storage area	–20°C
Cut-meat processing room	15°C
Delivery rooms/passageways, etc.	0 ~ 10°C

2) Electrical work

A 6-kV high-voltage line is intaken by means of underground cable to co-installed electrical room, and there the voltage is converted to a lower potential of 3 phase 380/220V by the power receiver/transformer panel.

More than twenty years has elapsed since construction of the existing facility, and, because adequate maintenance has not been performed on the substation equipment and other electrical equipment in the plant, superannuating of electrical equipment has become severe. Particularly widely recognized are the

aging of the connections of the wiring and cables and the wiring accessories; impairments to function and failure of devices designed to protect the circuits for power distribution and the control panels for refrigeration and slaughtering equipment; and breakage, including of the housings protecting the above equipment.

Though obtaining materials for renovation of those existing electrical equipment is difficult, it is essential to renovate them in order to maintain safety and function. Therefore, the executing organization intends to design a long term renovation plan and implement even a part of it.

It is estimated that the new refrigeration equipment will require roughly 700 to 800 kW of power. Since there is no extra capacity in the above existing substation, there are two ways of achieving this. One method is to branch a 6kV high voltage line from the existing substation to the secondary substation in the newly-built electricity room. A second method is to provide a dedicated required amount of power independently. In this Project, the second method was adopted because of the superannuated condition of the above existing electrical equipment and the scale of repair.

The capacity of receiving power is calculated based on the loads for all machines and equipment. It should be least amount necessary by fully taking into consideration future increases and expansion in equipment and facilities.

Lighting equipment in low temperature rooms such as refrigerated storage shall be basically fluorescent lamps because it is not affected by temperature and its illumination follows that of the existing facility. Furthermore, conservation of energy shall be taken into consideration such that flash circuits on a small section basis and curtailed circuits are used for corridor. For warning equipment, abnormal storage temperatures, refrigeration failures and lockup shall be considered.

① Power substation equipment

Electricity from the power station is supplied as high-tention voltage (6000kV), three-phase, three-line at 50 kHz, and run to the existing power substation room by 240mm^2–3C×2 underground cable.

Even at present, the existing power receiving/transformer substation equipment is overloaded (a load of 3,000kVA compared to a transformer capacity of 2,600kVA), and the power supply equipment of this construction plan cannot be supplied by shunting power from the existing

power substation equipment (220/380V). Moreover, because the existing power substation room is cramped, no space exists for installation of additional equipment called for by this plan. Therefore, installing second power substation equipment and shunting high voltage from the existing power station by modifying the existing power substation can be considered. However, since the existing power substation has deteriorated as explained before, electric leakage is thought to have been caused due to deterioration in insulation. Generally, a protective breaker is installed to secure safety against electric leakage. However, in the current condition, since a wide range of electric leakage is supposed, renovation of part of the equipment may induce new electric leakage, upsetting the overall balance. Therefore, it is thought that it may be necessary to renovate not only the subjects of the Project but also the all of the electric equipment in the existing plant. As a result, shunting high-voltage from the existing power substation was determined be inappropriate because of the scale of renovation required.

Based on the above, for power source facilities required by the Project, one line shall be newly installed from a power supply organization. Installation of a new power line was acknowledged by Darkhan City, which is in charge of the power supply organization.

② Removal and renovation of existing electrical equipment for storage of cut-meat, etc.

Results of examination of electrical equipment accompanying removal and renovation operations revealed that removal and renovation could be performed with essentially no effect on the existing facilities. To elaborate, the power supply equipment in the existing processing rooms are supplied from the main distribution panel, which is divided into sections by type of electrical equipment, and, by renovating and replacing the circuit breakers in the main distribution panel, the work can be carried out without affecting other facilities.

③ Other existing electrical equipment

The electrical equipment of the existing facility include 1) power substation equipment, 2) trunk lines, 3) power equipment, 4) electric light outlets, 5) customer-premises telephone equipment, 6) intercom equipment, and 7) broadcast equipment. Of these, 5) through 7) were excluded from maintenance operations, and aging and inadequate maintenance have rendered them dysfunctional.

④ Plan for renovation and addition of electrical equipment

The electrical equipment construction implemented by this plan include work on 1) power substation equipment, 2) main trunk lines, 3) power equipment, 4) electric lamp outlets, low-voltage electrical equipment (telephone, maintenance, intercom, etc.), and 6) automatic disaster indication equipment.

a. New installation of initial power receiving and transforming equipment (No. 2 initial power and receiving equipment)
Principal work to be performed for the newly installed (No. 2) power substation equipment is as follows.

- High-voltage drop wire cable
- High- and low-voltage power distribution panels
- Transformer and leading capacitor installation
- Securing of the above and wiring adjustment testing

b. Trunk lines and equipment
Perform work on the cable and wiring equipment from the newly installed initial power receiving and transforming equipment as per the above items to the newly installed electric lamp distribution panels and power control panels.

c. Power equipment work
Perform installation of the power control panels, and attachment of wiring connection equipment to the compressor devices and processor devices of these panels, required control equipment, and power outlets.

d. Electric lamp outlets

Perform attachment of illumination fixtures and switches, including installation of the lighting distribution panels, attachment of outlets, and installation of wiring thereto.

e. Low-voltage equipment (telephone and maintenance intercom)

Perform wiring of a single telephone circuit from the existing room and attachment of one telephone set to the new substation and work on maintenance intercom equipment between the newly installed machine room and electrical room and the existing control room, machine room and electrical room.

f. Electrical equipment and material

Although a survey on electrical equipment and materials in contemporary Mongolia was conducted, no devices or materials that satisfied the electrical equipment work in this plan were discovered.

Due to the above situation, it is desired that, in principle, Japanese products be procured for electrical equipment and materials.

⑤ Electricians

While there are some workers in the capital city of Ulan-Bator who are called electricians, their technical skill levels are unknown. Moreover, in Darkhan itself, there are no electricians.

Because of this, particularly for work that requires a high technical level such as that on high-voltage electrical equipment, trunk lines, and power equipment, dispatch of technical personnel from Japan is required.

3) Water supplies sewage and sanitary work

Main pipes for water and hot water of heating have been provided, and water is supplied to the various existing facilities by means of underground trenches on the site. With regard to the added section, cold and hot water shall be branched from the main line and supplied to the required locations in accordance with local codes; hot water shall also be used to heat the processing rooms.

Sanitation is indispensable by the use of wash water for the meat processing facility. In particular, because cut-meat processing is a meat processing step that is relatively close to end consumption, water supply equipment will be installed to ensure that there is sufficient water for washing everything from machinery

fixtures to workers' hands. Note that, because hot water is effective as an easy method to remove animal fats, hot water supply system will be examined.

Regarding drainage water facilities, it has been decided to connect to the discharge path that merges with the sewage treatment facility at the existing facility; this project will not be affected by local codes and the regulatory system with regard to drainage water processing, the processing condition of existing processing facilities and the impact on the local environment will be examined.

Mongolia has no gas distribution facilities and inadequate supplies of oil, and steam or high-temperature water produced by thermoelectric power plants is relied upon as the main source of heating. Because of this, the existence of adequate supplies of the said form(s) of energy must be confirmed before beginning construction of a new building; any remaining heating needs must be fulfilled with electricity. Moreover, due to the climatic conditions, the site slated for construction in the Darkhan area is frozen to a depth of 3.6m, and, excepting for drainage water, water distribution lines cannot be buried. In fact, underground in the center of the buildings of the existing facility runs a large trench for carrying water with branches laid directly into the buildings.

① Supply of water equipment

Darkhan City supplies city water at a pressure of 5 to 6 kg/cm^2. Although evaluation of the quantity of iron oxide in the metallic portion revealed the iron content to be high, the quality of hotel water from the same spring is said to be suitable for drinking. Thus, no special treatment is required for the Project, as the existing facilities are currently using water supplied by these water mains. This plan will branch a line from the 200mm main water distribution line in the trench of the existing facility.

Water supply usage fees are 10 Trg/m^3, and an identical fee of 10 Trg/m^3 is required for use of sewer water pipes.

② The existing drain water system is categolized into three systems: one for rainwater, one for ordinary dailiy water needs (including toilet water), and water discharged from industrial uses. This plan calls for rain water to be discharged to a nearby ditch on the rainwater side, and the water sanitation drained from the facility and discharged to the existing drainpipe for industrial effluent (a main, 300mm drainpipe is installed in the trench).

Regarding industrial effluent, a drainwater processing facility (pre-treatment facility for public sewage) of Hungarian design is installed on site, and,

accompanying this, miscellaneous drainwater was separated into two systems: household-type drainwater and industrial effluent. Industrial effluent secondarily-treated by this facility is discharged to the public sewage system of Darkhan City. The capacity of this drainwater pre-treatment facility is as follows:

• Average treatment capacity	1,350m³/day	
• Maximum treatment capacity	1,625m³/day	
• BOD	1,000 ppm	(when discharging)
• N-HEX (oil & fat components)	600 ppm	(when discharging)
• SS	50 ~ 0 ppm	(when discharging)
• PH	6.5 ~ 8.5	
• Water temperature	35℃	

③ Supply of hot water and steam equipment

Because the planned facilities are soiled with animal fats, a supply of hot water is usefull for cleaning. Hot-water supply equipment whereby a local hot-water supply system in which hydrothermal exchanger for converting steam into hot water has been installed at various locations in the facility, and this plan specifies installation of identical equipment. The steam is supplied by an adjacent Russian-financed construction material factory fees are fixed based on yearly, monthly and weekly usage quantities. Current usage fees are 1,400.67 Trg/ton, according to the increase in usage to be brought about by this plan, new fees shall be recontacted with said factory.

④ Air conditioning and ventilation equipment

Only cooling and heating equipment is installed in the meat processing rooms of the existing facility, and heavy condensation can be observed. The cooling and heating equipment are currently being used in the existing ham and sausage processing rooms. Ventilation equipment providing a filter for removing dust and hot water coils as a winter outside air preheat has been installed also. Those equipments are subject to removal and renovation operations. Thus, this plan specifies that the same systems in the cut-meat processing and other rooms.

The temperature in the cut-meat processing room shall be 15°C or cooler as in Japan, and in winter it shall be 0°C or higher that is no obstacles to operations. A preheater shall be mounted on the ventilation equipment, and drafts from outdoor air shall be prevented. Although it is generally desired that the meat processing room be maintained and used in as dry a condition.

The Mongolian atmosphere experiences long periods of extremely dry conditions, it shall be payed much carefullness on weight loss of the meat. Estimates from the temperature conditions of the outside air reveal that cooling of the refrigerated storage area could be performed adequately in the winter in terms of temperature through use of ventilated air from the outside, but a cooling system using outside air is not employed in order to prevent weight loss in meat.

The design for the refrigeration equipment and the cooling and heating system shall be as noted below.

[System] Summer : Installation of unit cooler with refrigeration equip.
Winter : Fan-equipped radiator

The energy source for cooling in the summer shall be electricity, and, in winter, high-temperature water supplied by electrical power generating plants shall be used for heating. Two, 200mm diameter pipes running side by side have been installed to the existing facility as well, and this plan specifies that they be used to transfer the hot water heating supply as well. The required temperature of the supplied hot water differs depending on the temperature of the outside air, and usage fees are determined by utilization and the volume of space to be heated. To present two examples of temperature requirements of the hot water supply, when the temperature of the outside air is –28°C, the temperature of the supplied high-temperature water must be 120°C, and when the temperature of the outside air is –48°C, the temperature of the supplied high-temperature water must be 150°C. Fees are 4.5 Trg/m^3/month for ordinary residences and 10.23 Trg/m^3/month for factories. The system shall stand on 150°C at a pressure of 12kg/cm^3.

(5) Construction material plan

Insulation is the most important component in rooms requiring temperature control. Because the local insulation material is low efficiency and requires a wet process method, the installation period is long and attention must be directed to maintenance, and it contributes to the aging and performance impairment of the facility as well. Accordingly, this plan specifies, in principal, the employment of a high-performance, easy-to-install, lightweight dry-system foamed-plastic type insulation panels, which are also effective toward reducing building weight, a requirement noted in the structural plan section. Through selection of a surfacing material, this material can be adapted for application to various types of rooms such as rooms requiring hygienic conditions such as processing rooms and rooms

requiring durability such as storage rooms. The doors through which the fork lifts pass shall be electric-powered, thermally-insulated doors, and other doors shall be manually-operated thermally-insulated doors.

Due to constructability requiring reduced building weight and short building period, surfacing material for interior and exterior walls shall, principally, require metallic-type pressed-sheets. Flooring material shall be selected based on durability and ease of maintenance according to room function.

Most construction materials with the exception of such materials as concrete materials other than sand, crushed stone and steel bar, concrete blocks for partitioning, and brick shall be procured from Japan or a third country as stated earlier.

4-3-4 Equipment plan

(1) Cut-meat processing equipments

The processing specified by this plan is cut-meat processing from carcasses,, mainly beef. In one section, cutting of pork and horsemeat was planned, but the quantity thereof is not consistent. The carcass just slaughtered emits a rigor mortis temperature of 40°C, but, because this meat is chilled in the existing facility, the scope of this plan targets equipment for processing steps after chilling.

In Mongolia, carcass to be cut is frozen during the butchering season from autumn to the beginning of winter. Once frozen carcass is used during the off-season, and it embraces many problems from the standpoint of quality crop up. However, this plan has specified as its greatest aims the improvement and standardization of product quality, the increase of storage capacity, and the improvement of transport efficiency, with the main focus on processing during the butchering season. Because material for sausage which is processed has no problem. Accordingly, the selection of machinery shall correspond to the processing method that is suitable for the butchering season. Because the field survey period did not cover the heaviest processing period of the facility, the ability of the employees' cutting processing could not be reliably evaluated (particularly their ability of cutting technique), but, in terms of deboning, etc., they were judged to be relatively highly-skilled even when compared to Japan. Based on the results of discussions with Mongolian representatives, this plan assumes a cutting capacity of 800 to 1,000 kg/person-day, and specifies the specifications of processing machinery to package the processed meat in plastic wrap and store it in cardboard containers.

For reasons of hygiene management, stainless steel, which enjoys wide-spread use in Japan, is to the main material to be used, and machinery that can be used for a long time is to be selected. However, ease of maintenance shall be considered, automation shall be avoided to the extreme and a system shall be frexible in regard to diversification of the processing methods.

The main materials are shown below categorized by process step.

① Carcass pre-chilling	Conversion of existing multi-purpose refrigerated storage room for use as a chilled carcass storage room	
② Carcass conveyance	Hung meat rail	60m, including trolley guide, support and auxiliary girder
	Carcass scale	1 scale, for 100kg, analog type
	Dropper	3 units, 1.5kw electric type
③ Cut processing	Carcass receiving cart	6 carts, 900 x 1,800 x 800mm
	Cart conveyor	3 conveyors, stainless steel (with 12 chopping boards and 8 working tables) 6,000 x 2,100 x 800mm, 0.75kw
	Turn table	3 tables, stainless steel, 1,200Ø, 0.75kw
	High speed cleaning machine	1 unit, 40kg/cm^2, 36 l/min., 3.5kw
	Indoor cart	10 trucks, stainless steel, for carrying bones and fats
	Knife and sharpening rod	1 set, knife sharpening device, disinfecting tubs
④ Packing operation	Conveyor for box	1 set, belt conveyor, roller conveyor, curb conveyor, 0.75kw
	Packing work table	4 tables, stainless steel, 1,800 x 900 x 700mm x 2
	Case of organ	2,000 cases, 20 ~ 25*l* plastic container
	Scale	4 scales, for 50kg, digital type
	Material shelf	8 shelves, steel, 600 x 1,800 x 2,100mm

(2) Loading machinery (Phase II, Phase III)

The number of freezer carts has been decided on as 21, based on the unit load weight per cart of cardboard boxes to freeze and the unit stocking amount. The total number of carts has been decided on as 120 in the 4 rooms plus the inlet room and outlet room sides. Also, 2 forklifts are necessary at both the inlet and outlet sides and 2 manual lifts are necessary as well. The number of pallets has been decided on as 672 for storage and about 10% of that number has been added for freight and as spares, thus the total number of pallets is 750.

①	Rapid freezing	Freezer cart	120 carts, steel plating finish, 650 x 1,800 x 1,500 (6 stages)
	[Phase II]	Electric forklift	2 lifts, loading weight 1 ~ 1.2 tons, 5m lifting
		Manual lift	2 lists, for 1 ton load
②	Refrigerated storage	Pallet rack system	2 systems, 12 pallets (960 kg: 20kg x 8 boxes x 6 stages) x 4 stages x 7 rows
	[Phase III]	Pallet	750 pallets, 1,200 x 1,200, with dedicated self-running guide

4-3-5 Basic design charts

The following diagrams have been drawn up based on the various plans described above.

①	Location map	
②	Site plan	1/500
③	Floor plan (removal of existing refrigeration facilities)	1/300
④	Distribution diagram (renovation of existing refrigeration facilities)	
⑤	Distribution diagram (upgrading of existing refrigeration facilities)	
⑥	Floor plan (area plan of removal of existing facilities)	1/200
⑦	Floor plan (renovation and expansion of facilities)	1/200
⑧	Elevation chart	1/200
⑨	Cross section diagram	1/200

4-4 Construction Execution Plan

Based on analyses of the examined items and collected material obtained through the field survey, issues in the performance of this plan using the Grant Aid Program are examined as described below, and a construction execution plan compiled based on these results.

4-4-1 Construction execution policy

The main implementor of this Project is the Darkhan Meat Plant and, under the direction of the Ministry of Food and Agriculture, it bears responsibility from implementation design to execution handover, as well as for maintenance control after project completion. However, because the objective of this plan is to stabilize the supply of meat products to urban areas, it is essential that the meat supply operation work in concert with the Ministry of Food and Agriculture. With regard to the implementation design and construction overseeing once the E/N has been completed for each phase, based on the contract concluded between the Darkhan Meat Plant and the Japanese consultants, the Ministry of Trade and Industry will oversee the removal, upgrading, and construction work, as well as lump sum bidding on associated equipment that is carried out by the Darkhan Meat Plant with the consultant assistance. The portion of this plan borne by the Grant Aid Program shall specify that the contractor shall be Japanese-based firms.

With regard to project implementation, under the supervision of the consultant and in conformance with the terms and descriptions of each phase of the Project, the contracting Japanese firm(s) will undertake equipment removal and upgrading, and renovation and/or expansion of facilities, as well as the procurement of associated equipment and materials.

The portion of the Project borne by the Grant Aid Program shall be carried out by contracted Japanese firms bidding under a lump sum bidding system, and, in the performance of the work, in addition to special expertise related to the meat processing facilities and refrigeration and under due consideration of the terms and conditions of the contract described below, the required construction execution system shall be established with the absolute minimum number of personnel dispatched from Japan and within the construction period set forth below. In addition, the requirement for a highly-efficient construction execution system that takes into account economical aspects such as the efficient use of local materials, equipment, and labor, and the operation and/or application of materials and equipment on a provisional basis necessitates the selection of a firm and/or firm(s) which possess construction ability in and experience with the said areas.

① Due to local environmental conditions, outdoor construction shall be limited to the period from the middle of March to the middle of November.

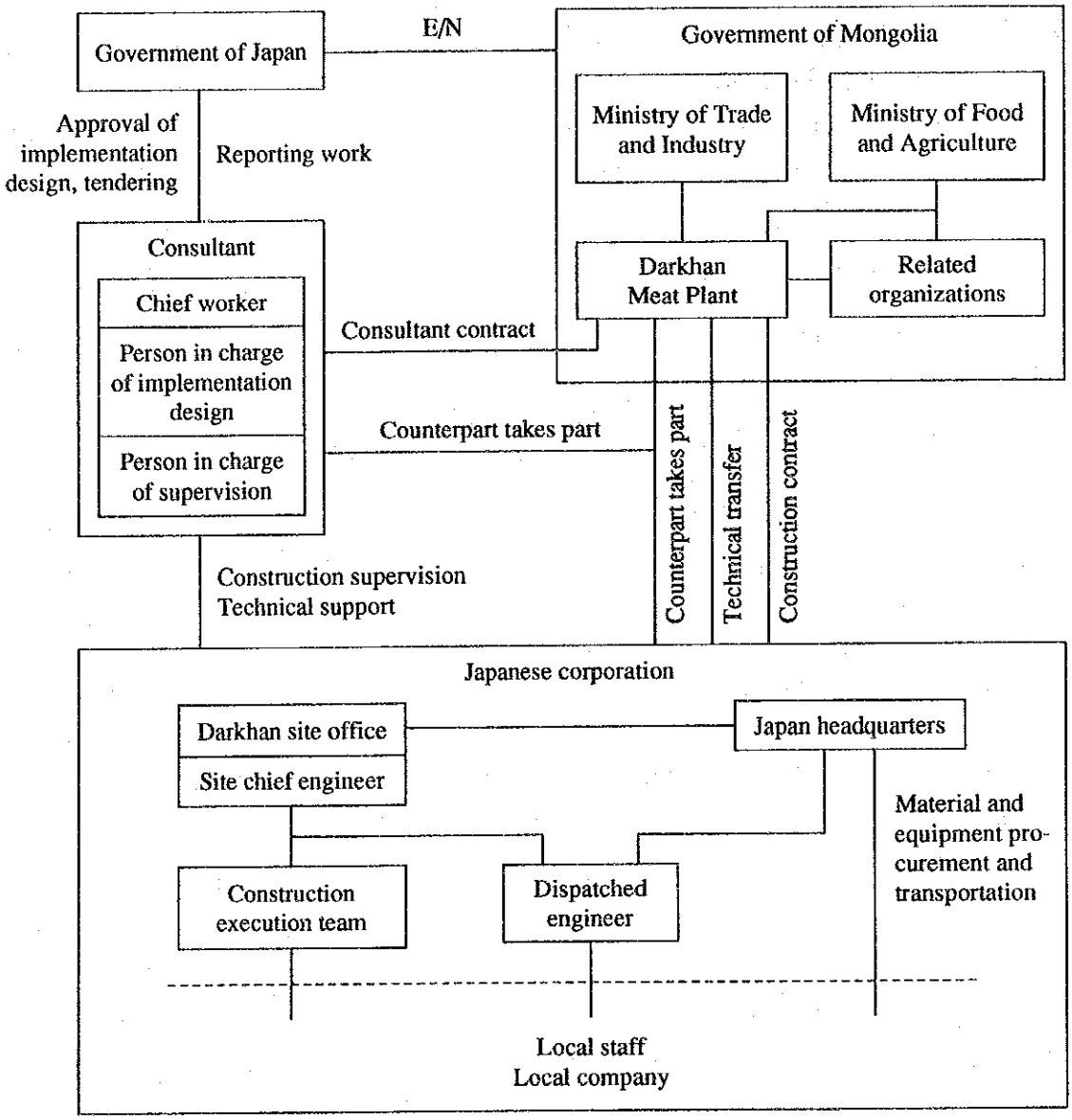
② Because existing facilities are in full operation during the slaughtering and dismembering season from the beginning August to the middle of December, the upgrading of existing refrigeration facilities specified in Phase I shall not be carried out during this period.

③ Additionally, various restrictions shall apply during this period with respect to renovation and expansion work carried out during Phase II and III of the construction.

Most of the local construction firms are smaller sized outfits, and enterprises that build mainly specialty facilities under time constraints similar to those imposed in this plan are rare. Therefore, although local firms may be employed to some extent as subcontractors in basic construction areas such as removal operations, ground preparation, foundation construction, etc., in the other areas, it is thought that technicians from Japan will be dispatched, and, under their direction, fellow Japanese contracting firms will directly utilize the local material, machinery, and labor. Dispatch of technicians is required for welding, plumbing, hydrothermal pipeline insulation, insulation penel work, steel framing, roofing, compressor work, and rack preparation and installation. Note that a local consultant may be employed to obtain the required approvals.

In all construction phases, the chief direct obligations to be borne by the Mongolia side are those related to the Darkhan Meat Plant, including the work entrusted to the Mongolian side; however, the Ministry of Trade and Industry, which is the responsible body, shall compile and implement the basic procedures related to the Grant Aid Program such as contracting consultants and building subcontractors, and the Food Department of the Ministry of Food and Agriculture, which is the administrative body, shall perform adjustments with their counterparts on the Mongolian side.

[Implementation structure]



4-4-2 Building and construction considerations (including procurement of equipment)

In addition to the time restrictions placed on construction, particularly in the winter due to climatic conditions, because it has been decided to procure much of the construction material from Japan due to the fact that only limited materials can be purchased locally, the material and equipment procurement plan, including the transportation thereof, exerts a large impact on the construction process. In other words, purchased materials and equipment must arrive at the construction site at the appropriate times and in a reliable manner. With respect to this requirement, transport to Mongolia is unreliable,

making arrangements undertaken prior to construction start an important component. With respect to construction machinery as well, although these machines, including heavy machinery, can be procured locally, problems exist in terms of their antiquated conditions and in the acquisition of spare parts, and machinery that can be used reliably must be selected. Moreover, because it is anticipated that a gap exists between the experience and ability of local skilled construction workers and laborers and the ability level corresponding to the construction time and quality control required by the Grant Aid Program of Japan, effective utilization planning and management that is in accord with the said ability is required.

In addition, the state of telecommunications in the city of Darkhan is far worse vis-a-vis the situation that exists in Ulan-Bator, where a satellite communications station has been set up. Intra-city service must be routed through a telephone exchange office, and service interruptions on these line are frequent. Thus, because this plan specifies much of the procurement be from Japan—meaning that telephone communication is essential—use of satellite-based mobile telephone communications is required.

As this plan differs from new construction, specifying mainly upgrading and renovation work, field surveys examining the implementation process are essential. Based on the results of these surveys, the handling of the tie-in areas and measures for curing must be formulated, and determination of the main construction steps be resolved. Moreover, because a portion of the work is to be carried out while operations are underway in the existing facility, adjustment with the responsible agencies responsible for administration and control of the facilities on the Mongolia side is required as well.

4-4-3 Construction management plan

A detailed examination based on the basic design will be performed in the execution design. That is, a detailed design to set the concrete implementation process and execution plan will be effected. In particular, attention will be directed to the tie-ins between the existing facilities and equipment, as well as implementation preparation, including the procurement of materials and equipment, and the implementation method and procurement details applicable to the activities currently taking place in the existing facilities. With regard to construction monitoring, rather than technical management of the construction process, consideration of existing facilities and equipment as is performed for the execution design, and operation of the existing facilities and adjustment of the building work are the critical areas. Accordingly, before the construction phase, spot management concentrating on the important phases within the construction process has been determined to be effective.

Consideration of various conditions such as special construction considerations, including the local environmental conditions, the limited construction period, renovation and expansion of existing facilities, the refrigeration facilities, as well as the location's remoteness from the capital and the level of the construction skills at the site require the creation of an adequate construction implementation system. Thus, in addition to the need for a skilled construction superintendent possessing sufficient experience to be on the site throughout the construction period, including during the preparation stage, a total of four engineers skilled in the areas of construction, refrigeration, electrical work, and management must always be on the site, and dispatch of construction implementation and control technicians in accordance with the details and the progress in each construction stage and the progress of reach cosntruction phase are required. As local staff, two interpreters possessing construction-related knowledge, approximately three drivers, a typist, a secretary, one guard each for the day and evening hours, respectively, and various personnel for various other assorted tasks are needed. Note that the dispatch of skilled engineers for the welding, plumbing, hydrothermal pipeline insulation work, steel framing, roofing, refrigeration, and work on the pallet rack system in accordance with the details and progress of the construction in each construction phase is required.

4-4-4 Material and machinery procurement plan

Construction materials that can be procured within Mongolia are limited to sand, crushed stone, concrete materials, concrete block for partitions, brick, a few types of tiles, and ordinary paint materials. These products can be purchased even in Darkhan, but imports must be relied upon for most industrial products. Moreover, due to the unreliable transportation situation, standards, quality and delivery dates of imported materials cannot be assured. Accordingly, excepting the basic construction materials as mentioned above, the material and machinery required to implement this plan shall be procured from Japan. Because the procurement conditions for spare parts and other articles required for future repairs and maintenance service are similar, the policies specified in this plan regarding the improvement of maintenance control, a facility design taking into account durability, selection of material and equipment, reduction in the types and numbers of spare parts, etc., and ensuring of required capacity are as described above in the sections on maintenance control, structural, and material and machinery planning.

Although at present there are two routes to the site from Japan, the 3,900-km Siberian route in which goods are landed at the port of Nakhodoka in the Russian Federation and from there proceed overland by train, and the 1,000-km China route in which goods are landed at the port of Tienjin in China and from there proceed overland by

train by way of Arlen overland shipment by truck being impossible. Although, in distance, the China route is shorter than the Siberian route, because the rail gauge of the tracks in China differ from those used in Mongolia and Russia, the freight must be transshipped at Arlen. However, there is inadequate contact between the two countries for this transshipment, resulting in the routine backup of several hundred parcels. As a result, a minimum of three weeks is required to transport goods from Japan along either route with many goods being damaged or lost when transferring cargo during port call or transshipment, and arrival of goods is sometimes delayed severely. The transport containers are ordinary safety containers, but restrict the length of shipped materials and machinery due to a maximum length of 20 feet that is imposed on the container. Due to these and other restrictions placed on transport, sufficient margin for error must be incorporated into the procurement plan.

4-5 Implementation Process

According to the share classification shown in the next section, regarding the implementation of the items borne by Japan side, the time required for "implementation construction" (including materials and equipment procurement) is as follows. This construction is divided into three Phases as follows, taking the especially severe winter and the influences on the process during the peak operation season of the existing facilities into consideration.

[First Phase] Removal and innovation construction of existing refrigeration facilities.

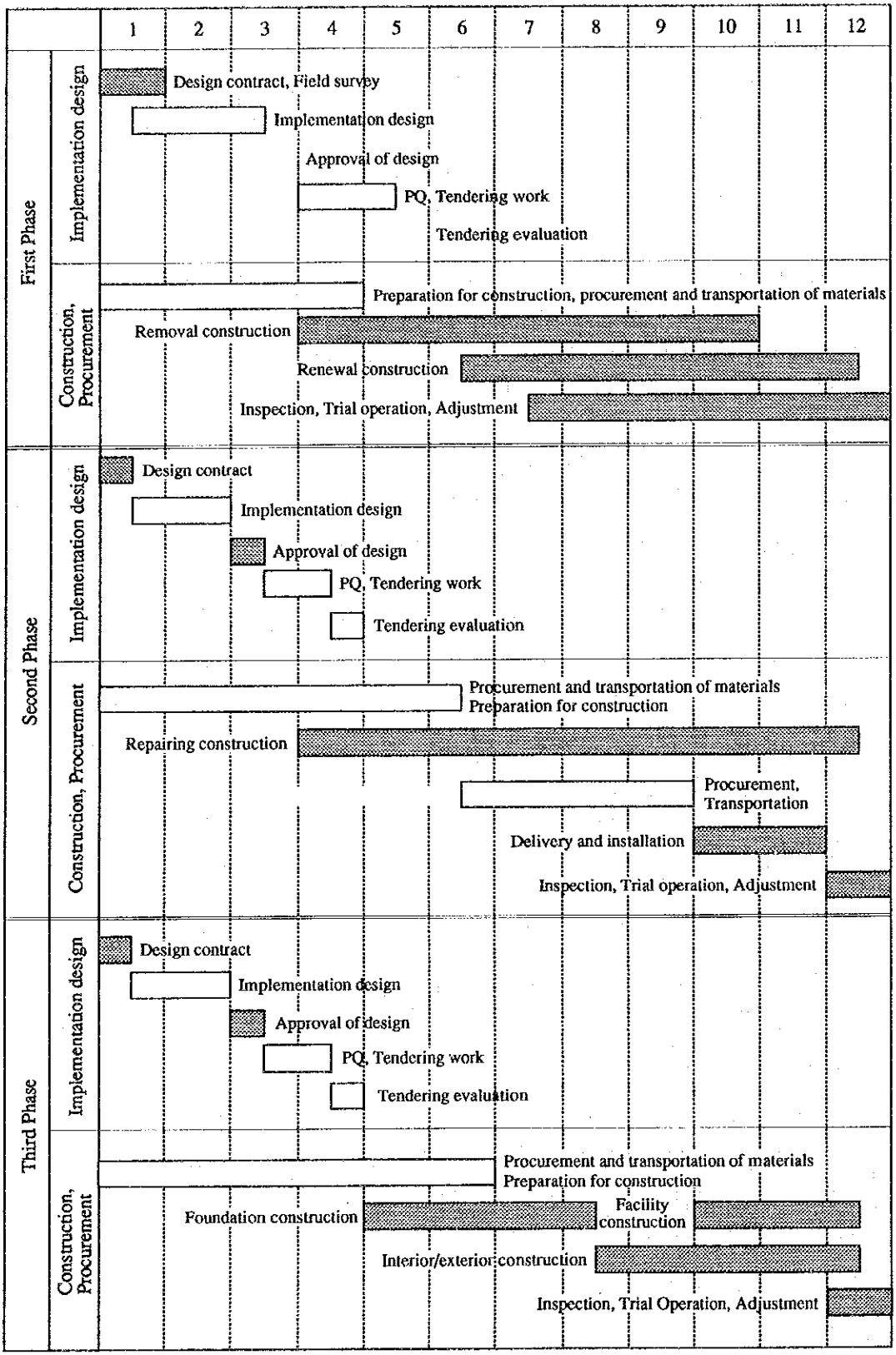
[Second Phase] Installation construction of cut-meat processing facility and cut-meat and organ rapid freeze facilities.

[Third Phase] Expansion construction of refrigerated cut-meat and organ storage.

Supply and installation of materials and equipment required for cut-meat and organ refrigerated storage (except gravity-run pallet rack and pallets which are in the Third Phase) is in the Second Phase.

However, the design was arranged so that installation of the substation, refirgeration facilities and construction for the refrigeration machine room which are a part of the repair and expansion section is included in the Second Phase. The implementation process table is shown on the next page.

[Implementation Schedule]



4-6 Share Classification of Project

(1) Scope of responsibilities borne by the Japanese side

1) Existing refrigeration facilities

- Removal and upgrading of refrigerant lines on low pressure side, and pipeline insulation sheathing work
- Removal and upgrading of unit coolers
- Installation of defrosters for unit coolers
- Removal and upgrading of refrigerant circulation pumps and evaporater condensers
- Provisioning of maintenance control tools and inspection equipment

2) Construction of cut-meat processing facilities

3) Construction of cut-meat and inner-organ rapid freeze facilities

4) Construction of cut-meat and inner-organ refrigerated storage facilities

5) Supply and installation of material and equipment required for refrigerated storage, including for cut-meat processing and inner-organ

6) Work incidental to items 1) to 5) above

(2) Scope of responsibilities on the Mongolian side

1) Removal construction of the existing facilities required for items 2) to 4) above.

2) Securing of work site and establishment of temporary storage shed for materials and machinery, including existing facilities, required for items 1) to 6) above.

3) Preparation of the primary side electricity, cold and hot water supplies, steam supply and drainage required for 1) to 6) above. However, brach connections to the secondary side are to be borne by the Japanese side.

4) Preparation of the primary side power (6kV) required for 1) above and hot and cold water supplies, steam and drainwater. However, branch connections to the secondary side are to be borne by the Japanese side.

5) Consumables and fixtures required for administration, maintenance and management of facility.

6) Measures to expedite unloading and customs clearance of materials and machinery within Mongolia, and measures to exempt material and machinery from indirect and domestic fiscal levies and to expedite domestic transport of same.

7) Maintenance of facilities and equipment, and establishment of an organization and budget for the proper use thereof.

8) Exemption from indirect fiscal levies of goods and services based on the contract, and exemption from domestic fiscal levies.

9) Cooperation with respect to goods and services required for entry procedures and stay of Japanese nationals engaged in this Project in Mongolia.

10) Acquisition of licenses and authorizations required for the execution of this plan such as measures exempting Japanese nationals engaged in project-related construction from domestic taxation and applications and approvals based on domestic laws.

11) Implementation of the efficient reception processing of Japanese nationals engaged in project-related construction and machine operation instructors.

12) Disbursement of payment commissions based on Banking Arrangement (B/A) and issuance of authorization to pay (A/P).

13) Bearing of all expenses other than those to be borne by Japan under the terms and conditions set forth in the Grant.

(3) Construction cost borne by Mongolian side

According to the above classification, the construction cost borne by the Mongolian side is the cost required for items 1) Removal construction of the existing facilities for items 2) to 4) of the scope of responsibilities borne by the Japanese side, and 3) Dedicated intake line of primary side power (6kV) to the newly-installed power substation of item (2) Scope of responsibilities on the Mongolian side. This has been estimated at 4,874,500 Trg. This construction must be completed before Second term construction begins.

Removal construction of existing facilities

Removal subject range : 1,350m^2
Estimated construction cost : 4,780,680 Trg (about ¥3,868,500)

[Estimation conditions]

① Estimation time : April 1993 (as of March 1993 field survey unit price)

② Basic design : Estimated based on separately attached basic design diagram.

③ Exchange rate : As of December 1992, prices have been rising at a high inflation rate of 383% a year. However, recent trends for construction costs have not been revealed. On the other hand, the fixed exchange rate, 150 Trg to 1US$ has been set up for business transactions. Therefore, the rise in the country's prices up to E/N (exchange of note) counterbalances fluctuations in the exchange rate.

CHAPTER 5

PROJECT EFFECTS AND CONCLUSIONS

CHAPTER 5 PROJECT EFFECTS AND CONCLUSIONS

[Effects]

The objective of this project is to provide a stable source of high quality meat products to urban markets. The improvement of existing refrigeration facilities at the Darkhan meat plant through the implementation of this project will, through reduction of the leakage of ammonia used as refrigerant, not only contribute largely toward the improvement of working conditions that adversely affect employee health, but also enhance the refrigeration capacity, improve the quality of the 9,000 tons of meat products (carcass) produced yearly, and reduce loss. Moreover, expansion of the cut-meat production and refrigeration facilities will, in addition to resolving the problem of the current 1,600-ton shortage in storage capacity, contribute to the expansion of the supply of cut-meat, which is graded, of better quality, and liked by consumers more than carcass meat.

Implementation of this project will have the effect of stabilizing the supply of staple meat products to the growing urban population and directly benefit 13 percent of the Mongolian population: the 100,000 people residing in and around the city of Darkhan, the 60,000 people residing in the city of Erdenet, and 20 percent of the 600,000 people residing in the capital city of Ulan-Bator.

The benefits of this plan target the ordinary citizenry, including those stricken by poverty, contributes to the stabilization of the people's livelihood and improvement of the foodstuff most basic to the daily lives of the residents. Because the project calls for the improvement and servicing of existing facilities, Mongolia will be able to perform maintenance, management, and administration using its own funds, personnel and expertise. This project is in agreement with the mid-term and long-term objectives and policies of the said country, and can be implemented through the Grant Aid Program of Japan.

[Conclusions]

Because, as described above, this project is expected to provide several beneficial and far-reaching effects and, at the same time, contribute widely to improving the daily lives of residents, implementation of this project through the Grant Aid Program has been judged to be reasonable. In addition, the system established by Mongolia for the administration and management of this project is believed to suffer from no dehabilitating problems in terms of both personnel and capital. However, with respect to the obligations of Mongolia in the implementation of this project, mutual cooperation from not only the Darkhan meat plant—the main implementor of the plan—but also the Ministry of Food and Agriculture, which is the administrative body, and the Ministry of Trade and Industry, which is the responsible body, is deemed essential.

[Proposal]

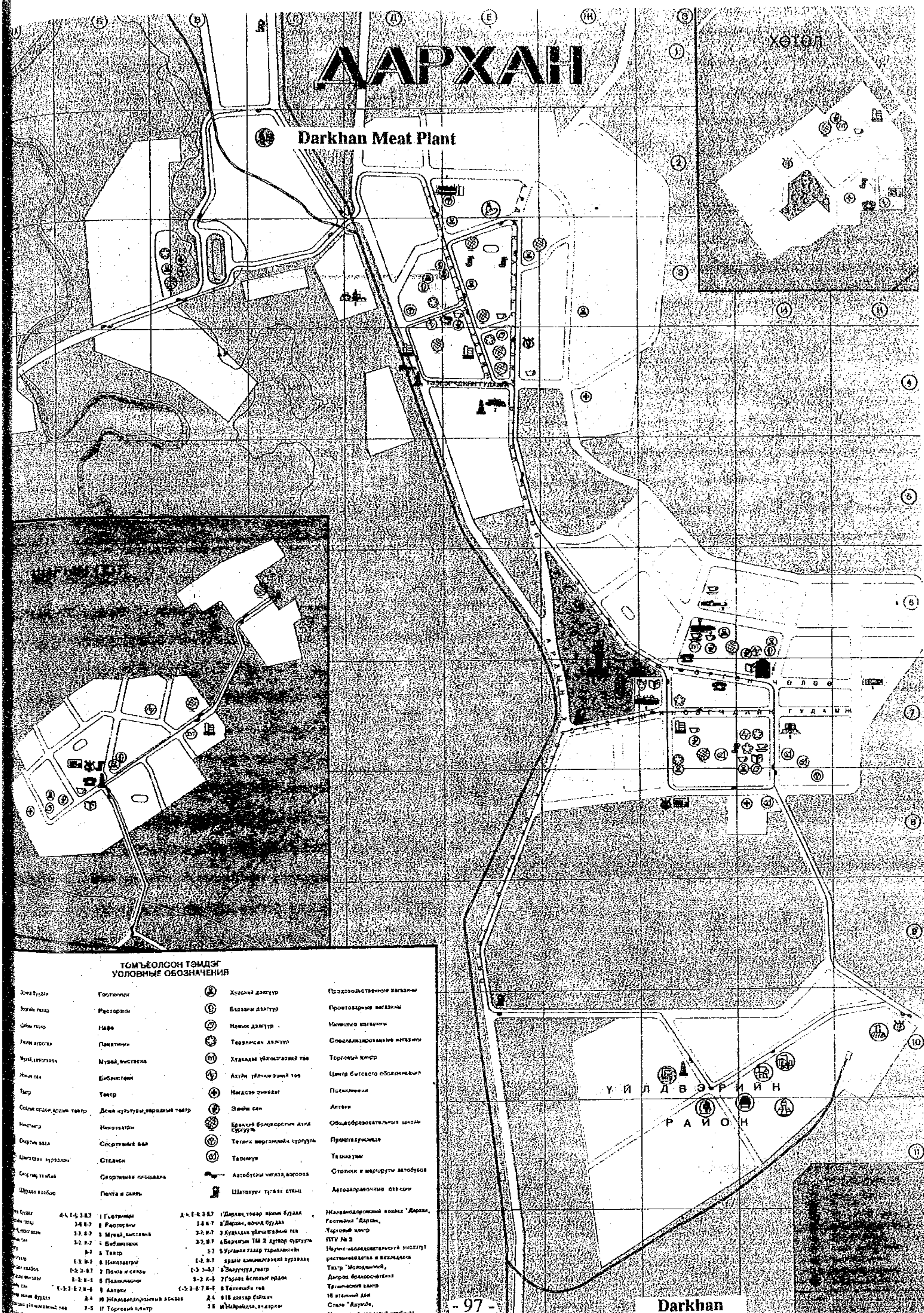
Completion of the maintenance and management system is important to ensure the smooth administration of the facilities after this project has been implemented. The improvement of the maintenance ability with respect to refrigeration facilities and supply lines through the transfer of technology or the utilization of the in-service training system from Japan under the auspices of the Grant Aid Program will lead to minimizing the aging of facilities and equipment and serve to maintain skills. Accordingly, soon after this plan has been implemented, preparation of personnel dispatch with counterparts is essential.

This project will not only have a large impact on expanding the operations of the Darkhan meat plant, but, at the same time, it is anticipated that it will have a great effect on the food situation in Mongolia. Therefore, premised on the liberalization of future food prices, strengthening of the administrative and management system that is adaptable to market and financial trends is required.

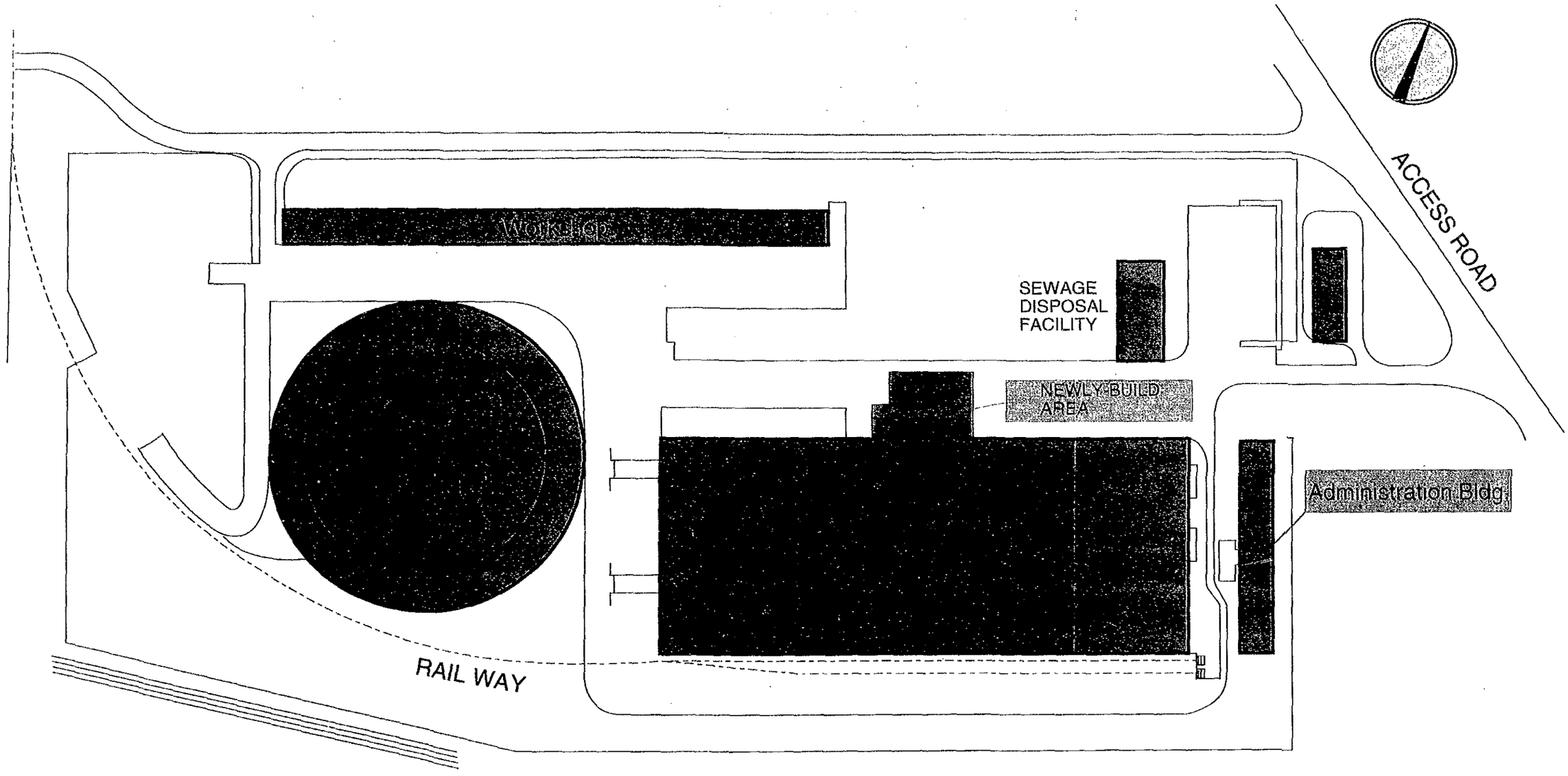
Moreover, in the future, through strengthening the ties between the Ministry of Food and Agriculture, the variously-located meat processing plants, and related bodies, it is desired that the grading of meat as specified in this project will become pervasive throughout the nation, and a nationwide meat distribution and marketing system will be put in place.

Effects of project implementation and how the current situation would be improved

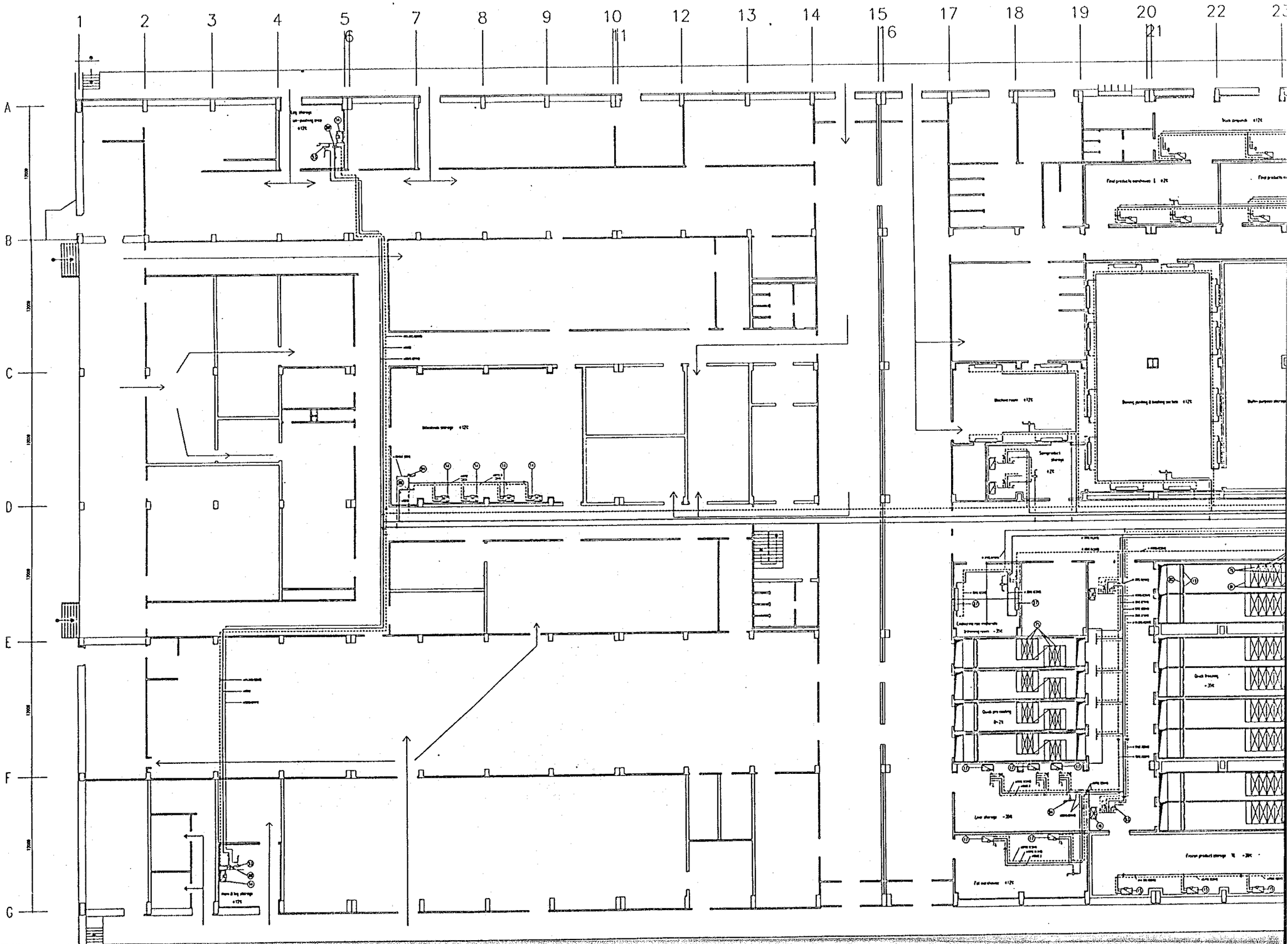
Current conditions & problems	Measures implemented through the Project	Effects of the Project and degree of improvement
1. Existing refrigeration facilities		
The Darkhan Meat Plant has become superannuated and there has been leakage of ammonia, the cooling medium, due to corrosion of the cooling medium pipes, having detrimental effects on the health of employees and product quality. Furthermore, deterioration of heat insulation coating materials and breakdown of defrosters decreases the cooling capability; as a result, product quality cannot be maintained, causing loss.	Excepting the existing machine room, all cooling medium pipes and valves and a part of heat insulation coating, unit coolers, defrosters, cooling medium circulation pumps and evaporator condensers will be removed and renovated. Also, tools and inspection instruments for maintenance control following project implementation will be granted.	By eliminating ammonia leakage in the facility except for withing the existing machine room, the working environment can be improved. Also, the carcass cooling capacity can be improved to about 12,000 tons/year, thus loss due to spoiling can be prevented.
2. Cut-meat processing, production and storage		
The meat supply has been decreasing due to an increase in demand for meat in urban areas and a severe shortage of refrigerated storage capacity because of a shortening of the livestock slaughtering period resulting from introduction of private livestock ownership.	A standardized cut-meat processing production facility with a capacity of 20 tons/day will be installed. A rapid freeze facility for cut-meat and organs with a capacity of 30 tons/day will be installed.	The 1,600 tons of storage lacking at the Darkhan Meat Plant will be provided and the necessary storage capacity of 5,000 tons will be secured. Consequently, a stable supply of meat can be promised throughout the year.
Along with increased production of crops and vegetables, the demand for livestock organs which contain a lot of vitamins has been increasing.	Refrigerated storage with a capacity of 600 tons will be added. Forklifts will be introduced to make product movement more efficient.	It will become possible to secure a stable supply of standardized cut-meat 2,600 tons/year and organs to major cities including Ulan-Bator, the capital, and Darkhan and their suburban areas.
In the ordinary market, meat is being sold in the form of carcasses at sales stores and there has not yet been the introduction and spread of cut-meat tailored to consumer preference (high value-added).		Standardized cut-meat production will contribute to future sanitary control and spread of the standardization of meat in Mongolia.
Since the amount of meat brought to the free market directly has been increasing, the necessity for sanitary control and standardization has been increasing.		The above effects will directly provide benefits to 37% of the approximately 760,000 residents living in major cities including Ulan-Bator, the capital, and Darkhan and surrounding suburbs, this number being equivalent to about 13% of the total population of Mongolia.


ДАРХАН
Darkhan Meat Plant
хотол
ТОМЪЁОЛСОН ТЭМДЭГ
УСЛОВНЫЕ ОБОЗНАЧЕНИЯ
ҮЙЛДВЭРИЙН
РАЙОН

Darkhan



Plot Plan of Darkhan Meat Plant S = 1:1,500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