Further, because of the large number of members in the estates management department, and, their need to work at night and an holidays in order to prepare for emergencies a vice manager will be appointed.

(5) Housing Management Department

This department is in charge of the operation and management of the housing at the IMT (high density, middle density, low density) and carries out the management of business such as the development of houses, sales, checking in and out of the tenant, the collection of rent, and the maintenance and management of the houses. This department consists of a housing business section and a housing maintenance section.

9.3.2 Scope of Work in Each Department

The scope of work in each department of the IMTPC is as follows:

(1) General Affairs Department

(a) General Affairs Section

This section carries out the general office work of the IMTPC such as carrying out the office work connecting the operation of the organization of the IMTPC, counter work, the personnel, the adjustment of connection with the investing agency the parent companies, the conferences by the managers, and the adjustments needed in connection with the other departments or sections in the IMTPC.

(b) Accounting Section

This section carries out the accounting of management for the IMTPC. The section is in charge of the reception and payment of money and the making of financial reports excluding the making of the budget and houses which are independently accounted.

(c) Operation Section

This section carries out the work needed for operation such as public information, advertisement, the issue of printing and the grasping of data on the condition of tenanting, etc. It also carries out the operation and management of the building of the Promotion Center itself and the training rooms and the conference rooms.

(2) Planning and development Department

(a) Planning and Development Section

This section is in charge of the work concerning on the development of the IMT and manages to carrying out of construction.

(b) Sales Promotion Section

This section is in charge of the work concerning the sales of the estates to the companies expected to move into the IMT and offers information to the locating companies in connection with the Investment Promotion Section.

(3) Promoting Department

(a) Investment Promotion Section

This section manages the function of promotion as the Operation Center shows above and the work is the same as is in "9.2 The Operation Planning of the Promotion Center".

(b) Business Support Section

This section offers various information and consulting service to support the locating companies. It consists of two groups, one being the company support group supporting the interchange of companies, universities and technical institution and the other exchange group.

(c) Technology Supporting Section

This section carries out the introduction of proper institution or companies to the locating companies and local companies according to their technical needs, adjustment of the training organization to increase the skill of the workers, and holding voluntary training seminar. Especially, the intermediation of the approach to R&D leads to the promotion of local companies (minor enterprises) and the establishment of the local companies to be entrusted a part of the IMT management business which makes for the first stage of technology support and makes use of the high- rational management of the IMT.

(d) Data and Information Room

According to requests, this room provides an information service on the collection of data, various books and data bases for investment promotion.

(4) Estates Management Department

(a) Road Management Section

This section controls the work of the road management office in this objective of the management of roads at the IMT and carries out the planning for repairs, the making of a budget and the ordering of constructional repairs.

(b) Parks and Green Belt Section

The objects of concern for this section are the parks and green belt in the IMT. This section controls the work of the park management office, and the management of the

formulation of work for operation and management, and the investigation of use of the parks, etc.

(c) Water Supply Section

This section controls the work of the water supply and drainage offices the facilities for the water supply of the IMT, plans management, and makes sure water supply data is available for the collection of changes. This section also commands the repairs needed in case water supply lines are damaged, etc.

(d) Waste Water and Sewage Section

This section is in charge of the management of waste water and sewage (waste water treatment plant, water-conveyance pipe, etc.) at the IMT, it controls the sewage water and sewage office, collects data in order to receive charges, and makes plans for management.

(e) Electricity Section

This section controls the machines for the supply of electrical power, the facilities for fuel, the varying-voltage facility, power transmission facility and the power generation facility (the power generation office). The section also formulates a plan for the power supply and the office makes commands for repairs.

(f) Pollution Control Section

This section is in charge of the work concerning the treatment of industrial solid waste (collection, transfer) and the measurement of pollution. If also controls the water supply and the sewage water office carries out the field work. As for pollution control, the objectives of this section are all concerned with pollution control such as the sewage water treatment plant, the power station, etc. This section also formulates a plans for operation and management, management manuals and the agreements for the prevention of pollution.

(g) Road Management Office

As for the branch of the road management section, this office carries out actual services such as checking, cleaning and repairing. The office consists of management engineers, the officers and working groups (road cleaning and repairing group; checking, cleaning and repairing the road belongings group). The office is set up at a vacant space inside the IMT or at the parks and green belt.

(h) Park Management Office

As for the branch of the park and green belt section, this office carries out checking, cleaning, pruning and trimming, additional plantation and repairing, etc. This office consists of management engineers, the officers and working groups (the management group of path-and-open space, the management group of plantation-and-the facilities for

landscape design, the facilities for use management group, the facilities for rest, the facilities for the management groups). At the same time, this office makes and revises a ledger of the facilities, makes daily reports, manages the fields for seedling. The office is set up in the corner of the park, and owns machines needed for the management.

(i) Water Supply and Waste Water Office

As the common branch of the water supply section, the waste water section and the pollution control section, this office carries out actual services such as operation, checking, cleaning and repairing of the facilities of each section. This office consists of management engineers, the operators, the officers and the working groups. This office makes the ledger and the daily reports and carries out measurement of leakage, prevention of accidents, the disposal of sludge, the affair of slips and measurement of pollution. The office is set up at the site of the sewage treatment plant or the distributing reservoir.

(j) Power Generation Office

This office is in charge of the actual operation and management of the power generation facilities (facilities for fuel, electrical power facilities, substitution facilities, building, exterior facilities) and the power transmission facilities. This office consists of management engineers, operators of the machines, officers and working groups (facilities for fuel group, electrical power and power transmission group, cleaning and repair group, building group) and makes a ledger and daily reports. The office is set up in the corner of the power generation building.

(5) Housing Management Department

(a) Housing Business Section

This section is in charge of the service of the data management of moving in or out of the resident area, receiving of rent and the service for operation and housing development. The account of the housing takes charge on a self-supporting basis.

(b) Housing Management Section

This section is in charge of the management of housing, reading toward self-management, and the controlling of the housing, management office, a branch of this section. In the case of receiving the payments by hand, implementation is made through this section.

(c) Housing Management Office

This office is in charge of the actual services of the housing buildings, the housing facilities and the exterior and is a branch of the housing management section. This office also manages the public parking lot in the case of one is built. A house in the central housing zone is used as the management office.

(6) IMT Liaison Council Secretariat

This secretariat is committed to various activities of the located companies and consists of the planning committee, the industrial policy committee, the environmental improvement committee, the health and welfare committee, the security and sanitary committee and the international exchange committee. The committees consist of people from the located companies and discuss operation and management. This secretariat deals with general office work (adjustment of contacts, information of holding conferences, holding events, etc.)

9.3.3 Figure of the operation and management organization

Figure 9.3.1 shows the organization in the operation and management in IMTPC, relating to the contents of "9.3.2 Scope of Work in Each Department."

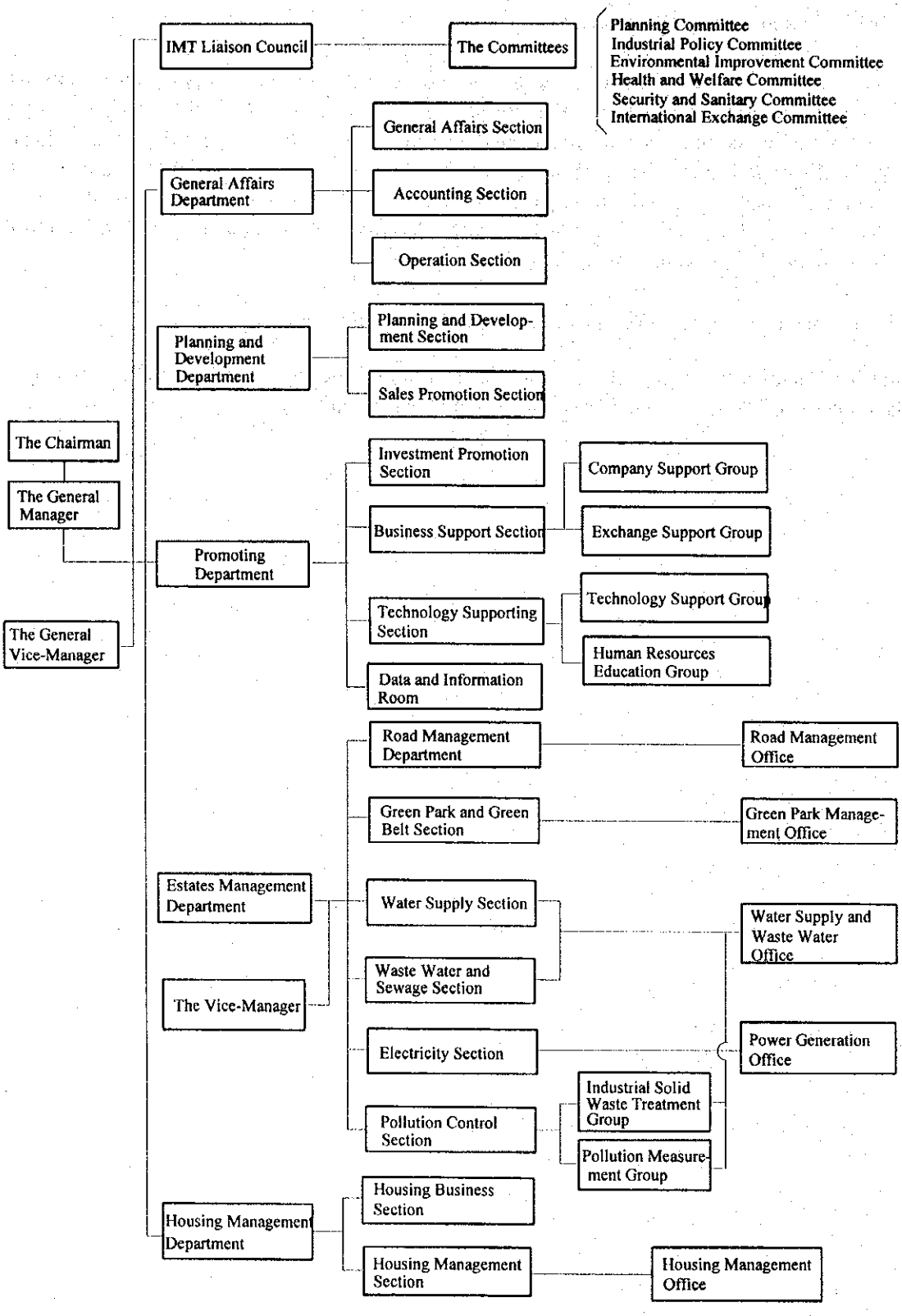


Fig. 9.3.1 The Operation and Management Organization

9.3.4 The IMTPC Implementation Plan

(1) Phased formation of the organization

The IMTPC organization should be extended gradually in pace with IMT's construction of infrastructure and with the level of occupancy of the industrial estates by companies.

The formation of IMTPC is envisioned to be effected in the following three steps. (Please refer to Figure 9.3.1.)

(a) Initial phase of construction (up to 2 years from ground breaking)

The initial functions of IMTPC have to do with IMT's construction work and activities related to attracting companies to the industrial estates. For this reason, such general affairs functions as general business administration, financial administration, public relations and management of constructed facilities are needed from the initial stage and a "General Affairs Department" will first be established. Other functions needed relate to administration of IMT's initial development capital investment, planning administration and marketing of completed factory plots and a "Planning & Development Department" will also be established. At this point, the Promotion Center will not have been completed and IMTPC will work out of either Haryana Bhawan in Delhi or the IAG building.

(b) Intermediate phase of construction (year 3 to year 5)

In this second phase, the construction of infrastructure will have progressed and IMT's estate management functions such as the management of roads, parks and green belts, water supply, waste water facilities, electrical power and treatment of industrial waste and pollution prevention will be transferred to IMTPC so that a "Estates Management Department" will be established. As needed, "Local Management Offices" will also be set up under this central management department to facilitate a service system that focuses on details.

The Promotion Center is the headquarters for IMTPC and should be finished by this time. Upon completion of the Promotion Center, IMTPC will occupy this facility to perform its management tasks.

(c) Final phase of construction (year 6 to year 10)

In the third phase, construction of housing and other facilities will progress in addition to infrastructure construction. To manage and operate these facilities, IMT's management and operation function, development and marketing of housing, occupancy of housing, collection of rents, maintenance of housing will be transferred to IMTPC and a "Housing Management Department" will be established. Further, at this time, a "Promotion Department" which will be responsible for implementing IMT's additional functions (Investment Promotion, Business Support, Technical Support, Human Resource Development) and for the accumulation of information needed to implement these additional functions will be established.

At this phase, since the functions of development, planning and marketing will have been completed, the "Planning and Development Department", an IMT development related department will be trimmed down to a small group consisting only of managers and assistant managers.

IMTPC's organizational structure at this point will be as shown in Figure 9.3.1.

(2) Phased introduction of functions

The various functions of IMTPC will be incorporated parallel to the phased formation of the organization.

The role of Investment Promotion focuses on providing information necessary for overseas corporations in deciding whether or not to locate facilities in the industrial estates, and as such must have the most up-to-date information available on the timely basis. The following information must be included:

- Information concerning law and tax issues as relate to the formation of legal entities by overseas corporation
- Information concerning restrictions in and support systems for investment
- Information concerning services that are indispensable to business activity (water supply, drainage, electric power, transportation facilities, telecommunication facilities, labor conditions, treatment of industrial waste, etc.)

There are two types of Business Support and Technical Support. One that needs to be implemented as soon as possible and the other that needs to be implemented within a mid to long term period depending on the needs of the companies that open facilities at the industrial estates. For both these types, the basic information providing function must be put in place as soon as possible.

Relative to the Business Support function, the preparation of the following essential information and the medium through which such information is disseminated is an issue requiring action in the short term.

- A directory of subcontractors and other support companies (nature of business, capital and other information about the company size, technical expertise of the company including whether or not the company possesses certain patents, financial condition, etc.)
- Information concerning export agents
- Information concerning trading companies, advertising companies and other such service companies
- Information concerning contractors for constructing factories, offices and other such structures

- Information concerning banking services for obtaining capital, effecting transfers and other such financial dealings

- Information concerning product pricing, demand, competition and other such marketing issues

Relative to the Technical Support function, the dissemination of the following essential information is an issue requiring actions in the short term.

- Information concerning standards and restrictions on individual product, the government agency in charge and period of testing.

- Information concerning pollution standards and permits and notifications necessary for establishing factories.

In the field of Business Support and Technical Support, provision of information is considered an issue requiring actions in the short term. Whereas the short term emphasis is on provision of information, in the mid to long term, the function of IMTPC should expand to include agency functions (including the services of lawyers, tax accountants, accountants, management consultants and other such specialists).

The information involved in the information provision function is complex and sorting this information to produce an explanatory booklet will involve much effort and know-how. For this reason IMTPC should initially limit itself to being the point of first contact and traffic controller, determining and introducing the relevant agencies to the inquiring companies. Realistically, explanatory booklets should be gradually prepared based on the information so accumulated and with the cooperation of such agencies.

The Human Resources Development and Technology Exchange Support functions relate to the varying needs of the companies establishing facilities and is considered a mid to long term issue.

(3) Personnel plan

In order to carry out its everyday duties, IMTPC will require a manager and staff as well as the experts in relevant fields necessary to provide business support services.

(a) Cooperation with external agencies

HSIDC will be involved except in those fields in which the private sector performs the management and operation functions. This means that the experience of HSIDC in management and operation may be utilized at IMT.

However, though housing and other facilities will be constructed at IMT, there is insufficient expertise in the management of such facilities. For this reason it is necessary to reinforce the organization by staffing from such highly experienced agencies as HUDA and HSEB.

(b) Employment and training of experts

As has been explained earlier, IMTPC has the function of promoting various industries. For this reason, personnel with the relevant expert knowledge should be recruited from the outside.

Educating IMTPC internal personnel to fill these roles may be considered in the future.

① Acquiring necessary personnel for short term actions

It is necessary to acquire 2 to 3 personnel for the Investment Promotion function, the Business Support function and the Technical Support function in order to effectuate these short term needs and to form a nucleus for mid to long term actions. Since HISDC is currently unable to satisfy all these functions, enlistment from the outside is unavoidable. Agencies from which such personnel may be enlisted are:

- Investment Promotion function: IIC, CII, private sector (employees of companies in India and overseas)
- Business Support function: The department of industries of the state government, others
- Technical Support function: The department of industries of the state government, employees of the department in charge of industrial standards, the Pollution Control Board, others

In order to achieve an international level, in the event the management and operation organization is unable to acquire the necessary personnel on its own, the cooperation of international organizations and overseas aid organizations should be sought with such organizations sending experts to effectuate the short term actions and to train personnel for the mid to long term actions.

② Policy relevant to the mid to long term actions

For the functions of Investment Promotion, business support and technical support, the results of the short term actions should be determined and evaluated and the scope of these functions expanded.

The function of Human Resources Development will focus on assisting companies in the training of local staff through providing facilities for study groups and seminars (consideration should be given to a charge for the use of such facilities) and introducing lecturers and experts for corporate training programs. This function involves understanding the needs of the companies setting up facilities in the industrial estates and planning training programs that fit these needs and to fulfill this function either a personnel should receive the necessary training to become an expert or an expert should be enlisted from the outside.

The function of Technology Exchange Support will involve planning and executing

trade shows and symposiums as well as technical exchange programs between the companies with facilities in the industrial estates and local businesses, universities and other research facilities and government agencies. For these planning and execution roles, it will be necessary to train personnel by sending them to receive training at such agencies as CII that perform similar functions.

Table 9.3.1 The IMTPC Implementation Plan

Item	Initial phase of construction (up to 2 years from ground breaking)	Intermediate phase of construction (year 3 to year 5)	Final phase of construction (year 6 to year 10)	After completion of construction
[The IMTPC organization]				
· General Affairs Department	●	○		
· Planning & Development Department	●	○		Δ
· Estates Management Department		●	○	
· Housing Management Department			●	○
· Planning & Development Department			●	○
[Industry Promotion functions]				
· Investment Promotion function	●	○		Δ
· Business Support function		●	○	
· Technical Support function			●	○
· Human Resources Development function			●	○
· Technology Exchange Support function			●	○

(Note) ●: establish department or function;
○: reinforce organization/expand scope of function;
Δ: decrease scope of function

9.4 Operation and Management Planning of Infrastructure in the IMT

9.4.1 Roads

The national road No.8 expected to be constructed across the proposed site of the IMT is excluded from the items for management because it is under the control of the Public Works Department (PWD) of the central government. It is considered that the HSIDC, the existing developer, construct the roads in the IMT. The national roads should be excluded from this object.

There are road surfaces, gutters, objects belonging to roads, etc., in the management. The type of management, the method of work and the implementation of work are as follows:

(1) Objects: Pavement of roads (roadways, sidewalks), shoulders of roads, gutters, rain inlet chambers, objects on roads (traffic signs, guardrails, reflecting mirrors, etc.), streetlights, road making, etc.,

(2) Methods: As for checking, cleaning, and repairing, the management of the above-mentioned objects is given in the following table.

Table 9.4.1 : Method of Operation and Management of Roads

Objects / Kind	Pavement of Roads	Shoulder of Roads	Gutters	Rain Gathering Inlets Chamber	Adjuncts on Roads	Roadside	Street Lights	Marking
Checking	All objects are checked periodically.							
Cleaning	Pavement and shoulder of roads are cleaned by road cleaning team. It removes a solid and sweeps dirt and sand. It removes weeds from the shoulders of the roads.		The road cleaning team cleans dust and polluted mud. Same place will be cleaned two or three times a year.		-	The dead leaves, boughts, etc. are removed.	-	The same as pavement of roads.
Repairing	The pavements are repaired (suitably).	The shoulders are repaired (suitably).	The damaged places are repaired (suitably).	The damaged places are repaired (suitably).	The damaged places are repaired (suitably).	The damaged or dead trees are removed and the new ones are planted (suitably).	The damaged places are repaired and the burned light bulbs are changed (suitably).	The damaged or worn-out markings are remarked (suitably).

The following are some methods in operation and management to which additional attention should be paid.

(a) Because the passing of heavy vehicles cause a hollowing in pavement, making the plans for repairing the pavement and restatement is implemented periodically.

(b) Objects adjunct to roads, such as streetlights, etc., are suitably repaired according to the periodical patrol or the report from passengers.

(c) The maintenance and management trees along the street are entrusted to the plantation group of the park and green belt because of its requirement of technical knowledge.

(3) Implementation of work

The paving, cleaning and maintenance of the facility adjuncts on roads are included in the work of management. The group for regular road cleaning needs to work, with 1 working vehicle and 5 to 6 laborers and the working vehicle cleans at the rate of 2 to 5 kilometers per hour. The checking and maintenance group concerned with the facility adjuncts on roads consist of 2 to 4 laborers including technicians. They patrol and check the objects for management and repair in case of damage. Repairing of pavement and the facility adjuncts on roads is entrusted to road construction companies.

9.4.2 Parks and Green Belt

HSIDC, as a developer or contractor undertakes the concrete development of the park and the green belt of the IMT. All the facilities in the park and the green belt are the objects for management.

The sort of management, the method of work and the implementation of work are as follows:

(1) Object: Here there are two objects: the park and the green belt. The pathways, plantation, etc. are needed for both objects. The open space and the facilities for visitors' needs are set up in the park and mentioned collectively. Therefore, the objects of the facilities are those for landscape design (the pathways, the open spaces, the plantations, the horticulture, the ponds, etc.), those for visitors' needs (parking, lavatories, etc.), and those for management (the gates, the fences, the lights, etc.). As for the human resources, the daily work is implemented by laborers in charge of upkeep.

(2) Method: The checking, cleaning, pruning and trimming, additional plantation, repairing, etc., are implemented as discussed above-mentioned objects and facilities. The following table shows the method of upkeep.

Table 9.4.2 : Method of Operation and Management of Parks and Green Belt

Objects / Kind	Path Open Space	Plantation and the Landscape Design Facilities	The Facilities for Visitors	The Facilities for Rest and for Management	Notes
Checking	The pavement is seldom checked but the gravel path and open spaces are checked periodically for unevenness. Particularly, basically, the drainage is checked carefully.	They are checked by paying attention to the death of plantation. In the flowerbeds the flowers are always additionally planted and changed so the flowers at that bloom each season are listed up and planted accordingly.	In case lavatories is set up, they are ease to become dirty and to be damaged therefore, they are always checked for choking up.	The damage of rest spaces (house, pergola, etc.) and benches are checked.	Setting the limit of use according to needs, the conditions are checked and plans for repair are formed.
Cleaning	The path and open spaces are easily littered, so should be cleaned periodically. The method is the same for the cleaning of the roads. The gutters of the park and the green belt should be cleaned of leaves and branches.	The trash thrown in the hedges to be removed. The patrol and the removing of trash manpower are carried out.	The lavatories are cleaned suitably and checked, chamber pots are also cleaned.	Litter is removed and the dust, mud etc. are also removed.	-
Purring Trimming	-	The hedges along the landscape design facilities are pruned at a fixed height to maintain beautiful scenery.	-	-	The fertilizing, the weeding, the trimming, getting rid of damaging insects are carried out according to needs.
Additional planting	-	The dead plantation is checked, removed, and planted additionally. The flowerbed is changed according to the plantation plan.	-	-	
Repairing	The repairing of damaged areas, the re-paving of pavement, and the adding of gravel to the gravel path are carried out.	The simple facilities such as flower grants are easily broken and need to be repaired in order to maintain an effective view.	The repairing of the parking lot is the same for the path repairs. The washstand, and the water clock are easily damaged due to mischief so are in need of repair.	The facilities which visitors tend to use, such as benches are easily damaged due to mischief and need restoring promptly not to be broken for any duration.	

The following are some methods of operation and management to which additional attention should be paid.

(a) Long-range planning for operation and management

The documentation for the method of operation and management of the pathways, the open spaces, the plantation and the facilities for landscape design, for visitors' needs, for rest, for management, the useful facilities for visitors, the transplanting and improving of the plantation for the long-range schedule is made.

(b) Short-range planning for operation and management

The short-range plan for the objects mentioned in the long-range plan for the guide to the operation and management is made.

(c) Preparation for the daily report of the operation and management

The report of the daily work is prepared and the state of the operation and management (the data and time, the names of laborers, the contents of the implementation of work, etc.) is written.

(d) Survey of visitors

The investigation of visitors is divided into a variety of items such as time, spots and age, which is implemented and information about the problems of the operation and management or availability of the facilities is obtained.

(e) Preparation for the list of the facilities

The list of all the facilities within the park and the green belt is prepared and it is made for the use of management.

(f) Reformation of the facilities

The facilities or the facilities for visitors' use which need reformation are checked and reformed suitably.

(g) Seedlings Nursing

In the case of death of plantation due to bad soil or wind, new plantation is added and flowers according to their seasonal blooming are transplanted. It is considered that supplying of plantation will be from the external companies and seedlings shall be planted in the field inside the green belt.

(h) Compost made of pruned boughs and trimmed leaves

The plantation and the flowers are fertilized. The pruned boughs and trimmed leaves in the park and the green belt are made use of as compost, i.e. a natural fertilizer.

(3) Implementation of work

The main upkeep work in the park and the green belt consist of cleaning, maintenance and safety preservation. A working group (about 5 laborers) promote work periodically, non-periodically and especially provide machines necessary to enhance the uniformity. Further, the management group of the park and the green belt also manage the trees along the street because they possess the know-how of the maintenance of the plantation.

9.4.3 Water supply and Drainage

(1) Water Supply

In general, the PHED is in charge of the water supply and manages the water conveyance pipeline from the treatment plant outside the IMT to the stop valve in the IMT. The PHED manages the treatment facilities inside the IMT (distributing reservoir, water conveyance pipeline, etc.) and the meters of each company.

The objects, the methods and the implementation of work for the water supply are as follows:

(1) Objects: The operating machinery, the meters, the distributing reservoir, the exterior facilities, the water conveyance pipeline and works are done by laborers.

(2) Methods: The above-mentioned objects are operated, checked, cleaned, repaired, etc. and the methods for this are shown in the following:

Table 9.4.3 : Method of Operation and Management of Water Supply

Objects / Kind	Operating Machinery/Meter	Distributing Reservoir	Exterior Facilities	Water Conveyance Pipeline
Administrative operating	Ordinary operation is implemented by the technicians for the pressure conveyance machinery, meters in charge of the control of amount of flow, etc.			
Checking	The machinery and meters are checked periodically.	Sampling physical or chemical checking for water quality is implemented; foreign substance and sedimentation in the distributing reservoir are checked up on once or twice a year; distributing reservoir tanks made of steel or plastic are checked up inside by emptying.	Exterior consists of premise path or hedge. See the article of roads, green belt.	According to the information on the construction works near the buried pipelines, if needed, giving attention and observation are implemented. As the line of machines used in the water filtering, plant or mixed in the water stick to pipe, it is possible to reduce water flowing quantity, and perhaps prompt rusting. Checking up is implemented once a year. In the future, worm water pipelines are needed to be checked up on for water leakage. The way of stopvalve is checked up and the changing of manholes is also checked on
Cleaning		Distributing reservoir is cleaned and also the inside once or twice a year.	Exterior is premise path or hedge. See the article of roads, green belt.	
Repairing	By periodical checking or due to operation trouble, the parts out of order and machinery are repaired.	When a changing in the wall is found, it is repaired.	Exterior is consists of premise path or hedge. See the article of roads, green belt.	The damage of pipeline accompanied with other roads construction works often happen. If an accident is left alone for a long time losses of water result and a set of needed repairing machine should be ready for emergency.

Some measures to be kept in mind for operation are as follows:

(a) Long-range planning for operation and management

The operational checking of the machinery, checking, cleaning, repairing, the renewal of the facilities beyond the durable length of time are planned in the long-range according to the kind of facilities, i.e. civil engineering facilities such as the operating machinery and the meters, the distributing reservoir, the water conveyance pipeline in the exterior facilities, the aim, and the scale. The implementation of work for maintenance and management concerned with the organization, the budget and the source of revenue, etc., are studied.

(b) Short-range planning for operation and management

The planning of the work implemented in a short term for the items mentioned in (a) is formed.

(c) Preparation for the ledger of the management

The charts of the main feature of the facilities for the management (structure, site, scale, method, the set-up date, etc.) are prepared for useful management.

(d) Preparation for the daily report of operation and management

A diary of everyday work of the operation and management are kept and the records on the conditions (the date, the names of laborers, the details of work which were implemented) are made to be submitted to managers and the form and the manual of the diary are decided.

(e) Measurement of leakage of water

The leakage of water is found by the reporting of citizens, the patrol of the organization and the examination, or inspection of a meter. In general, the leakage of water is prevented by: 1. setting up of the area for examination, 2. examining of the tubes, 3. equipping and repairing of the stop valve and the fireplug, 4. adjusting the water valve, 5. measuring the amount of leakage, 6. discovering and repairing the place leakage, 7. the investigation of the results of repairs, etc.

Since it costs too much to discover and prevent leakage systematically, it is necessary to set a target that will allow the practical prevention of water leakage, then considering the amount between the loss of the leakage of water and the cost of the work, and then implementation the work according to the cost.

(f) Provision for accidents or power interruption

For laborers who can promptly cope with the machines out of order, the checking and the accidents of water conveyance pipelines, vehicles and machine and materials are prepared and the action manual to achieve the measures are formulated. Some measures

are taken to manage the urgent situations such as power failure.

(3) Implementation of work

The operation of the machinery, checking and repairs are implemented by each group. The cleaning group of the other infrastructure facilities serves concurrently with the cleaning of the facilities of the water supply.

2. Sewerage and Drainage

The drain pipes are under the control of the PHED as for like the water supply and the IMT manages from the drain pipes of the sewage constructed by the roads in front of the site of the companies to the main drain pipes of the PHED through the treatment facilities in the IMT.

Each company implements the primary treatment and after the secondary treatment at the treatment plant in the IMT, the sewage water is discharged outside the IMT. Therefore, the checking of water after the primary treatment and the testing of the quality of the water toward the standards of the sewage to the main drain pipelines of the PHED is necessary and it is required for the IMT to manage the quality of the water.

The objects, the methods, the implementation of work for the drainage are as follows:

(1) Objects: The machinery for operation, the meters of the sewerage treatment plant, the sand basin, the exterior facilities, the drain pipelines, etc.

(2) Methods: The operation of the machinery, checking, cleaning, repairing are implemented to the above- mentioned objects and the methods are shown in the following table.

Table 9.4.4 : Method of Operation and Management of Drainage

Objects / Kind	Sewage Treatment Plant			
	Operating Machinery/Meter	Civil Engineering Facilities such as Grit Chamber	Exterior Facilities	Drainage Pipeline (including manholes)
Machinery operating	Lubricating machinery should not be neglected because the sewage causes an enhancement in the rusting machinery and operation trouble.	The excess sludge is adopted and discharged periodically. According to the examination of the condition of the activated sludge, raw sludge is added, if necessary.		
Checking	The work of machinery and meters are checked periodically.	The conditions of sedimentated soil and sand, and those of mixture of foreign substances are checked. Voluntary examination is often implemented to check whether the quality of sewage water is below standards.	The exterior mainly consists of the premise roads and hedges. See road, park and green belt.	The conditions of the dirt attached and the sediment are examined by the inspection from the manhole. According to the shape of water surface in the pipe, the substance of drainage pipe is inspected. The inspections are implemented several times a year. The quality of the first disposal water from each company is examined several times a year to check whether it is below standards. The examination is held by the PHED.
Cleaning	Periodical cleaning around the machinery is implemented.	The sand accumulated in the grit chamber is discharged periodically. Some large foreign substances attached to the screen are checked several times a day and the substances large enough to be picked up are removed early and the water flow should be smooth.	The exterior mainly consists of the premise roads and hedges. See road, park and green belt. When the excess sludge is ejected by trucks, the trucks become dirty; therefore, the tires are cleaned lest the roads in the IMT should not be dirty.	Small sized pipes are cleaned by the cleaning equipment and large ones are done by hand. The inlet chamber has soil and sand pools, etc., which are inspected (2 to 3 times a year) periodically and the soil is discharged.
Repairing	As the sewage pump starts to rust due to sewage, the exchange of the liner ring (once every two years) and propeller are paid attention to and the exchange of the sludge pump is paid special attention. The space parts of such items as bearing, shaft, which are easy to be worn are prepared.	Although the duration of civil engineering facilities is long, the corroded steel attached is changed to maintain the functions.	The exterior mainly consists of the premise roads and hedges. See road, parks and green belt.	Manhole covers are easily broken by the cars running on the streets. The damage is found and repaired by the periodical inspection and the report from people.

The following are some methods on management to which attention should be paid.

(a) Long-range planning for operation and management

The plan in the long-range to checking operation, checking and cleaning, repair and the renewal of the machines over the durable length of time are formulated according to the sort, the aim, the scale, etc. of the facilities of the management. And the system of maintenance and management such as the organization for the management, the budget and the source of revenue are planned.

(b) Short-range planning for operation and management

The plan in the short-range to check the operating of machinery, checking, cleaning, repair, etc. are formulated and to be the guide for the operation and management.

(c) Preparation of the list for the management

A list shown by charts on the main features of the facilities for the management (structure, site, scale, method, the set-up date, etc.) is prepared for use by the management.

(d) Preparation of the daily report of the operation and management

A report of the daily operation and management is prepared and the condition of the operation and management (the date, the name of laborers, the work which were implemented) is written and handed in to the next managers. The form and manual of the report is also formulated.

(e) Treatment of sludge

The sludge is disposed as industrial solid waste. But the sludge is well-nourished and the effective use of it will be considered in the future, as fertilizer or as fuel for generating or heating.

3. Rain Drainage

Facilities for rain drainage are transferred to the PHED and managed by the department. A sand basin is settled in the way of the rain tubes of rain drainage. As different substances flow through it is expected to be cleaned sufficiently.

In the case that a lot of companies located to the IMT are middle and small sized, there are few cases that sewage water waste might be treated as rain drainage. Therefore, management should bear this point in mind.

9.4.4 Electric Power Supply and Telecommunication

1. Electric Power Supply

The IMT has two electric power systems; one is buying electric power from the HSEB and the other is generating electric power through the independent electric power plant.

In the facilities for buying electric power, the management range of the IMT is from the power-line terminal newly constructed at the existing HSEB's transformation substitution in Faridabad to the meter of each located company.

The objects, the methods and the implementation of work for this management of electric power are as follows:

(1) Objects: The facilities of transmitting electricity, the facilities of transformer substitution and the independent electric power plant.

(2) Methods: The above-mentioned objects, the method of operation, checking, cleaning, repairing and prevention of pollution are shown below.

Table 9.4.5 : Method of Operation and Management of Electric Power Supply

Objects / Kind	Generation Facilities				
	Construction Facilities	Electric Machinery	Building	Exterior Facilities	Transmission Facilities
Administration operating	The operation at the lowest output, the transformation and the over-loaded conditions are implemented. The gas turbine is operated taking care of the outbreak of over-load because it has high temperature and high pressure. It is needed to train the engineers. The facilities and machinery are operated paying attention to the temperature, the burning conditions, the condition of supplying fuels, the water supply and the change of the state of air.				
Checking	The turbine is checked once every other year periodically. The piping facilities are checked all the time for the leakage of water.	Each machine is examined to work.	The bolts and nuts of the drain pipes are examined carefully.	The exterior mainly consists of the premise roads and hedges. See road, park and green belt.	As for the transmission in the air, the suspension of a foreign substance, the attachment of a foreign material and the outercover of transmission are examined.
Cleaning	The drain pipes are cleaned both inside and outside.		The ordinary cleaning inside the building is always implemented.	The exterior mainly consists of the premise roads and hedges. See road, park and green belt.	The cleaning when needed is implemented while checking.
Repairing	The needed meters and tools are equipped and the preparation and training for prompt action toward the damage of facilities are provided. The daily repairing and planned repairing are implemented.		The repairing is implemented according to the drainage.	The exterior mainly consists of the premise roads and hedges. See road, park and green belt.	The cleaning when needed is implemented while checking.
Pollution control	As for the air pollution caused by combustion and the hot drainage caused by the coolant should always be observed and managed voluntarily in order to keep the given standard of environment assessment.				

The following are some methods of operation to which attention should be paid.

(a) Long-range planning for operation and management

The needed amount of electrical energy, the needed maximum of electrical power each month and the planning for repairs of each unit are formulated, reducing the amount of buying electrical energy, and the gross weight of electrical power is set up. The plan in the long-range for the checking of operation, checking, cleaning, repairing and the renewal of the machines beyond the durable length of time are formulated according to the sort, the aim, the scale, etc. for the facilities of the management such as the facilities of fuel, the machinery of electrical power, the buildings, the exterior facilities, etc., and the implementation for work for the maintenance and management of power transmission such as the organization, the budget, the source and the revenue are all screened for implementation at the same time.

(b) Short-range planning for operation and management

A formulated plan of implementation of the latest year is used as a concrete plan to put the plan for the long-range into practice; its contents are nearly the same as those of the plan in the long-range.

(c) Making the ledger for management

The ledger arranged by charts about the features of the facilities for the management (site, scale, specification, the set-up date, etc.) is prepared for the use of management.

(d) Preparation for the daily report of operation and management

The report of the daily operation and management are prepared as written; the conditions of the operation and management (date, the name of laborers, the implementation of work) which was implemented are to be submitted to the next managers and the manual to the preparation of the report are also formulated.

(e) Provision for accidents

As a black-out or a voltage change will have a substantial effect on the production system of a manufacturing industry, in the case that this type of accident occurs, the man power, machinery and materials are prepared and a manual is made out showing the procedures in certifying accidents, repairs and making contacts, etc.

(f) Meters and tools

It is desirable that meters and tools which are needed for the conservative management of facilities of electrical power should always be prepared.

(3) Implementation of work

As there is an independent power plant, mechanical and electrical engineers expected to be being stationed at the plant and a group in charge is to be organized with workers who operate and generate generating the facilities of the electricity and maintenance personnel. Checking, cleaning and repairing are also implemented by these engineers and workers. Besides this, the repairing on a large scale should be carried out using special workers from other groups. Pollution problems are carried out by engineers in charge who, are with familiar the prevention of pollution. According to the scale of the facilities related to the electric power, it is required to have about 20 workers for operation and management including clerks.

2. Telecommunication

Telecommunications (telephone facilities) are generally carried out by the DOT which exists under the MOC. The IMT also carries out telecommunication business by entrusting to and constructing facilities to transmit a message. The cable constructed in the IMT is operated and managed by the DOT.

9.4.5 Industrial Solid Waste Treatment

Industrial solid waste is thought to have two types such as solid and liquid, but the introduced types of industry are variously extended into food, fiber, wood, paper, print, chemistry, rubber, leather, ceramics, steel, general machines, electric machines, transport machines and precision machines, but in a trial calculation on F/S amount of solid waste accounts for 76.61 t/day, therefore it becomes an important theme on how to treat the industrial solid waste while advancing the IMT management in a good way.

(1) Object: Final disposal scene of the industrial solid waste is managed by the State government. The collection and transportation of the industrial solid waste let out from the IMT as requested by the companies are managed by the operation and management agency of the IMT.

(2) Method: The stable treatment needed for collection and transportation is in charge of the originated companies while it is in charge of the IMT at this stage. The treatment of the industrial solid waste is implemented as the first treatment (stabilization) in each company in a proper method. From the inside of the IMT to the outside disposal site the disposals are to be transported. Still more, transportation containers or vehicles which can close the air inside are needed. Further, besides collection and transportation, the treatment of management is also important; the management is to be implemented as follows:

(a) Operation and management planning in the long-range

So as to implement thorough industrial solid waste treatment, a long-range plan for the industrial solid waste woven collection, transportation, disposal performance, analysis

examination, functional maintenance, etc., is made.

(b) Operation and management planning in the short-rage

As a concrete plan to implement the long-range planning, the implemential planning is made at the present time. The contents are almost the same as those in the long-range plan for collection, transportation, disposal performance, analysis examination, functional maintenance, etc.

(c) Analysis examination

The Haryana State Pollution Control Bureau (HSPCB) is in charge of the analysis of the industrial solid waste. The HSPCB has functions which can implement voluntarily classified analysis examination of the industrial solid waste and always implements analysis examination.

(d) Treatment slip

As for the industrial solid waste treatment, the data management of the industrial solid waste is very important. It is indispensable to adopt a system based on a treatment slip. The contents are the name of the office, the seat, occurred date, established place, the table of ingredients, the table of a manufacturing process, attentions while handling, pictures, etc.

(e) Intermediate storage

In the case of intermediate storage of the industrial solid waste in the IMT, the dust and sewage outflow are paid attention to in the intermediate storage place. The place of storage should be prepared for the establishment of enclosure, prevention from flood, removal of injurious insects and fire prevention.

(f) Formulation of manual

The manual of treatment is made in a way that people are aware of it, and to have models in terms of the treatment of the industrial solid waste and to have solid way free from the people who deal.

(g) The managers of the industrial solid waste treatment

The managers settled by India's domestic law are appointed.

(3) Implementation of work

As for the industrial solid waste treatment toward harmlessness, collection (tool) is implemented and an operation company and treatment traders, etc., are entrusted with the transportation.

In the case of having a standard value in terms of the treatment of the last treatment site,

to avoid having conflict, the examination function should be located in the IMT.

9.4.6 Pollution Control

The waste water, the exhausted gas, the industrial sold waste, the noise and the vibration are considered as the items for pollution control. "9.1.5 Water Supply, Drainage" mentions that the treatment of the quality of water let-out of each company and the sewage treatment plant is needed to be self-managed.

The pollution regulations concerning the industrial solid waste weave the necessity of the waste stability by the pollution control agreement. It is thought that noise and vibration are not to cause any problem since the factory site is wide, and is far away from the dense built-up area, but the HSPCB will be in charge of pollution control. Therefore, at the present time, exhausted gas regulations are adopted and how the management will implement this is shown, but the concrete guard business.

As the IMT will introduce several businesses such as chemistry, ceramics, food, etc., those businesses shall make use of a lot of diesel oil and kerosene. So the measures against exhausted gas are as follows:

(1) Object: The measurement of exhausted gas

(2) Regulation items: Carbon monoxide, Hydrogen Sulfide, Ammonia, Sulfur oxides, Nitrogen oxides, etc., after the combination of fuel such as fossil oils (mainly heavy oil)

(3) Method: Every regulation item, which became an object in the regulations of air pollution law in 1981, is to be measured regularly whether it is within the sphere of regulation.

Since there are some accidents in which the sewage water penetrates into the ground because of the damage of sewage storage tanks of companies, the sewage water should 'not be let out. The operation and management of the IMT should conclude through the pollution control agreement and prepare for the checking of facilities for the pollution control inside the companies.

And as for the observation items of each company with the condition of location, the items necessary for decision are gathered, then a pollution control agreement is concluded.

In order to observe the agreement, one should have a supervisor (an engineer) and he should work as a management engineer of the sewage treatment plant as well. And should work in cooperation with the HSPCB in becoming a window which requires operation, management, etc., if necessary.

9.4.7 Housing

The housings are planned "for rent" and "for sale". As "high-class housings" are managed by the owners, in this chapter the objects of the operation and management are indicated as "the ordinary housing for rent".

(1) Objects: Housing, housing sites.

(2) Methods: The objects of the operation and management are as follows:

Table 9.4.6 : Method of Operation and Management of Housing

Objects	The Housing Management		Building Housing	Housing Facilities	Housing Sites (Exterior)
Kind	Accounting	Tenant Affairs			
Administ-ration operation	Receiving the rent charge (receiving by visiting or transferring to bank account) and needed utility expenses shall be paid.	Collection of tenant, selection and contract.	-	Facility for water and polluted water treatment are operated by the plant developer or the entrustees. Treatment for solid waste collection is entrusted to Autonomy by tenants.	-
Checking	-	-	Interiors will be checked when tenant changes. Building, facilities are checked once or twice a year. And its cost is burdened by utility expenses. Water tank, elevator are checked periodically (once a year).		See road, park and green belt.
Cleaning	-	-	Public space (corridors, elevator, steps, etc.) is cleaned with a round. And its cost is burdened by utility expenses.	Waste gathering space, parking, public facilities, exterior facilities are checked voluntarily by tenants.	See roads, park and green belt.
Repairing	-	-	Periodical repairing for peeling of paint and repairing for changed parts are implemented every time when it occurs.		See roads, park and green belt.

The following are items in operation to which attention should be paid.

(a) Parking management

There is a large area for parking at the housing site. It is expected to levy the fee on the benefiters and managers. The profit allot to the management cost for external housing sites.

(b) Collection of classified waste

Although the local government will collect home waste, combustible waste, land disposable waste, and recyclable waste are expected to be collected respectively.

(c) A reserve fund for repair

Durable years of housing (for rent) are 20 to 30 years the cost for repairs during those years are quite high. As a burden by beneficiary principle, the cost for repairing has to be included into the rent charge or it is needed to be reserved as a fund for repairing built-upon the rent.

(3) Implementation of work

The operation and management of housing are divided into two parts, one is the office affairs related to administrative operation, the other is field maintenance related to cleaning and checking of the estate and buildings. In the former, accounting affairs occupy a large part of the work. Especially, in the case of receiving rent charges for 13,600 houses by man power. It is necessary to set up full time-collectors. As for cleaning, most people spend a lot of time staying at home, therefore, the housings yield much waste and easily get dirty. The public space of housing and the exterior are different from roads, parks and and green belt, which belong to the private part, therefore the cleaning of them needs another work posture and it should be done by a self supporting accounting system. Out of 13,600 houses, there are always going to be need of repairs, almost on an everyday basis, for such things as door-lock disorder, the breaking of glass, etc.

The setting up of a "housing management office," is necessary. This office will take charge in daily management which includes receiving the rent charges and will need to have a few staff members, those who can check and repair and clean as teams.

As for the repairing of buildings, the office will make a special contract with a construction company and every time there is some sort of damage or break, the office will entrust the construction company and as for the requiring of an occupancy area which responsibility belongs to the tenant, the office will introduce a construction company.

9.4.8 Public Service Facilities

As functional facilities for the IMT, the facilities to keep city function and business supporting facilities are built in the IMT. The next passage shows the outline of three facilities.

In case these are to be set up, public city functional facilities are generally controlled by the local autonomy. Shopping centers, business supporting facilities, office buildings, intended to offer business supporting services are expected to do business by the private developer or entrust self-management by the tenant companies. Therefore, as for the civil and public service facilities, the right of ownership is transferred to the concerned service supplier or public agents and the management is to be entrusted.

The Promotion Center which is planned to stay in the business supporting facilities is supported to have the site of a agency which is managed by the IMT and as for the operation plan, it is mentioned in "9.2.3 Operation Planning for the IMTPC".

(1) City functional facilities: City functional facilities are supposed to be as follows:

A Tower Center, Community Center, Shopping Center, Restaurant Building, Shopping Mall, Health Care Center, primary school, junior high school, police office, fire station etc.

In the town center banking facilities are supposed to enter, along with an administration center which plays the role of a window for the country and state. The Community Center is a cultural exchange facility for the IMT residents. The Shopping Center, the Restaurant Building and the Shopping Mall provide indispensable service which the IMT residents or employees need for daily life. The Health Care Center consists of a sports club and a hospital and has facilities to promote and manage health conditions along with total body examinations.

(2) Business support facilities: Business support facilities consist of the Promotion Center, the Training Center, and the Seminar house. The Promotion Center with the IMT Promotion Center (IMTPC) which manages and operates has a purpose for promotion of the IMT. The Training Center aims at supplying high-quality laborers, and because the same kind of organization already exists in Haryana State, it is important to harmonize. The Seminar House is supposed to be a common use facility for companies.

(3) Office building: This building has head offices and business section for companies.

Chapter 10

Cost Estimation and Implementation Schedule

Chapter 10 Cost Estimation and Implementation Schedule

In this chapter, the development cost of the Industrial Model Town is estimated based on the conceptual design mentioned detail in Chapter 8, and the unit construction cost collected during the field survey. Following that, the implementation schedule is described.

10.1 Major Premises for Cost Estimate

The following conditions and assumptions are applied to the cost estimate.

(1) Scope of the Cost Estimate

In this study, the components of the IMT are divided into the following 9 groups, and the cost estimate of each group is separately accomplished.

- Land Acquisition
- Basic Infrastructure
- Flyover (modification of National Highway No. 8)
- Power Supply
- Telecommunication
- Water Supply
- Drainage and Waste Water Treatment
- Solid Waste Management
- Buildings (Housing, Town and Commercial Facilities)

(2) Price Base

Costs are estimated in fiscal year 1994 constant prices, and inflation is not included. The unit costs applied to cost estimate are basically market rate in India. The cost of consulting services including design works are estimated based on the assumption that the consultants of developed countries are hired in order to develop the model town with an international standard.

(3) Currency and Exchange Rates

The estimates are carried out in local currency (Indian Rupee), and any costs estimated in foreign currencies are converted to local currency by using the following exchange rates.

Rs 1 = 3.3 Japanese Yen = US$ 0.033

(4) Taxes and Duties

All taxes and duties including the sales tax, are not considered in this study.

10.2 Land Acquisition Cost

In this study, the acquisition cost for a land area of 600 ha is estimated to be 1,500 million Rs assuming that compensatory acquisition charge higher than ordinary rate is paid to the villagers with a view of acquiring smoothly the land in a short period.

10.3 Basic Infrastructure

10.3.1 Direct Construction Cost

The direct construction cost is required for the development of the basic infrastructure, and the costs for consulting works and administration are not included. In this study, the direct construction cost of basic infrastructure is separately estimated for the following classifications: (a) Site Preparation, (b) Road, (c) Park and Green Belt, (d) Street Lighting, (e) Underground Utility Duct, (f) Power Distribution Line, (g) Water Supply Piping Network, (h) Sewage Collection System, (i) Storm Water Drainage facility, and (j) Settling Basin for Storm Water.

(a) Site Preparation

At the site preparation, removal of obstructions such as trees, stripping of topsoil, and grading works are conducted. Further, earth works to construct dyke and open channel for storm water drainage around the IMT site are required. In this study, the volume of earth work is estimated on condition that the site is graded by following the natural slope, and land preparation cost is estimated by multiplying the unit cost collected during the field survey by the estimated work volume. The estimation of work volume has been constrained by the lack of detailed survey drawings of the site area, and this study estimates the work volume base on the contour map of the site. Table 10.3.1 summarizes the estimated land preparation cost.

Table 10.3.1 Direct Construction Cost required for Land Preparation

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Site Clearing, Stripping of Topsoil, etc.	ha	600	28,750	17,250,000
Excavation	m^3	1,940,000	45	87,300,000
Filling	m^3	4,010,000	20	80,200,000
Landscape Mounting (excess material)	m^3	120,000	40	4,800,000
Total				189,550,000

(b) Road

Five classes of asphalt surfaced roads is constructed in IMT. The direct construction cost of the road is shown in Table 10.3.2.

Table 10.3.2 Direct Construction Cost of Road Network

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Flexible Road Pavement (700 mm thick)	m^2	16,000	830	13,280,000
Flexible Road Pavement (600 mm thick)	m^2	66,320	710	47,087,200
Flexible Road Pavement (500 mm thick)	m^2	249,760	640	159,846,400
Flexible Road Pavement (450 mm thick)	m^2	130,560	480	62,668,800
Flexible Road Pavement (400 mm thick)	m^2	14,350	450	6,457,500
Curb	m	110,580	240	26,539,200
Cycle Path	m^2	81,920	200	16,384,000
Footpath	m^2	141,100	270	38,097,000
Allowance for Diversion of				
Local Access Road cut by IMT	km	5	1,000,000	5,000,000
Line Marking and Signs	Item			10,000,000
Total				385,360,100

(c) Landscaping

In addition to the park and green zone, a buffer green belt using the dyke around the site is arranged. Planting using a road network is also planned. The cost for landscaping is shown in Table 10.3.3.

Table 10.3.3 Direct Construction Cost of Landscaping

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Road Reservations	m^2	202,380	55	11,130,900
Parks/Green Belt - Industrial Zone	m^2	470,000	55	25,850,000
Parks/Green Belt - Urban Zone	m^2	220,000	55	12,100,000
Total				49,080,900

(d) Street Lighting

The cost of street lights is estimated to be Rs 40 million by multiplying total lighting area of 1.6 million m^2 by unit cost of Rs 25 /m^2.

(e) Underground Utility Duct

To allow a high standard of operation and maintenance of utilities, it is planned that underground duct contains electricity, telecommunication and water supply are constructed. The cost required for the construction of the duct is shown in the following table.

Table 10.3.4 Direct Construction Cost of Underground Utility Duct

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
RC Duct Type A (2.40m x 2.50m)	m	5,357	27,500	147,317,500
RC Duct Type B (2.05m x 2.15m)	m	3,397	24,300	82,547,100
Duct Junctions	No.	7	1,219,000	8,533,000
Service Connections - one side of road	No.	21	1,015,000	21,315,000
Service Connections - both side of road	No.	15	1,247,000	18,705,000
Lighting, Ventilation and Drainage of Duct	Item			27,838,000
Total				306,255,600

(f) Power Distribution Network

Power distribution network consists of 66 kV cable, 11 kV transmission line and low voltage distribution line. The cost of 66 kV cable is estimated based on the price in Japan because the cable is not obtainable in India. Following table shows the cost required for the construction of power distribution network.

Table 10.3.5 Direct Construction Cost of Power Distribution Line

Item	Foreign Portion (Million Yen)	Local Portion (Rs Million)	Total Cost (Rs Million)
66 kV Cable			
Cable (9,000 x 3 ph)	351.00	--	106.36
Cable End Treatment (36 pcs)	32.40	--	9.82
11 kV Transmission Line (20 km)	--	20.00	20.00
Low Voltage Transmission Line	--	12.00	12.00
Total	383.40	32.00	148.18

(g) Water Supply Piping Network

Table 10.3.6 shows the cost of water supply piping network to be installed in the underground utility duct.

Table 10.3.6 Direct Construction Cost of Water Supply Piping Network

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Water Mains less than 450 mm diameter	m	35,000	1,800	63,000,000
Water Mains greater than 450 mm diameter	m	5,000	3,000	15,000,000
Total				78,000,000

(h) Sewage Collection System

Besides the utility duct, the underground sewage collection system from factories and houses to waste water treatment plant is developed. Table 10.3.7 shows the cost required for the construction of the sewage collection system.

Table 10.3.7 Direct Construction Cost of Sewage Collection System

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
200 mm RC Pipe	m	4,258	500	2,129,000
300 mm RC Pipe	m	15,621	805	12,574,905
400 mm RC Pipe	m	9,487	900	8,538,300
600 mm RC Pipe	m	3,252	1,725	5,609,700
800 mm RC Pipe	m	1,500	2,800	4,200,000
Sewer Connection Pit (700 mm dia.)	No.	115	5,000	575,000
Sewer Manhole (900 mm diameter)	No.	573	15,000	8,595,000
Sewer Manhole (1,200 mm diameter)	No.	31	18,000	558,000
Sewer Manhole (1,500 mm diameter)	No.	2	22,000	44,000
Total				42,823,905

(i) Storm Water Drainage Facility

It is proposed that underground culvert is constructed for the storm water drainage. Table 10.3.8 shows the cost of this facility.

(j) Settling Basin for Storm Water

Storm water gathered at settling basin through the culvert is discharged after separating sand and soil. Table 10.3.9 shows the cost of settling basin.

Table 10.3.8 Direct Construction Cost of Storm Water Drainage Facility

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
200 mm RC Pipe	m	21,360	400	8,544,000
500 mm RC Pipe	m	2,976	1,100	3,273,600
600 mm RC Pipe	m	2,725	1,553	4,231,925
700 mm RC Pipe	m	724	1,800	1,303,200
800 mm RC Pipe	m	3,672	2,050	7,527,600
900 mm RC Pipe	m	1,568	2,300	3,606,400
1,000 mm RC Pipe	m	944	2,650	2,501,600
1,100 mm RC Pipe	m	724	3,000	2,172,000
1,200 mm RC Pipe	m	4,746	3,450	16,373,700
1,350 mm RC Pipe	m	2,036	4,500	9,162,000
1,500 mm RC Pipe	m	3,285	5,750	18,888,750
1,650 mm RC Pipe	m	2,036	6,800	13,844,800
1,800 mm RC Pipe	m	2,763	8,050	22,242,150
2,000 mm RC Pipe	m	1,565	10,000	15,650,000
Curb Drainage Pit	No.	2,512	2,300	5,777,600
Sewerwater Pipe Manhole for 900 mm pipe	No.	262	8,000	2,096,000
Sewerwater Pipe Manhole for 1,200 mm pipe	No.	92	10,000	920,000
Sewerwater Pipe Manhole for 1,500 mm pipe	No.	31	12,000	372,000
Sewerwater Pipe Manhole for 1,800 mm pipe	No.	16	15,000	240,000
Sewer Manhole (2.1m x 1.2m)	No.	11	20,000	220,000
Sewer Manhole (2.6m x 1.2m)	No.	3	25,000	75,000
2,000mm x 2,000mm Box Culvert	m	384	20,300	7,795,200
2,500mm x 2,000mm Box Culvert	m	400	22,700	9,080,000
3,000mm x 2,000mm Box Culvert	m	184	26,700	4,912,800
3,500mm x 2,000mm Box Culvert	m	356	29,000	10,324,000
5,000mm x 3,000mm Box Culvert	m	208	55,890	11,625,120
Main Drain on Southern IMT Boundary	m	4,160	2,330	9,692,800
Main Drain on Northern IMT Boundary	m	2,600	62,600	162,760,000
Fill in Abandaned Section of Manesar Nala	m	1,200	1,150	1,380,000
Spillway and Outlet at Drainage Diversion Bund	Item			2,500,000
Remove Abandand Drainage Diversion Bund	m	1,000	200	200,000
Total				359,292,245

Table 10.3.9 Direct Construction Cost of Settling Basin for Storm Water

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Retention/Sedimentation Pond	Item			23,600,000
Outlet Culvert and Spillway	Item			1,673,600
Total				25,273,600

(k) Total

As shown in Table 10.3.10, total of the direct construction cost from the above (a) to (j) amounts to Rs 1,589.7 million.

Table 10.3.10 Summary of Direct Construction Cost of Basic Infrastructure of IMT

(Unit: Rs)

Item	Estimated Cost
Land Preparation	189,550,000
Road	385,360,100
Landscaping (Parks, Green Belt, Boundary, etc.)	49,080,900
Street Lighting	40,000,000
Underground Utility Duct	306,255,600
Power Distribution Line	148,180,000
Water Supply Piping Network	78,000,000
Sewage Collection System	42,823,905
Storm Water Drainage Facility	359,292,245
Settling Basin for Storm Water	25,273,600
Total	1,623,816,350

(2) Engineering Service

The cost of owner side including site survey, soil exploration, basic and detail design works, preparation of tender documents with work drawings, and management of construction works is estimated at Rs 162 million, equivalent to 10 percent of direct construction cost.

(3) Total Cost

Total cost from the above (1) plus (2) and the contingency equivalent to 5 percent of direct construction cost is as follows:

Direct Construction Cost	1,623,816,350 (Rs)
Engineering Service	162,381,635
Contingency	81,190,818
Total	1,867,388,803

10.4 Flyover (Improvement of National Highway No. 8)

(1) Direct Construction Cost

As shown in Table 10.4.1, the direct construction cost required for the improvement of National Highway No. 8 by the construction of flyover is estimated to be Rs 239 million.

Table 10.4.1 Direct Construction Cost of Flyover

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Removal of Old Pavement	m^2	15,000	70	1,050,000
Excavation - ramps	m^3	5,000	50	250,000
Filling of Bridge Approrches	m^3	160,000	50	8,000,000
Bridge (2 No. each, 29 m wide x 2 x 40m spans)	m^2	4,640	23,000	106,720,000
Bridge Approach Retailing Walls	m^2	12,780	4,000	51,120,000
Flexible Road Pavement - Natl. Highway (790 mm thick)	m^2	32,560	1,000	32,560,000
Flexible Road Pavement - Ramps (700 mm thick)	m^2	1,933	875	1,691,375
Flexible Road Pavement - Ramps (600 mm thick)	m^2	6,053	710	4,297,630
Flexible Road Pavement - Ramps (400 mm thick)	m^2	7,400	450	3,330,000
Curb	m	8,880	260	2,308,800
Guardrail	m	3,760	800	3,008,000
Cycle Path	m^2	6,000	200	1,200,000
Footpath	m^2	6,000	290	1,740,000
Line Marking and Signs	Item			2,500,000
Temporary bypass during Construction of Flyover	m	600	9,200	5,520,000
Allowance for Relocation of Existing Utilities	Item			500,000
Drainage Pipe	m	4,440	800	3,552,000
Curb Drainage Pits & Connection to S/W	No.	111	3,450	382,950
Stormwater Pipe Manholes	No.	44	10,350	455,400
RC Culvert under N8 at North Side	m	40	31,000	1,240,000
Landscaping	m^2	42,500	55	2,337,500
Total				233,763,655

(2) Engineering Service

The cost of owner side including basic and detail design works, preparation of tender documents with work drawings, and management of construction works is estimated at Rs 23.4 million, equivalent to 10 percent of direct construction cost.

(3) Total Cost

Total cost from the above (1) and (2) and the contingency equivalent to 5 percent of direct construction cost is as follows:

Direct Construction Cost	233,376,366 (Rs)
Engineering Service	23,376,366
Contingency	11,688,183
Total	268,828,203

10.5 Power Plant

(1) Land Acquisition

Besides the land area of 600 hectors, land for replacement of Manesar Sub-station and that for transmission line to Badshapur must be acquired for the development of the IMT. In this study, the cost to acquire these land is included in the project cost.

(a) Land for Replacement of Manesar Sub-station

The existing sub-station at Manesar must be replaced to other place for the development of IMT at the proposed site. The land acquisition cost is estimated to be 7.5 million Rs by multiplying the required area of 30,000 m^2 by the unit cost of Rs 250/m^2.

(b) Land for Transmission Line

The construction of power transmission line of 55 km from IMT to the sub-station at Badshapur is required for the sale of surplus power to outside and/or to receive the power from the outside as an emergency measure. Under the current regulation, it is necessary to acquire the land for the construction of pylon for power cable. The total area required for the pylon is estimated to be 270,000 m^2 (900 m^2/unit x 300 units). The land acquisition cost is estimated to be Rs 54 million, and is derived by multiplying the required area by the unit cost of Rs 200/m^2.

(2) Construction Cost

(a) Gas Pipeline

It is necessary to construct a gas pipeline (45 km; from main pipeline to the IMT) to receive the natural gas for power generation. The construction cost of the pipeline is included in the project cost in view of the importance of the gas supply to the IMT, while construction work

of the pipeline will be executed by the GAIL (Gas Authority of India Limited). The construction cost of the pipeline consists of costs of material (steel pipes), machinery (compressor, receiver, drain separator, etc.) and erection work. In this study, the cost is estimated assuming that steel pipes and machinery are imported from Japan and local contractor executes the erection work. The construction cost of the pipeline is estimated to be Rs 434.59 million as shown in the following table.

Table 10.5.1 Construction Cost of Gas Pipeline

Item	Foreign Portion (Million Yen)	Local Portion (Rs Million)	Total Cost (Rs Million)
Material	802.00	--	243.03
Machinery	350.00	--	106.06
Erection Work	--	85.50	85.50
Total	1,152.00	85.50	434.59

(b) Gas Turbine Power Plant

It is planned that 4 units of gas turbine generator of 38 MW are installed. This study estimates the cost assuming that all machinery are imported from Japan and the local contractor install the machinery and equipment. As shown in the following table, the cost is estimated to be 2,149.58 million Rs.

Table 10.5.2 Construction Cost of Gas Turbine Power Plant

Item	Foreign Portion (Million Yen)	Local Portion (Rs Million)	Total Cost (Rs Million)
Machinery and Equipment			
Gas Turbine Generator (4 units)	4,960.00	--	1,503.03
Auxiliaries Machinery	380.00	--	115.15
Transformer	540.00	--	163.64
Spare Parts (for 5 years)	580.00	--	175.76
Erection Work	--	103.00	103.00
Civil Work	--	89.00	89.00
Total	6,460.00	192.00	2,149.58

(c) Transmission Line and Sub-station

As shown in the following table, the cost of transmission line for power interchange with the outside and sub-station at the IMT is estimated to be 818.71 million Rs. The items described the cost in foreign currency are not obtainable in India, and the costs are estimated assuming that they are imported from Japan.

Table 10.5.3 Construction Cost of Transmission Line & Sub-station

Item	Foreign Portion (Million Yen)	Local Portion (Rs Million)	Total Cost (Rs Million)
220 kV/66 kV Sub-station (2 units)	400.00	--	121.21
66 kV Switchgear (15 units)	600.00	--	181.82
66 kV/11 kV Sub-station (8 units)	800.00	--	242.42
220 kV Cable			
Cables (500m x 3 ph)	45.00	--	13.36
Cable End Treatment (6 pcs)	36.00	--	13.36
Supervision (1 month/1 trip)	4.00	--	1.21
220 kV Bay (Modification of			
Existing 6 Bays at Badshapur)	--	42.00	42.00
220 kV Transmission Line (IMT to Badshapur; 55 km)	--	93.50	93.50
11 kV Switchgear (40 units)	--	12.00	12.00
11 kV/LV Sub-station (100 unit)	--	30.00	30.00
LV Switchgear	--	10.00	10.00
Miscellaneous	--	60.00	60.00
Total	1,885.00	247.50	818.71

(d) Rearrangement of Manesar Sub-station

In order to rearrange the sub-station at Manesar, it is necessary to construct a new sub-station, to dismantle the existing sub-station and to rearrange transmission lines. Based on the discussions with HSEB, the costs to construct new sub-station and to dismantle the existing sub-station are set at Rs 100 million and Rs 25 million, respectively. The cost required for the rearrangement of the transmission lines is estimated to be Rs 57.04 million, as shown in the following table. From the above estimates, total cost for the replacement of Manesar sub-station amounts to 182.04 million Rs.

Table 10.5.4 Cost for Rearrangement of Transmission Lines at Manesar Sub-station

Item	Foreign Portion (Million Yen)	Local Portion (Rs Million)	Total Cost (Rs Million)
66 kV Cable			
Cables (3,000m x 3 ph)	117.00	--	35.45
Cable End Treatment (6 pcs)	5.40	--	1.64
Construction of 66 kV Transmission Line (6 km)	--	3.60	3.60
Dismantle of 66 kV Transmission Line (3 km)	--	0.60	0.60
Construction of 11 kV Transmission Line (15 km)	--	15.00	15.00
Dismantle of 11 kV Transmission Line	--	0.75	0.75
Total	122.40	19.95	57.04

(e) Total Construction Cost

As shown in Table 10.5.5, total of the construction cost from the above (a) to (d) is Rs 3,423 million.

Table 10.5.5 Summary of Construction Cost of Power Supply

(Unit: Rs Million)

Item	Estimated Cost
Gas Pipeline	434.59
Gas Turbine Power Generation Power Plant (38 MW x 4 units)	2,149.58
Transmission Line from IMT to Badshpur and Sub-station in IMT	818.71
Rearrangement of Manesar Sub-station	182.04
Total	3,584.92

(3) Engineering service

The cost of owner side including basic and detail design works, preparation of tender documents with work drawings, and management of construction works is estimated at Rs 286.8 million, equivalent to 8 percent of construction cost.

(4) Total Cost

Total cost from the above (1) to (3), and the contingency (5% of construction cost) is shown below.

Land acquisition	:	61,500,000 (Rs)
Construction costs	:	3,584,920,000
Engineering service costs	:	286,793,600
Contingency	:	179,246,000
Total	:	4,112,459,600

10.6 Telecommunication Facilities

As mentioned in Chapter 8, it is planned that a remote exchange station is constructed at the IMT and the remote exchange station is controlled by the main exchange station at Grugaon through the optical fiber cable to be installed in this project. In this study, construction cost including administration expenses is estimated assuming that machinery and equipment are imported from Japan. The cost of machinery and equipment to be installed at the IMT is estimated to be 300 million Yen, or 90.91 million Rs, by multiplying the capacity of 2,000 lines by the unit cost of 150,000 Yen/line. The cost of subscriber line is estimated at 300 million Yen, or 90.91 million Rs, based on the capacity and unit cost of 150,000 Yen. The cost of optical fiber is estimated at 45 million Yen, or 13.64 million Rs, by multiplying length of 15 km by the unit cost of 3 million Yen per km. From the above, total construction cost amounts to 64.5 million Yen, equivalent to 195.45 million Rs.

The total cost including the cost of engineering service (8% of construction cost) and contingency (5% of construction cost) is as follows.

Construction costs	:	195,450,000 (Rs)
Engineering service costs	:	15,636,000
Contingency	:	9,772,500
Total	:	220,858,500

10.7 Water Supply System

The water supply system of the IMT consists of water supply channel, water treatment plant, water reservoirs, water pipeline from treatment plant to IMT, pumping station in the IMT, and water supply piping network to be installed in the underground duct. The cost of water supply piping network is included in the development cost of basic infrastructure. The cost of water supply channel from water source (Yamuna river) to the treatment plant is not considered, because an existing open channel can be used. The construction cost of treatment plant, water reservoirs, water pipeline, pumping station, and total construction cost are Rs 92.91 million, Rs 300 million, Rs 131.5 million, Rs 114.5 million, and Rs 638.91 million respectively (Table 10.7.1).

The total cost including land cost for water treatment plant and reservoirs (25ha = Rs 25 million), engineering service (8% of construction cost) and contingency (5% of construction cost) is as follows.

Land cost	:	25,000,000 (Rs)
Construction costs	:	638,913,000
Engineering service costs	:	51,113,040
Contingency	:	31,945,650
Total	:	746,971,690

Table 10.7.1 : Construction Cost for Water Purification Plant and Pump Stations for the IMT

(Unit : 1,000Rs)

	Items	Materials	Labor	Sub Total	Remarks
1.	Water Purification Plant				
I.	Direct Field Cost				
	Major Equipment Cost	14,800	-	14,800	
	Field Cost				
	Equipment Installation	-	738	738	
	Civil & Architectural	37,061	4,438	41,499	
	Electrical & Instrument	10,372	1,812	12,184	
	Piping	2,593	512	3,105	
	Others	1,037	207	1,244	
	Direct Field Cost	65,863	7,707	73,570	
	Sub Total				
II.	Indirect Field Cost			11,987	
III.	Overhead			7,357	10.0% of Direct field cost
	Water Purification Plant Total	65,863	7,707	92,914	
2.	Water Reservoirs			300,000	175,000 m^3/Reservoir x 2
3.	Water Pipeline	125,000	6,500	131,500	600mm × 16.5km × 2
4.	Pumping Station in IMT				
I.	Direct Field Cost				
	Major Equipment Cost	12,000	-	12,000	
	Field Cost				
	Equipment Installation	-	153	153	
	Civil & Architectural	51,189	6,897	58,086	
	Electrical & Instrument	12,638	2,414	15,052	
	Piping	3,159	705	3,864	
	Others	1,264	282	1,546	
	Direct Field Cost				
	Sub Total	80,250	10,451	90,701	
II.	Indirect Field Cost			14,728	
III.	Overhead			9,070	10.0% of Direct field cost
	Sub Total	80,250	10,451	114,499	
	Total			**638,913**	

10.8 Sewage Treatment and Drainage Facility

(1) Facilities in the IMT

The sewage treatment system in the IMT consists of sewage collection system, sewage treatment plant using activated sludge process, and sludge treatment facility. The cost of sewage collection system is included in the basic infrastructure of the IMT. The construction costs including administration expense are sewage treatment plant; Rs 264.55 million, sludge treatment facility; Rs 209.66 million, and total; Rs 474.21 million (Table 10.8.2).

(2) Facilities outside the IMT

It is necessary to construct the facilities to discharge the treated water. The construction cost of this facility is estimated as follows:

Table 10.8.1 Construction Cost of Water Discharge Facility

(Unit: Rs)

Item	Unit	Quantity	Unit Cost	Total Cost
Improvements to Manesar Nala Drainage Channel	m	7,000	1,150	8,050,000
Allowance to Improve Culvert under Railway Line	Item			4,600,000
Total				12,650,000

In addition to the above, a land cost for the discharge canal (7 km x 25 m = 175,000 m^2) amounts to Rs 35 million (Rs 200/m^2) is required.

The total cost including engineering service (8% of construction cost) and contingency (5% of construction cost) is as follows.

Land Acquisition	:	35,000,000 (Rs)
Construction Cost	:	486,862,000
Engineering Service	:	38,948,960
Contingency	:	24,343,100
Total		585,154,060

Table 10.8.2 Construction Cost of Waste Water Treatment Facilities and Sludge Treatment Facilities

(Unit : 1,000Rs)

Items		Materials	Labor	Sub Total	Remarks
1.	Waste Water Treatment Facilities				
I.	Direct Field Cost				
	Major Equipment Cost	101,720	-	101,720	
	Field Cost				
	Equipment Installation	-	1,857	1,857	
	Civil & Architectural	54,072	5,929	60,001	
	Electrical & Instrument	31,158	2,725	33,883	
	Piping	7,790	779	8,569	
	Others	3,116	311	3,427	
	Direct Field Cost				
	Sub Total	197,856	11,601	209,457	
II.	Indirect Field Cost			34,147	
III.	Overhead			20,946	10.0% of Direct field cost
	Sub Total	197,856	11,601	264,550	
2.	Sludge Treatment Facilities				
I.	Direct Field Cost				
	Major Equipment Cost	116,700	-	116,700	
	Field Cost	-	2,606	2,606	
	Equipment Installation				
	Civil & Architectural	9,488	1,300	10,788	
	Electrical & Instrument	25,238	1,367	26,605	
	Piping	6,309	391	6,700	
	Others	2,524	156	2,680	
	Direct Field Cost				
	Sub Total	160,259	5,820	166,079	
II.	Indirect Field Cost			26,975	
III.	Overhead			16,608	10.0% of Direct field cost
	Sub Total	160,259	5,820	209,662	
	Total			**474,212**	

10.9 Solid Waste Management

The investment cost for composting solid waste is broadly divided into land cost for dumping, transportation vehicles, and other equipment.

(1) Land Cost

Some land area must be acquired to place the solid waste of the IMT. As mentioned in Chapter 8, the quantity of solid waste is 94 ton/day. The solid waste transported by trucks is compacted and placed in a landfill area located at about 10 km from the IMT. Assuming that the density of compacted solid waste is 0.3 ton/m^3 and the landfill depth is 3 m, the required landfill area is calculated as follows.

(94 ton/day) / (0.3 ton/m^3) x (365 days/year) / (3 m) = 38,122 m^2/year

Based on the calculated required area and the unit cost of 90 Rs/m^2, the cost to acquire the required land for 3 years operation is estimated as follows.

38,122 m^2/year x 90 Rs/m^2 x 3 years= Rs 10,292,940/-

(2) Trucks

The solid waste volume discharged from the IMT is estimated at 940 m^3/day by dividing discharge weigh by the density of 0.1 ton/m^3. To transport that volume of solid waste 188 trucks (capacity of 5 m^3) are required. The number of trucks is estimated to be 47 and was derived by diving the total requirement by assuming 4 working trips per day. In this study, the number of trucks is set at 50 by adding 3 trucks as a standby. The required cost for purchasing the truck is estimated to be Rs 45 million by multiplying the price of trucks used for this purpose (900,000 Rs per truck).

(3) Other Cost

In addition to the above, garbage storage places are required in the IMT. At the landfill site, such machinery as dozer are required. The costs of these facility and machinery are estimated at 5.5 million Rs based on the conceptual design and discussions with Indian side.

(4) Total Cost

From the costs of the above (1) to (3) and contingency (5% of the total costs of trucks and others), total cost is as follows.

Land Acquisition Cost	10,292,940 (Rs)
Trucks	45,000,000
Machinery & Equipment	5,500,000
Contingency	2,525,000
Total	63,317,940

10.10 Buildings

In this study, construction costs of buildings are estimated by multiplying the total floor area by the cost per area (unit cost). This method is called Area Method, and is normally applied to estimate the cost at the study stage.

10.10.1 Housing

(1) Direct Construction Cost

(a) High Density Housing (4 Floors)

It is planned that 50 units of 4 floors apartment buildings (20 m^2/unit x 100 units = 2,000 m^2) are constructed for junior employees (single). Direct construction cost is estimated to be Rs 550 million by multiplying total floor area of 100,000 m^2 (2,000 m^2/building x 50 buildings) by unit cost of 5,500 Rs/m^2.

(b) High Density Housing (10 Floors)

It is planned that 50 units of 10 floors apartment buildings (100 m^2/unit x 100 units = 10,000 m^2) equipped with elevators are constructed for junior employees (with family). Direct construction cost is estimated to be Rs 4,200 million by multiplying total floor area of 600,000 m^2 (10,000 m^2/building x 60 buildings) by unit cost of 7,000 Rs/m^2.

(c) Middle Density Housing

The constructions of 50 units of 3 floors apartment buildings (125 m^2/unit x 30 units = 3,750 m^2) for middle and senior level employees are planned. Direct construction cost is estimated to be Rs 1,312.5 million by multiplying total floor area of 187,500 m^2 (3,750 m^2/building x 50 buildings) by unit cost of 7,000 Rs/m^2.

(d) Housing for EWS

It is planned that 25 units of low cost apartment buildings (36 m^2/unit x 40 units = 1,440 m^2) are constructed for EWS (Economically Weaker Section). Direct construction cost is estimated to be Rs 4,200 million by multiplying total floor area of 36,000 m^2 (1,440 m^2/building x 25 buildings) by unit cost of 3,800 Rs/m^2.

(e) Total Direct Construction Cost

Although low density housings are constructed in addition to the above (a) to (d), the costs of low density housings are not estimated since this study assumes that investors to the IMT and/or developers purchase the land, and pan and construct houses. Direct construction cost of housings are as following:

High Density Housing (4F)	:	550,000,000 (Rs)
High Density Housing (11F)	:	4,200,000,000
Middle Density Housing	:	1,312,500,000
Housing for EWS	:	136,800,000
Total	:	6,199,300,000

(2) Engineering Work

The cost of owner side including basic and detail design works, and management of construction works is estimated at 433.95 million Rs, equivalent to 7 percent of construction cost. The rate of engineering works for construction of housings is set at lower than that of civil works, because buildings of same or similar design will be constructed.

(3) Contingency

Since construction cost of buildings vary with design and/or specifications, contingency is set at higher than other items, or 8 % of the direct construction cost. Total costs including contingency are as follows.

Direct Construction Cost	:	6,199,300,000 (Rs)
Engineering Service	:	433,951,000
Contingency	:	495,944,000
Total	:	7,129,195,000

10.10.2 Town and Commercial Facilities

(1) Direct Construction Cost

The direct construction costs of town and commercial facilities are estimated by using total floor area and unit construction cost. This study assumes that some buildings are equipped with central air conditioning system, and the cost of the air conditioning is added. As shown below, the cost of central air conditioning is estimated by multiplying the unit cost of 4,000 Rs/m^2 by percentage of air conditioned area. Table 10.10.1 shows the results of cost estimates for town and commercial facilities.

Promotion Center	:	4,000 Rs/m^2 x 100 %	=	4,000 Rs/m^2
Seminar House	:	4,000 Rs/m^2 x 50 %	=	2,000 Rs/m^2
Health Care Center	:	4,000 Rs/m^2 x 70 %	=	2,800 Rs/m^2
Restaurant Building	:	4,000 Rs/m^2 x 50 %	=	2,000 Rs/m^2
Office Building	:	4,000 Rs/m^2 x 100 %	=	4,000 Rs/m^2

Table 10.10.1 Direct Construction of Town and Commercial Facilities

Item	Total Floor Area (m^2)	Unit Cost (Rs/m^2)	Construction Cost * (Rs Million)	
Promotion Center	20,000	19,000	380.0	(80.0)
Town Center (Public Service)	20,000	8,000	160.0	
Community Center for Residents	4,400	8,000	35.2	
Primary and Middle School	18,000	8,000	144.0	
Police Station	1,000	8,000	8.0	
Fire Station	500	8,000	4.0	
Training Center	9,000	8,000	72.0	
Seminar House	6,000	10,000	60.0	(12.0)
Health Care Center	6,000	10,800	64.8	(16.8)
Shopping Center	28,000	8,000	224.0	
Restaurant Building	7,200	10,000	72.0	(14.4)
Shopping Mall	48,000	8,000	384.0	
Office Buildings	68,000	17,000	1,156.0	(272.0)
Total	236,100		2,764.0	(395.2)

Note: * Figures in parenthesis are cost of central air conditioning.

(2) Engineering Work

The cost of engineering works is estimated to be Rs 276.4 million, equivalent to 10 % of direct construction cost.

(3) Contingency

The rate of contingency is set at 8 % of direct construction cost, or the same rate as that of housing facilities. The total cost including contingency is as follows.

Direct Construction Cost	:	2,764,000,000 (Rs)
Engineering Service	:	276,400,000
Contingency	:	221,120,000
Total	:	3,261,520,000

10.11 Total Cost

The summary of the above cost estimate is shown in Table 10.11.1.

Table 10.11.1 Summary of Cost Estimate

(Unit: Rs Million)

Item	Direct Cost			Engineering Service	Contingency	Total Cost
	Foreign	Local	Total			
(1) Land Acquisition						***1,500.0***
(2) Basic Infrastructure of IMT						
Land Preparation	0.0	189.6	189.6	19.0	9.5	218.0
Road	0.0	385.4	385.4	38.5	19.3	443.2
Landscaping(Green Belt, Park, Boundary, etc.)	0.0	49.1	49.1	4.9	2.5	56.4
Street Lighting	0.0	40.0	40.0	4.0	2.0	46.0
Underground Utility Duct	0.0	306.3	306.3	30.6	15.3	352.2
Power Distribution Line	116.2	32.0	148.2	14.8	7.4	170.4
Water Supply Piping Network	0.0	78.0	78.0	7.8	3.9	89.7
Sewage Collection System	0.0	42.8	42.8	4.3	2.1	49.2
Storm Water Drainage Facility	0.0	359.3	359.3	35.9	18.0	413.2
Settling Basin for Storm Water	0.0	25.3	25.3	2.5	1.3	29.1
Sub-total	116.2	1,507.6	1,623.8	162.4	81.2	***1,867.4***
(3) National Highway No.8(Flyover)	0.0	233.8	233.8	23.4	11.7	***268.8***
(4) Power Supply						
Land Acquisition						
Rearrangement of Manesar Sub-station (3 ha)						7.5
Transmission Line to Badshapur (27 ha)						54.0
Gas Pipeline (45km)	349.1	85.5	434.6	34.8	21.7	491.1
Gas Turbine Power Plant	1,957.6	192.0	2,149.6	172.0	107.5	2,429.0
Sub-station & Transmission Line to Badshapur	571.2	247.5	818.7	65.5	40.9	925.1
Rearrangement of Manesar Sub-station	37.1	145.0	182.0	14.6	9.1	205.7
Sub-total	2,915.0	670.0	3,584.9	286.8	179.2	***4,112.5***
(5) Telecommunication						
Machinery	90.9	0.0	90.9	7.3	4.5	102.7
Subscriber Line	90.9	0.0	90.9	7.3	4.5	102.7
Optical Fiber Cable	13.6	0.0	13.6	1.1	0.7	15.4
Sub-total	195.5	0.0	195.5	15.6	9.8	***220.9***
(6) Water Supply						
Land Acquisition (25 ha)						25.0
Water Purification Plant	0.0	92.9	92.9	7.4	4.6	105.0
Water Reservoirs	0.0	300.0	300.0	24.0	15.0	339.0
Water Pipeline to IMT	0.0	131.5	131.5	10.5	6.6	148.6
Pumping Station	0.0	114.5	114.5	9.2	5.7	129.4
Sub-total	0.0	638.9	638.9	51.1	31.9	***747.0***
(7) Sewage Treatment and Drainage						
Waste Water Treatment Plant	0.0	264.6	264.6	21.2	13.2	298.9
Sludge Treatment Facility	0.0	209.7	209.7	16.8	10.5	236.9
Improvements to Manesar Nala Drain (7km)	0.0	8.1	8.1	0.6	0.4	9.1
Land Acquisition for Outlet Channel (17.5 ha)						35.0
Improvement of Culvert under Railway Line	0.0	4.6	4.6	0.4	0.2	5.2
Sub-total	0.0	486.9	486.9	38.9	24.3	***585.2***
(8) Solid Waste Management						
Trucks	0.0	45.0	45.0	0.0	2.3	47.3
Land Acquisition (dumping for 3 year)						10.3
Others	0.0	5.5	5.5	0.0	0.3	5.8
Sub-total	0.0	50.5	50.5	0.0	2.5	***63.3***
Total Cost excl. Buildings	3,226.6	3,587.6	6,814.2	578.2	340.7	***9,365.0***
Total Cost excl. Buildings(Million Yen)	10,647.8	11,839.2	22,487.0	1,908.2	1,124.3	***30,904.4***
(9) Residential Facility						
High Density Housing(4F)	0.0	550.0	550.0	38.5	44.0	632.5
High Density Housing(10F)	0.0	4,200.0	4,200.0	294.0	336.0	4,830.0
Middle Density Housing (3F)	0.0	1,312.5	1,312.5	91.9	105.0	1,509.4
Housing for EWS(4F)	0.0	136.8	136.8	9.6	10.9	157.3
Sub-total	0.0	6,199.3	6,199.3	434.0	495.9	***7,129.2***
(10) Town and Commercial Facility						
Promotion Center	0.0	380.0	380.0	38.0	30.4	448.4
Town Center for Public Service	0.0	160.0	160.0	16.0	12.8	188.8
Community Center for Residents	0.0	35.2	35.2	3.5	2.8	41.5
Primary and Middle School	0.0	144.0	144.0	14.4	11.5	169.9
Police Station	0.0	8.0	8.0	0.8	0.6	9.4
Fire Station	0.0	4.0	4.0	0.4	0.3	4.7
Training Center	0.0	72.0	72.0	7.2	5.8	85.0
Seminar House	0.0	60.0	60.0	6.0	4.8	70.8
Health Care Center	0.0	64.8	64.8	6.5	5.2	76.5
Shopping Center	0.0	224.0	224.0	22.4	17.9	264.3
Restaurant Building	0.0	72.0	72.0	7.2	5.8	85.0
Shopping Mall	0.0	384.0	384.0	38.4	30.7	453.1
Office Building	0.0	1,156.0	1,156.0	115.6	92.5	1,364.1
Sub-total	0.0	2,764.0	2,764.0	276.4	221.1	***3,261.5***
Grand Total	3,226.6	12,550.9	15,777.5	1,288.6	1,057.8	***19,755.7***
Grand Total(Million Yen)	10,647.8	41,418.1	52,065.8	4,252.4	3,490.7	***65,193.8***

10.12 Implementation Schedule

Indian side has an intention to hasten the implementation of the project. However, after completion of the Feasibility Study, the following development stages should be followed for the successful implementation of the IMT project.

(1) Evaluation of the Feasibility Study (F/S) Report

Indian side reviews the contents of this F/S report, and discusses the propriety of the implementation of the project. In the evaluation, a clarification of financial resources (own funds and loan) should be accomplished as well as the evaluations from technical and economical viewpoints.

(2) Formation of Implementation Organization

The organization responsible for the implementation of the each component of the project should be determined in an early stage, and should establish the new organization if necessary.

(3) Land Acquisition

The land required for the development of the IMT will be acquired. To start the land acquisition works in parallel with the work of the above (2) in an early stage will be useful to encourage the participation of foreign companies to the development of the IMT.

(4) Detailed Design

Design works (basic design and detail design) will be accomplished and the documents with work drawings will be prepared.

(5) Sales Promotion Activity

The activity to invite the foreign and local companies to the IMT should be commenced at the preparatory stage of construction works.

(6) Site Preparation and Infrastructure Development

Site preparation and infrastructure (electric power supply, telecommunication, water supply and sewerage) will be executed.

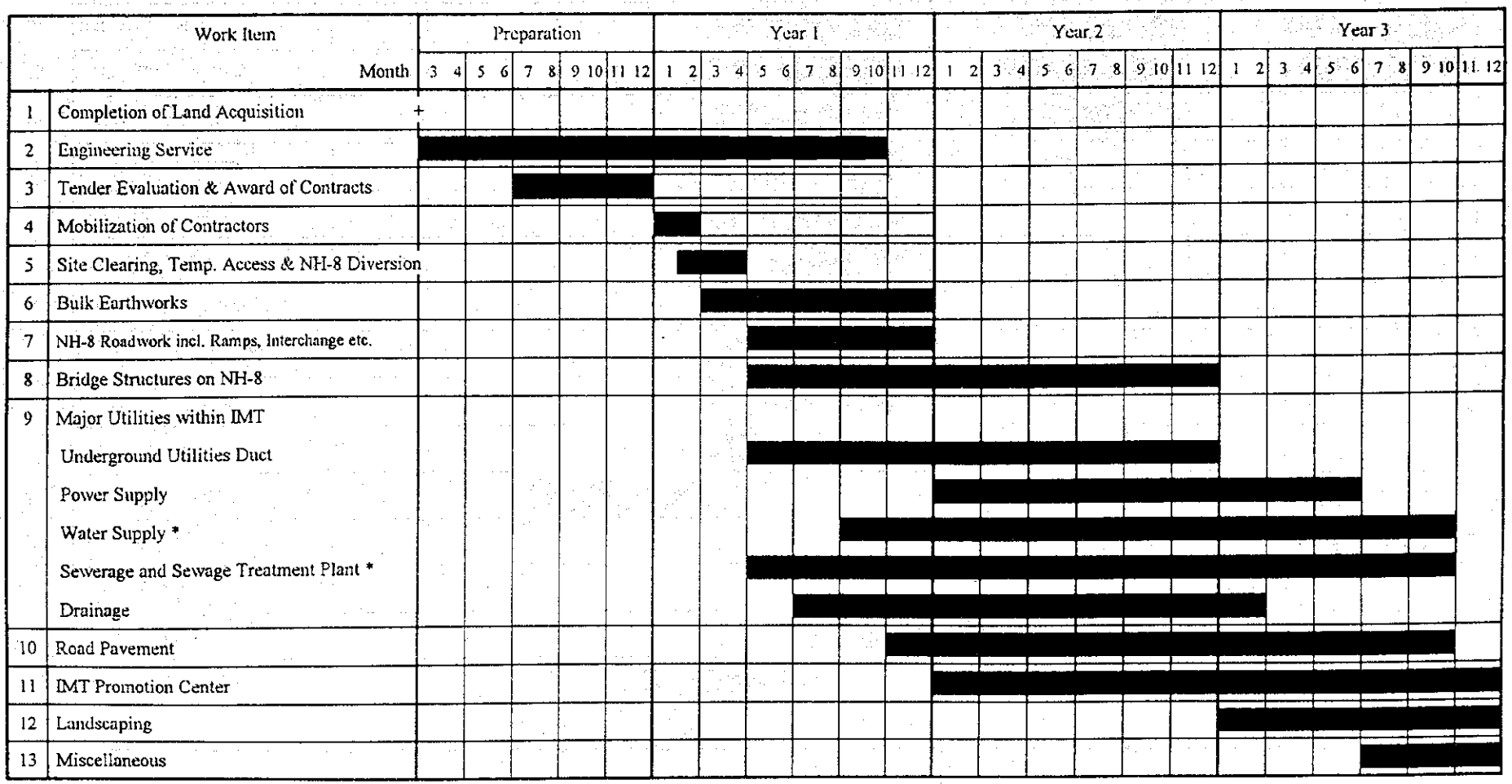
(7) Facility Construction

The promotion center, facility for management and operation of the IMT, will be constructed. In the industrial area, construction of factories by investors will be started. Also, housing facilities for the employees of the factories, and town and commercial facilities for the residents in and around the IMT will be constructed.

(8) Development Schedule

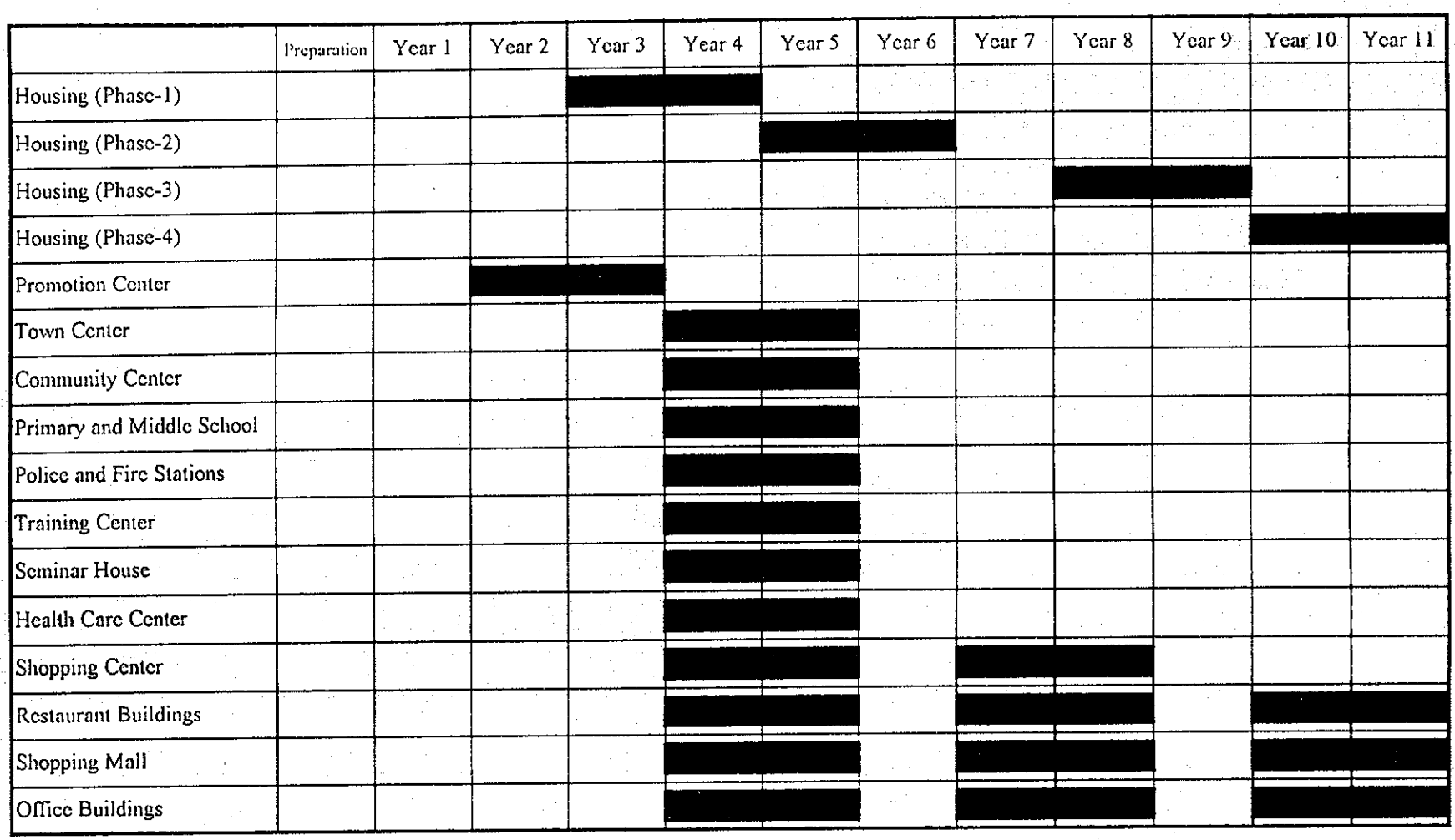
Figure 10.12.1 shows the development schedule after the completion of land acquisition work. It is scheduled that construction works exempt for residential, town and commercial facilities will be completed within 3 years. Residential, town and commertial facilities will be constructed by stages corresponding to the demands. Figure 10.12.2 shows the building construnction schedule in case that the sales of industrial area will be completed in 10 years.

Figure 10.12.1 Implementation Schedule



Note: * Time to start construction work depends on demand and the policy of developer.

Figure 10.12.2 : Schedule for Construction of Buildings



Chapter 11

Financial and Economic Evaluation

Chapter 11 Financial and Economic Evaluation

11.1 Financial Evaluation

11.1.1 Basic Objectives for the Financial Analysis

This project consists of multiple project items and facilities where the managing organizations may change, and the profitability of the five assumed independent items and facilities, i.e. development and sales of land, power supply, water supply, sewage treatment, and housing are individually studied. The overall profitability of the project is also included. For the profitability study of each item, the minimum salable price to recover the investment costs is derived under the assumed conditions of land acquisition and IMT development costs and financing plans, and the adequacy of the price is discussed. The minimum price is to satisfy the criteria of "No outstanding short-term loans during the (assumed) final year of the project," and "Total dividends exceed the total investment." For the development and sales of land which annual revenue may change from that estimated, dividends are not paid until the retained earnings exceed the debt outstanding (The project management will decide the dividend policy in the actual project.), and the IRROE (internal rate of return on equity) is determined taking dividends as inflow. For other facilities, all of the surplus cash is assumed to be paid as dividends instead of retained for the IRROE determination.

11.1.2 Major Conditions and Assumptions for the Financial Analysis

The major conditions are summarized below.

(1) Prices

All prices are 1994 basis, and inflation is not considered. The effect of inflation leading to inflated costs of construction is, however, studied in the sensitivity analysis for the development and sales of land, the most important project item to the IMT. All currencies are expressed in local (Indian Rupees: Rs), and the below exchange rates have been used for necessary conversion.

Rs 1 = 3.3 yen = US$ 0.033

As there is much uncertainty in the future projection of exchange rates, the effect of varied exchange rates on the project profitability is not considered in the base case but is included in the sensitivity analysis.

(2) Corporate Taxes

Corporate taxes in India are imposed on all types of business activity. The following is assumed applicable in this study based on the current taxation policies. Tax on power supply is exempt for five years after start-up of operation.

Corporate Taxes: Base (40%) + Surcharge (6% or 15% of Base) = 46%
Loss-carry-forwards: 8 years (unlimited term for loss caused by depreciation)

(3) Depreciation

All fixed assets excluding land are depreciated by the following declining balance method. However, the cost incurred on the land acquisition and the development of basic infrastructure is recovered in proportion to the area sold in tax calculation.

- Plant and Machinery	:	25 %
- Buildings	:	10 %
- Houses	:	5 %
- Car and Truck	:	20 %
- Waste Water Treatment Facility	:	100 %

(4) Sales Forecast of Land

For the industrial area portion, two cases of sales completion in 10 years (Case-A) and 5 years (Case-B) are considered. The residential portion is assumed as increase in land acquisition and construction of residential buildings by the real estate developers from the sales performance of the industrial portion. All town facilities are assumed to be completed in the 6th year for the convenience of residents. Incremental development is assumed in commercial facilities based on growth in resident population. Tables 11.1.1 (Case-A) and 11.1.2 (Case-B) summarize the sales forecast of land.

Table 11.1.1 Sales Forecast of Land (Case-A)

	Preparation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Sold Industrial Area	–	–	–	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	0%	0%	100%
Total Sold Industrial Area (ha)	–	–	–	26.7	53.4	80.1	106.8	133.5	160.2	186.9	213.6	240.3	267.0	267.0	267.0	–
Number of Employees	–	–	–	–	–	3,889	7,778	11,667	15,556	19,445	23,334	27,223	31,112	35,001	38,890	–
Required Houses (Rooms)	–	–	–	–	–	1,350	2,700	4,050	5,400	6,750	8,100	9,450	10,800	12,150	13,500	–
High Density Housing (4F)																
No. of Units (newly constructed)	–	–	–	–	–	10	0	20	0	0	10	0	10	0	0	50
No. of Rooms	–	–	–	–	–	1,000	1,000	3,000	3,000	3,000	4,000	4,000	5,000	5,000	5,000	–
High Density Housing (10F)																
No. of Units (newly constructed)	–	–	–	–	–	12	0	24	0	0	12	0	12	0	0	60
No. of Rooms	–	–	–	–	–	1,200	1,200	3,600	3,600	3,600	4,800	4,800	6,000	6,000	6,000	–
Middle Density Housing																
No. of Units (newly constructed)	–	–	–	–	–	10	0	20	0	0	10	0	10	0	0	50
No. of Rooms	–	–	–	–	–	300	300	900	900	900	1,200	1,200	1,500	1,500	1,500	–
Housing for EWS																
No. of Units (newly constructed)	–	–	–	–	–	5	0	10	0	0	5	0	5	0	0	25
No. of Rooms	–	–	–	–	–	200	200	600	600	600	800	800	1,000	1,000	1,000	–
Total																
No. of Units (newly constructed)	–	–	–	–	–	37	0	74	0	0	37	0	37	0	0	185
No. of Rooms	–	–	–	–	–	2,700	2,700	8,100	8,100	8,100	10,800	10,800	13,500	13,500	13,500	–
Balance	–	–	–	–	–	1,350	0.0	4,050	2,700	1,350	2,700	1,350	2,700	1,350	0	–
Land Sale (ha)																
Industrial Area	–	–	–	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	0.0	0.0	267.0
Housing Area	–	–	–	22.4	0.0	44.8	0.0	0.0	22.4	0.0	22.4	0.0	0.0	0.0	0.0	112.0
Other Area																
Town Center	–	–	–	–	2.0	–	–	–	–	–	–	–	–	–	–	2.0
Community Center for Residents	–	–	–	–	3.0	–	–	–	–	–	–	–	–	–	–	3.0
Primary and Middle School	–	–	–	–	7.0	–	–	–	–	–	–	–	–	–	–	7.0
Police Station & Fire Station	–	–	–	–	1.0	–	–	–	–	–	–	–	–	–	–	1.0
Training Center	–	–	–	–	3.0	–	–	–	–	–	–	–	–	–	–	3.0
Seminar House	–	–	–	–	2.0	–	–	–	–	–	–	–	–	–	–	2.0
Health Care Center	–	–	–	–	5.0	–	–	–	–	–	–	–	–	–	–	5.0
Shopping Center	–	–	–	–	2.5	–	–	2.5	–	–	–	–	–	–	–	5.0
Restaurant Building	–	–	–	–	0.5	–	–	1.0	–	–	0.5	–	–	–	–	2.0
Shopping Mall	–	–	–	–	1.8	–	–	3.5	–	–	1.8	–	–	–	–	7.0
Office Building	–	–	–	–	1.3	–	–	2.5	–	–	1.3	–	–	–	–	5.0
Sub-total	–	–	–	–	29.0	0.0	0.0	9.5	0.0	0.0	3.5	0.0	0.0	0.0	0.0	42.0
Total	–	–	–	49.1	55.7	71.5	26.7	36.2	49.1	26.7	52.6	26.7	26.7	0.0	0.0	421.0

Table 11.1.2 Sales Forecast of Land (Case-B)

	Preparation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Sold Industrial Area	–	–	–	20%	20%	20%	20%	20%	0%	0%	0%	0%	0%	0%	0%	100%
Total Sold Industrial Area (ha)	–	–	–	53.4	106.8	160.2	213.6	267.0	267.0	267.0	267.0	267.0	267.0	267.0	267.0	–
Number of Employees	–	–	–	–	–	7,778	15,556	23,334	31,112	38,890	38,890	38,890	38,890	38,890	38,890	–
Required Houses (Rooms)	–	–	–	–	–	2,700	5,400	8,100	10,800	13,500	13,500	13,500	13,500	13,500	13,500	–
High Density Housing (4F)																
No. of Units (newly constructed)	–	–	–	–	–	20	0	30	0	0	0	0	0	0	0	50
No. of Rooms	–	–	–	–	–	2,000	2,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	–
High Density Housing (10F)																
No. of Units (newly constructed)	–	–	–	–	–	24	0	36	0	0	0	0	0	0	0	60
No. of Rooms	–	–	–	–	–	2,400	2,400	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	–
Middle Density Housing																
No. of Units (newly constructed)	–	–	–	–	–	20	0	30	0	0	0	0	0	0	0	50
No. of Rooms	–	–	–	–	–	600	600	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	–
Housing for EWS																
No. of Units (newly constructed)	–	–	–	–	–	10	0	15	0	0	0	0	0	0	0	25
No. of Rooms	–	–	–	–	–	400	400	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	–
Total																
No. of Units (newly constructed)	–	–	–	–	–	74	0	111	0	0	0	0	0	0	0	185
No. of Rooms	–	–	–	–	–	5,400	5,400	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	–
Balance	–	–	–	–	–	2,700	0.0	5,400	2,700	0	0	0	0	0	0	–
Land Sale (ha)																
Industrial Area	–	–	–	53.4	53.4	53.4	53.4	53.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	267.0
Housing Area	–	–	–	44.8	0.0	67.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112.0
Other Area																
Town Center	–	–	–	–	2.0	–	–	–	–	–	–	–	–	–	–	2.0
Community Center for Residents	–	–	–	–	3.0	–	–	–	–	–	–	–	–	–	–	3.0
Primary and Middle School	–	–	–	–	7.0	–	–	–	–	–	–	–	–	–	–	7.0
Police Station & Fire Station	–	–	–	–	1.0	–	–	–	–	–	–	–	–	–	–	1.0
Training Center	–	–	–	–	3.0	–	–	–	–	–	–	–	–	–	–	3.0
Seminar House	–	–	–	–	2.0	–	–	–	–	–	–	–	–	–	–	2.0
Health Care Center	–	–	–	–	5.0	–	–	–	–	–	–	–	–	–	–	5.0
Shopping Center	–	–	–	–	2.5	–	2.5	–	–	–	–	–	–	–	–	5.0
Restaurant Building	–	–	–	–	1.0	–	1.0	–	–	–	–	–	–	–	–	2.0
Shopping Mall	–	–	–	–	3.5	–	3.5	–	–	–	–	–	–	–	–	7.0
Office Building	–	–	–	–	2.5	–	2.5	–	–	–	–	–	–	–	–	5.0
Sub-total	–	–	–	–	32.5	0.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.0
Total	–	–	–	98.2	85.9	120.6	62.9	53.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	421.0

11.1.3 Development and Sale of Land

The below costs are assumed to be recovered by the selling price of land:

- Acquisition of land area of 600 hectares
- Development of basic infrastructure
- Construction of flyover
- Construction of promotion center building
- Improvement and land acquisition for outside drain

(1) Disbursement Schedule

The schedule is listed below according to the construction schedule in Chapter 10.

Table 11.1.3 Disbursement Schedule for the IMT Development

	Preparation	Year-1	Year-2	Year-3	Total
Land Acquisition	100 %	0 %	0%	0 %	100 %
Basic Infrastructure	0 %	30 %	50 %	20 %	100 %
Flyover	0 %	50 %	50 %	0 %	100 %
Promotion Center Building	0 %	0 %	50 %	50 %	100 %
Improvement of Outside Drain	0 %	0 %	0 %	100 %	100 %

(2) Selling Expenses

The selling expenses are assumed as 2% of sales revenue.

(3) Financing Plans

The below four cases are studied. Any cash shortage is assumed to be financed by short-term loans carrying a 16% p.a. interest for all cases.

(a) Case-1

This Case is one of the typical example of financing plans for the J/V formation. 25% of the land acquisition will be covered by equity, and the remaining 75% and interest during construction will be covered by borrowings (interest rate of 16% p.a.) from local financial institutions in India. The development costs of the IMT (from servicing of basic infrastructure to construction of the flyover and Promotion Center, and construction and land acquisition for drainage outside of the IMT) will be covered by 20% equity and the remaining 80% and interest during construction by borrowings (interest

rate of 6.5% p.a.) from foreign commercial financial institutions. The repayment term of the debt is assumed to start from the second year of sales of land until completion (9 years for Case-A and 4 years for Case-B).

(b) Case-2

25% of land acquisition and 15% of IMT development will be covered by equity, and the remaining (including interest during construction) will be covered by borrowings (interest rate of 16% p.a.) from local financial institutions in India. The repayment term of the debt is as same as that of Case-1. This Case-2 is an example of the project unable to be financed by foreign financial institutions, and the project will be highly indebted.

(c) Case-3

25% of the land acquisition will be covered by equity, and the remaining 75% and interest during construction will be covered by borrowings (interest rate of 16% p.a.) from the local financial institutions in India. The development costs of the IMT will be covered by 47% equity, and the remaining (including interest during construction) by borrowings (interest rate of 5% p.a.) from governmental financing institution of foreign country. The repayment term of the debt is as same as that of the former two Cases. This Case 3 is an example of the project assumed to be financed by loans and equity from foreign governmental financing institution but is less likely, for there have been few past cases of such financing on development and sales of land.

(d) Case-4

This Case is similar to the above three cases besides the borrowings from local financial institutions in India on land acquisition will be changed to those from foreign governmental financing institution on the year of J/V formation. The project will be less indebted, but such financial conditions are less likely to be applicable.

The detailed financing schedule of the Case-A1 is listed in Appendices V.1.

(4) Evaluation of Profitability

The calculated minimum selling prices of land under the assumed conditions are shown in the following Table (details of Case-A1 are shown in Appendix V. 2).

Table 11.1.4 Minimum Selling Prices of Land and Internal Rate of Return

	Salable Price		ROI(b/tax)	ROI(a/tax)	ROE(b/tax)	ROE(a/tax)
	(Rs/m^2)	(US$/m^2)				
Case-A1	1,737	57.3	10.9 %	6.3 %	0.0 %	0.0 %
Case-A2	2,079	68.6	15.0	8.9	0.0	0.0
Case-A3	1,629	53.8	9.5	5.5	0.0	0.0
Case-A4	1,278	42.2	4.6	2.6	0.1	0.0
Case-B1	1,489	49.1	12.2	7.0	0.0	0.0
Case-B2	1,691	55.8	16.4	6.9	0.0	0.0
Case-B3	1,423	47.0	10.7	6.1	0.0	0.0
Case-B4	1,192	39.3	5.2	2.9	0.0	0.0

The above listed prices are the minimum salable prices and do no include the developers' margin. An appropriate margin is to be secured, for the development and sales of land will be handled by the State Government and private J/V firms as mentioned in Chapter 7. Margins included, the selling price of land is likely to be higher than that of major industrial estates located nearby such as Noida (US$ 50/m^2) or Udyog Bihar (US$ 45/m^2), the latter developed by HSIDC, besides that under highly favorable financing conditions (Case-4). The interest on land acquisition costs is the main cause of raising selling prices.

The below Table summarizes the salable prices for cases of the entire land acquisition costs covered by equity (No borrowings make Case-4* identical to Case-3*.). Appendix V.3 shows the Profit & Loss Statement and Cashflow Table of Case-A1.

Table 11.1.5 Minimum Selling Prices of Land and IRR (without debt financing on land acquisition)

	Salable Price		ROI(b/tax)	ROI(a/tax)	ROE(b/tax)	ROE(a/tax)
	(Rs/m^2)	(US$/m^2)				
Case-A1*	1,221	40.3	3.7 %	2.1 %	0.0 %	0.0 %
Case-A2*	1,563	51.6	8.6	4.9	0.0	0.0
Case-A3*	1,113	36.7	1.9	1.1	0.0	0.0
Case-B1*	1,136	37.5	3.8	2.1	0.0	0.0
Case-B2*	1,337	44.1	8.7	5.0	0.0	0.0
Case-B3*	1,070	35.3	2.0	1.1	0.0	0.0

From the above analyses, this project will not be financially feasible unless the entire land acquisition costs be covered by equity. Appropriate profits can be realized depending on the financing plans of the

IMT development costs, given the entire land acquisition is by equity. Hence, the entire land acquisition costs by equity is a prerequisite for implementing this project which will be assumed in this study from here on.

The profitability of each Cases will be as below, assuming the entire land acquisition is by equity and setting the selling price of the IMT land as same as that of Noida (US$ 50/m^2). Appendix V.4 shows the Profit & Loss Statement and the Cashflow Table of Case-A1*.

Table 11.1.6 Internal Rate of Return of Land Sales (without debt financing on land acquisition)

	Salable Price		ROI(b/tax)	ROI(a/tax)	ROE(b/tax)	ROE(a/tax)
	(Rs/m^2)	(US$/m^2)				
Case-A1*	1,515	50.0	8.0 %	4.6 %	5.8 %	3.3 %
Case-A2*	1,515	50.0	8.0	4.6	-1.1	-1.1
Case-A3*	1,515	50.0	8.0	4.6	7.0	4.0
Case-B1*	1,515	50.0	12.8	7.4	12.0	6.8
Case-B2*	1,515	50.0	12.8	7.4	6.2	3.5
Case-B3*	1,515	50.0	12.8	7.4	12.4	7.1

(5) Sensitivity Analysis

(a) Changes in Exchange Rate

Borrowings from foreign lenders with lower interest rates are regarded as favorable but can change if much devaluation of Rs occurs from significant changes in exchange rates. The effect on profitability by changes in exchange rates of Rs vs. US$ and Rs vs. yen (US$ vs. yen is neglected.) is studied, and the results are shown in Figures 11.1.1 and 11.1.2. Debt service by the foreign lenders is preferred despite devaluation of Rs to US$ or yen by 5% p.a.

Figure 11.1.1 Sensitivity to Change in Exchange Rates (Case-A)

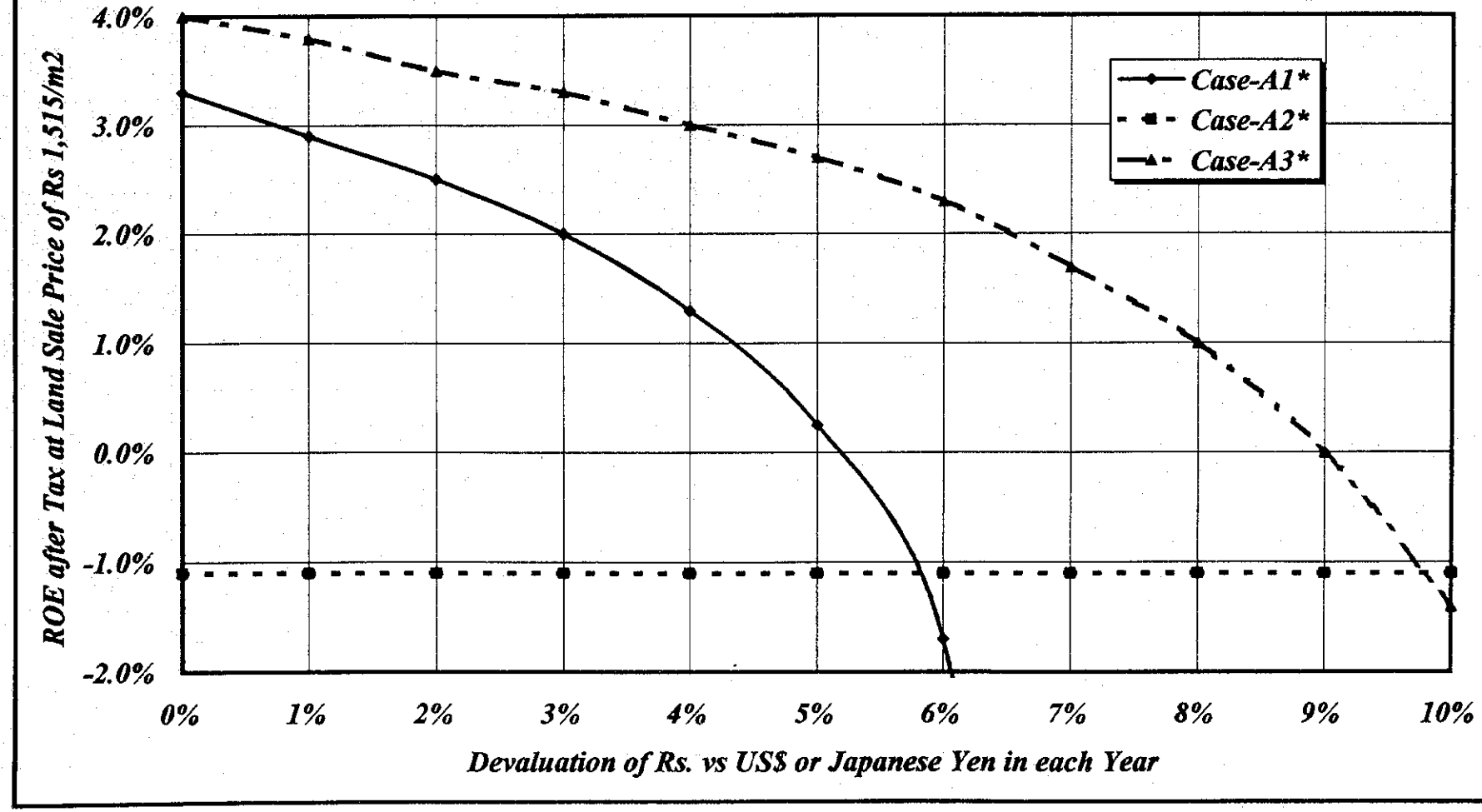
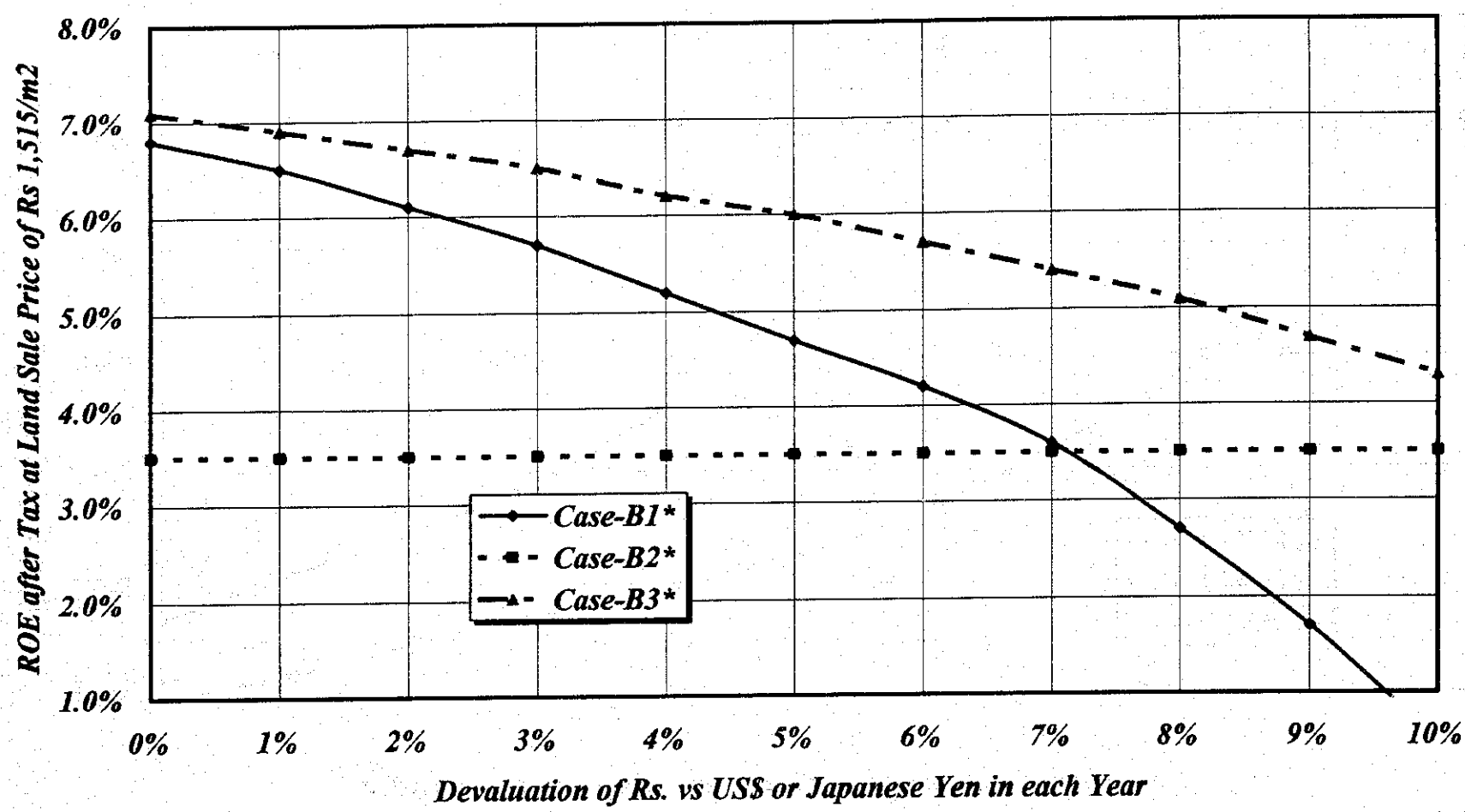


Figure 11.1.2 Sensitivity to Change in Exchange Rates (Case-B)



(b) Effect of Inflation on Costs of Development

The inflated development costs will raise the selling price of land. The study results under various inflation factors are shown in Figures 11.1.3 and 11.1.4. The salable price approaches US$ 50/m^2 for Case-A1*, the base case, under 10% p.a. inflated costs of development. The competitive position, however, will be less affected, for other industrial estates in India including Noida will have to raise their land prices to withstand the 10% p.a. inflation if it continues in India.

(6) Summary

The entire acquisition costs of land need to be covered by equity to make this project financially feasible. Finance arrangements by foreign commercial financial institutions (Case-A1*) are required to maintain the selling price of Noida (US$ 50/m^2). Financing by foreign governmental financing institution (Case-3*) is not a requirement for implementation because of the similar interest rate to that of foreign commercial financial institutions (Case-1*). Investments by foreign public institutions are, however, important for the sound foundation of J/V resulting from decreased amount of debt and decreased risk of private J/V partners. The IMT considering investments by companies targeting the Indian market should take competition with other industrial estates in India such as Noida into account when setting the selling price of land. Stable supply of electricity is of high importance due to supply problems (unstable voltage, low voltage at night, shutdowns, etc.) in India. The advantage of IMT is in terms of stable supply of electricity from its self-generator while some firms in Noida have had to build their own self-generating facilities. The IMT can have this edge over Noida despite its higher price of land, but the price should be lower than the industrial estates in Southeast Asia. The unit prices of industrial estates in the southeast Asia are listed in Table 11.1.7. The land of industrial estates in Singapore and Brunei is leased and not sold. That in Malaysia is also leased for 30 to 99 years but can be resold, and the prices can hence be regarded as for selling.

Figure 11.1.3 Sensitivity to Changes in Annual Inflation Rate (Case-A)

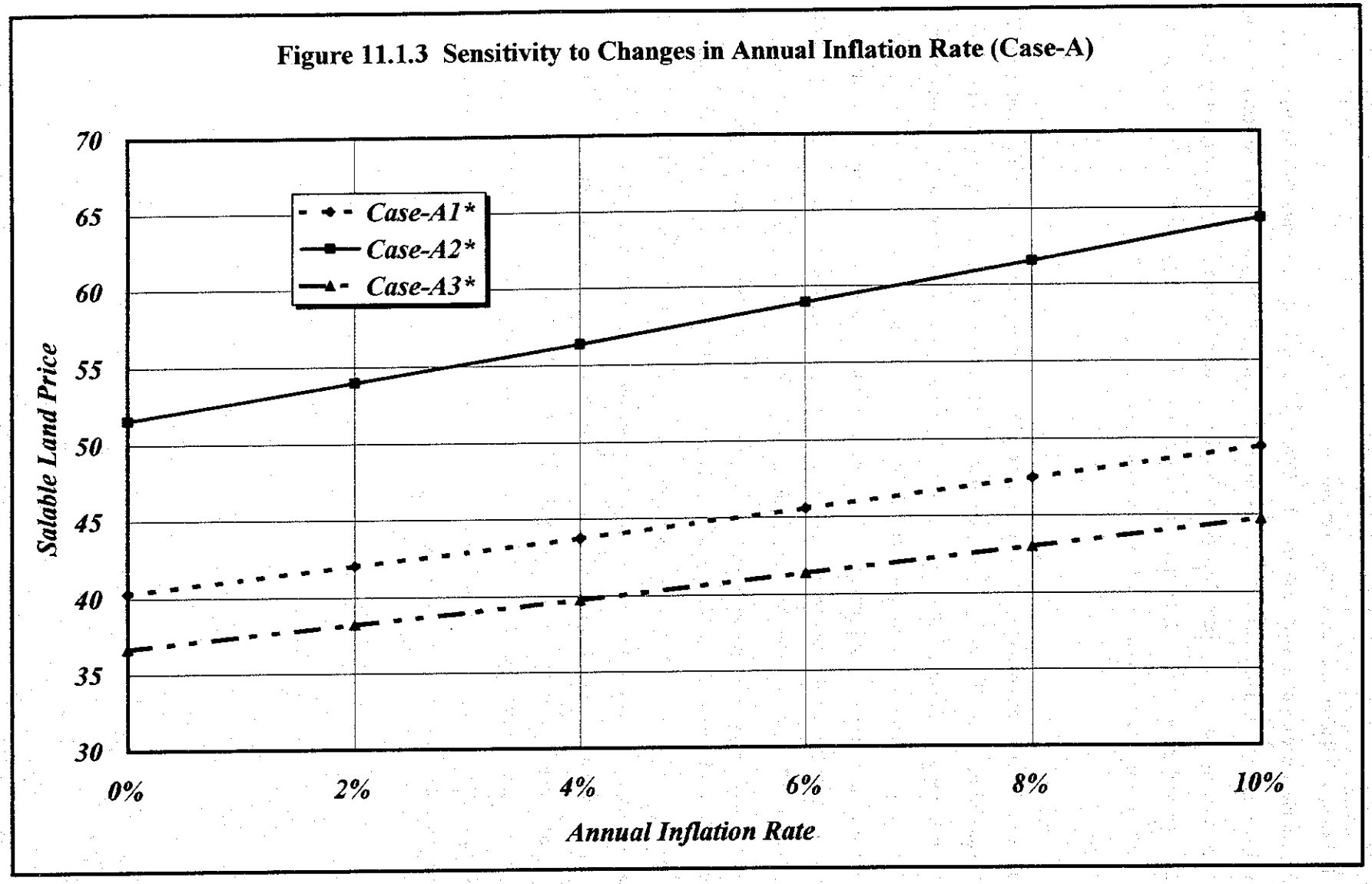


Figure 11.1.4 Sensitivity to Changes in Annual Inflation Rate (Case-B)

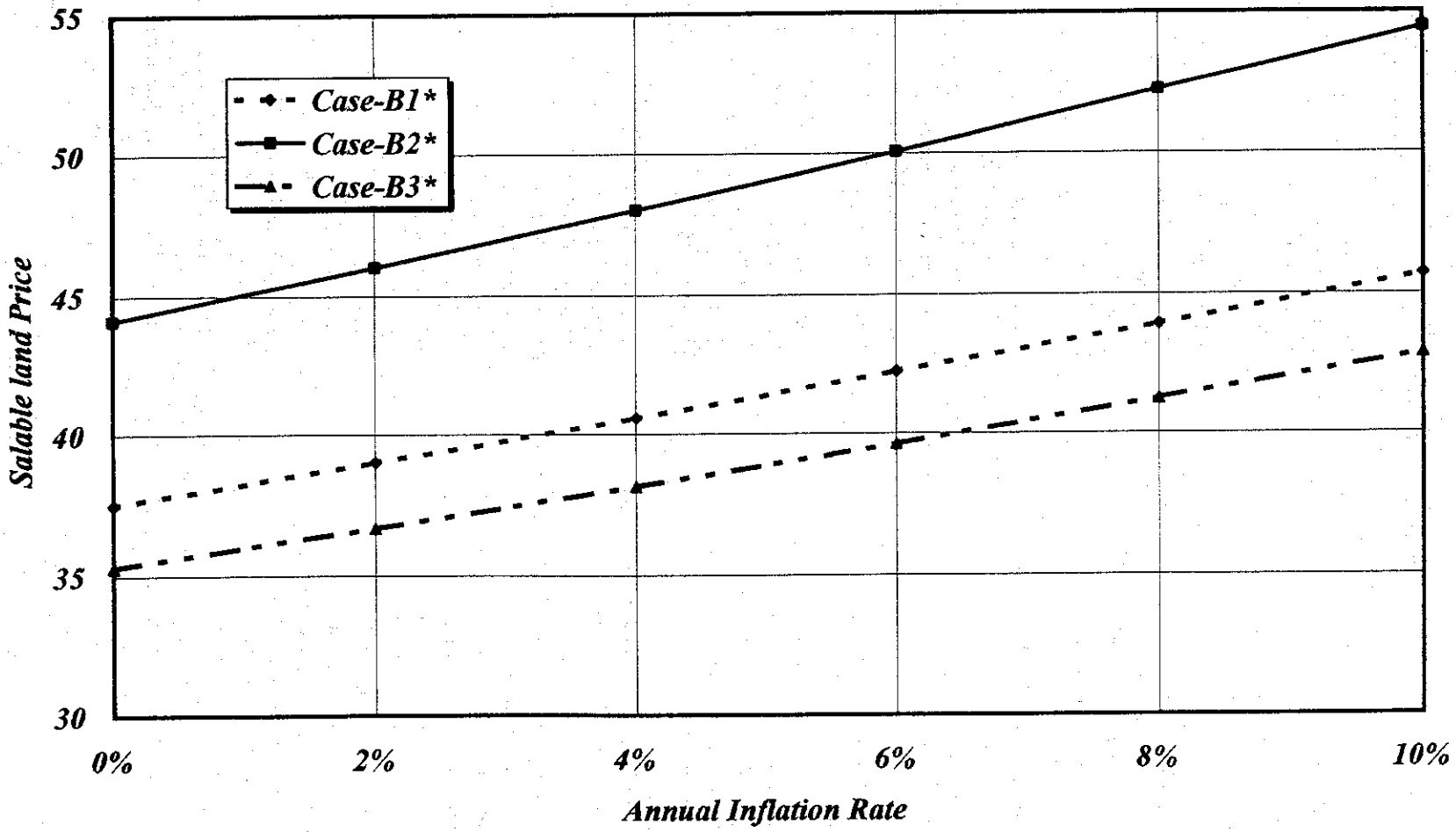


Table 11.1.7 Unit Selling Prices of Land of Industrial Estates in the ASEAN Countries

(Unit; US$/m^2)

Name of Estate	Distance from Major City (Area)	Sales Price
Indonesia		
East Jakarta Industrial Park	40 km (Jakarta)	73
MM2100 Industrial Town	30 km (Jakarta)	70 ~ 76
Bukit Indah City	70 km (Jakarta)	57
Modern Cikande Industrial Estate	68 km (Jakarta)	38 ~ 41
Gresk Industrial Estate	18 km (Surabaya)	51
Suri Mulia Permai Industrial Estate	10 km (Surabaya)	95
Tanjung Emas Export Processing Zone	0 km (Semarang)	76
Terboy Industrial Park	5 km (Semarang)	44
Kuang Hwa Industrial Park	16 km (Batam)	57
Kabil Industrial Estate	10 km (Batam)	51
Malaysia		
Pasir Gudang Tambahan	36 km from Johor Bahru	54 ~64
Senai (Phase III)	32 km from Johor Bahru	43 ~ 64
Sri Gaging	117 km from Johor Bahru	29
Shah Alam	25 km from Kuala Lumpur	118 ~128
Rawang	32 km from Kuala Lumpur	64 ~ 75
Kampunting Tambahan	60 km from Penang (Perak)	37
Philippine		
Anabu Industrial Center	17 km from Naia	149 ~
Carmelray Industrial Park	50 km from Naia	50
First Carvite Industrial Estate	35 km from Manila	64 ~ 74
Laguna International Industrial Park	30 km from Makati	76
Languana Technopac Inc.	40 km from Makati	70
Thailand		
Eastern Industrial Estate (Map Ta Phut)	170 km from Bangkok	84
Bangpa-In Industrial Estate	52 km from Bangkok	69
Bangpa-In Industrial Estate (EPZ)	52 km from Bangkok	75
Gateway City International Estate (Phase I)	82 km from Bangkok	65
Saraburi Industrial Estate	120 km from Bangkok	56
Kabinburi Industrial Estate (Phase III)	165 km from Bangkok	38
Samut Sakhon Industrial Estate	32 km from Bangkok	75 ~100
Chonburi Industrial Estate	110 km from Bangkok	62
Chonburi Industrial Estate (EPZ)	110 km from Bangkok	75
Bangpakong Industrial Estate (Phase II)	57 km from Bangkok	84 ~ 90
Hi-Tech Industrial Estate	75 km from Bangkok	74
Hi-Tech Industrial Estate (EPZ)	75 km from Bangkok	84
Siam Cement Industrial Land	86 km from Bangkok	75
Lamphun Industrial Park	26 km from Chiang Mai	37
Si-Racha Industrial Park	136 km from Bangkok	125

Source : ASEAN Industrial Estate Guidebook, Asean Center Japan

Note : The Study team converted the original data into US$ using an exchange rate of US$1=100 Japanese Yen.

11.1.4 Power Supply

The below costs are assumed to be recovered by selling electricity:

- Land acquisition for the re-arrangement of Manesar sub-station
- Land acquisition for the 220 kV transmission line to be used for the power interchange
- Construction of gas turbine power plant
- Construction of sub-station and transmission line in the IMT
- Re-arrangement of Manesar substation and transmission line

(1) Disbursement Schedule

The schedule is listed below according to the construction schedule in Chapter 10.

Table 11.1.8 Disbursement Schedule of the Electricity Supply Facilities

	Year-1	Year-2	Year-3	Total
Land Acquisition	100 %	0%	0 %	100 %
Power Plant	0 %	60 %	40 %	100 %
Rearrangement of Manesar Sub-station	0 %	60 %	40 %	100 %

(2) Operation Schedule

The HSEB (Haryana State Electric Board) of Haryana State experiencing shortage of electricity is interested in purchasing electricity from the IMT, and full-scale operation is possible from the start-up by selling the excess electricity. The annual generation is estimated at 75% of installed capacity of 1,331.52 GWh or 998.64 GWh (average of 114 MW x 8,760 hours) including periods for maintenance and repairs on equipment.

(3) Transmission/Distribution Loss and Operating Expenses

(a) Transmission and Distribution Loss

From the distribution in the IMT and 220 kV transmission, the loss is assumed as 3% of the generated electricity.

(b) Costs of Fuel

The annual costs of gas are Rs 1,166.77 million assuming the consumption of 38,055 m^3/hour and the unit price of Rs 3.5/m^3.

(c) Other Operating Expenses

Other operating expenses besides fuel are assumed as 5% of the cost of gas turbine generator or Rs 97.9 million/year. Operation of the Manesar substation and the transmission facilities will be handled by the HSEB and will not be expenses by the IMT.

(4) Financing Plans

The land acquisition costs and 15% of the construction costs will be covered by equity, and the remaining will be covered by debt. Cash shortage is assumed to be financed by short-term loans with a 16% p.a. interest. The below listed two cases of financing conditions are studied where the interest rate of Case-1 is based on borrowings from foreign governmental financing institutions but in local currency through the central government. The local governmental agencies will take role for Case-1. Case-2 is based on borrowings from domestic financial institutions in India.

Table 11.1.9 Borrowing Terms for the Electricity Facilities

	Interest	Repayment	Grace Period
Case-1	12.0 % p.a.	20 years	10 years from the first drawdown
Case-2	16.0 % p.a.	10 years	2 years from the first drawdown

(5) Investigation on Profitability

The salable prices of electricity derived under the conditions are listed below (Profit & Loss Statement and Cashflow Table of Case-1 is shown in Appendix V.5). Prices for the Case-1 borrowing condition from foreign public institutions (Rs 1.84/kWh) is lower than the simple average of the current prices of Rs 1.955/kWh (Rs 1.84/kWh for small purchases of 70 kW or less, Rs 2.07/kWh for more than 70 kWh) by the public local firm (HSEB). Operation of power supply facilities is hence feasible with appropriate margin on the selling price. Operation of Case-2 under the borrowing condition of domestic financial institutions in India can also be regarded as feasible without subsidy.

Table 11.1.10 Salable Prices of Electricity and the IRR

	Power Charge (Rs/kWh)	ROI(b/tax)	ROI(a/tax)	ROE(b/tax)	ROE(a/tax)
Case-1	1.84	12.9 %	10.0 %	13.1 %	8.1 %
Case-2	1.93	15.0	11.8	8.6	3.5

(6) Investigation on Implementation Organization

The supply of electricity is to be handled by either State Government or J/V formed by State Government and local firms as mentioned in Chapter 7. If the State Government is to take role, financing under more favorable conditions than Case-1 is less likely. Project management by the J/V formed by mainly private firms can improve the profitability if borrowings are from foreign financial institutions under more favorable conditions, but private firms cannot be concluded as with more preference in terms of power charge including the margin of implementation organization. The below problems occur if private firms become involved in electricity generation projects:

- Private firms handling electricity generation may be unable to satisfy the condition of covering re-arrangement costs of the existing substation by sales of electricity.
- If the costs of the re-arrangement is not recovered by sales of electricity, they will have to be reflected in the selling price of land. The profitability of the development and sales of land will be lower, resulting in problems in the J/V formations with partners involved in development and sales activities of land.
- If the electricity business is handled by private firms, the cash surplus from this project item cannot be passed to other items (such as in water supply and sewage described later) with problems in cash flows.

Therefore, the supply of electricity is to be handled by the State Government.

11.1.5 Water Supply

In this study, it is planned that HUDA constructs water treatment plant with a capacity of 90,000 m^3 /day and supplies water of 42,759 m^3/day to the IMT. From the nature of the project item, water supply will have to be handled by the State Government.

(1) Demand and Supply of Water

From the two cases of sales completion of land (in 10 years; Case-A and 5 years; Case-B) listed in Tables 11.1.1 and 11.1.2, respectively, the projected demand of water is listed in the following table.

Table 11.1.11 Projected Demand of Water Supply (Case-A)

(Unit: m3/day)

Project Year	4	5	6	7	8	9	10	11	12	13	14
Industrial Area	0	3,576	7,152	10,728	14,304	17,880	21,455	25,031	28,607	32,183	35,759
Housing Area	0	980	980	2,940	2,940	2,940	3,920	3,920	4,900	4,900	4,900
Promotion Center	200	200	200	200	200	200	200	200	200	200	200
Town Center	0	0	120	120	120	120	120	120	120	120	120
Community Center	0	0	40	40	40	40	40	40	40	40	40
Primary/Middle School	0	0	60	60	60	60	60	60	60	60	60
Police/Fire Station	0	0	20	20	20	20	20	202	20	20	20
Training Center	0	0	60	60	60	60	60	60	60	60	60
Seminar House	0	0	90	90	90	90	90	90	90	90	90
Health Care Center	0	0	210	210	210	210	210	210	210	210	210
Shopping Center	0	0	120	120	120	240	240	240	240	240	240
Restaurant Building	0	0	15	15	15	45	45	45	60	60	60
Shopping Mall	0	0	100	100	100	300	300	300	400	400	400
Office Building	0	0	150	150	150	450	450	450	600	600	600
Total	200	4,756	9,317	14,853	18,429	22,655	27,210	30,786	35,607	39,183	42,759

Table 11.1.12 Projected Demand of Water Supply (Case-B)

(Unit: m3/day)

Project Year	4	5	6	7	8	9	10	11	12	13	14
Industrial Area	0	7,152	14,304	21,455	28,607	35,759	35,759	35,759	35,759	35,759	35,759
Housing Area	0	1,960	19,60	4,900	4,900	4,900	4,900	4,900	4,900	4,900	4,900
Promotion Center	200	200	200	200	200	200	200	200	200	200	200
Town Center	0	0	120	120	120	120	120	120	120	120	120
Community Center	0	0	40	40	40	40	40	40	40	40	40
Primary/Middle School	0	0	60	60	60	60	60	60	60	60	60
Police/Fire Station	0	0	20	20	20	20	20	202	20	20	20
Training Center	0	0	60	60	60	60	60	60	60	60	60
Seminar House	0	0	90	90	90	90	90	90	90	90	90
Health Care Center	0	0	210	210	210	210	210	210	210	210	210
Shopping Center	0	0	120	120	240	240	240	240	240	240	240
Restaurant Building	0	0	30	30	60	60	60	60	60	60	60
Shopping Mall	0	0	200	200	400	400	400	400	400	400	400
Office Building	0	0	300	300	600	600	600	600	600	600	600
Total	200	9,312	17,714	27,805	35,607	42,759	42,7590	42,759	42,759	42,759	42,759

(2) Disbursement Schedule

The water supply will start from the 5th year based on the projected demand of water (Well water will be used for the 4th year due to less demand.). The construction period is assumed as three years, and the respective disbursement percentages will be 10%, 30%, and 60% of the construction costs.

(3) Financing Plans

15% of construction costs and interest during construction will be covered by equity, and the remaining will be borrowed. Cash shortage is assumed to be financed by short-term loans with a 16% p.a. interest. Two cases of financing conditions are studied where Case-1 is borrowed from foreign public institutions through the central government, and Case-2 is from domestic financial institutions in India. The financing conditions for the sewage will also be the same.

Table 11.1.13 Disbursement Schedule of the Water Supply and Sewage Facilities

	Interest	Repayment	Grace Period
Case-1	12.0 % p.a.	20 Years	10 years from the first drawdown
Case-2	16.0 % p.a.	10 Years	2 years from the first drawdown

(4) Operating Expenses

(a) Water Treatment Plant

As mentioned previously, the IMT will receive water from the water treatment plant (90,000 m^3/day treatment capacity) built by the HUDA, and the excess will be supplied by the HUDA to meet the ordinary demand in the Gurgaon area. The annual costs of water is obtained by multiplying the averaged unit supply price under the two Cases of financing conditions, with the supply volume to the IMT. The supply costs of water to the IMT is assumed to consist of costs of raw water, operation, interest, and recovered investment costs. The cost of raw water is a product of unit price of Rs 0.06/m^3 and 90,000 m^3/day treatment, and that of operation is assumed as Rs 17.12 million/year from unit costs of labor and chemicals obtained during the field study and from the estimated design. The interest expense is obtained from the financing plans of the two Cases, and the investment costs are assumed to be recovered in equal amounts for 29 years. Tax exemption for the HUDA is assumed in this study. The unit supply cost to the IMT per m^3 of water is by dividing the total supply costs in Table 11.1.14 by the total volume of water supply (90,000 m^3/day x 365 days/year x 29 years = 952.65 million m^3) which will be 2.09 Rs/m^3 (Case-1) and 1.52 Rs/m^3 (Case-2).

Table 11.1.14 Cost of Water Treatment

(Unit: Rs Thousand)

Year	Case-1					Case-2				
	Raw Water	Opex	Interest	Cost Recovery	Total	Raw Water	Opex	Interest	Cost Recovery	Total
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	1,971	17,121	50,954	16,938	86,984	1,971	17,121	70,598	17,512	107,201
6	1,971	17,121	50,954	16,938	86,984	1,971	17,121	63,538	17,512	100,141
7	1,971	17,121	50,954	16,938	86,984	1,971	17,121	56,478	17,512	93,082
8	1,971	17,121	50,954	16,938	86,984	1,971	17,121	49,418	17,512	86,022
9	1,971	17,121	50,954	16,938	86,984	1,971	17,121	42,359	17,512	78,962
10	1,971	17,121	50,954	16,938	86,984	1,971	17,121	35,299	17,512	71,902
11	1,971	17,121	50,954	16,938	86,984	1,971	17,121	28,239	17,512	64,843
12	1,971	17,121	50,954	16,938	86,984	1,971	17,121	21,179	17,512	57,783
13	1,971	17,121	50,954	16,938	86,984	1,971	17,121	14,120	17,512	50,723
14	1,971	17,121	48,406	16,938	84,437	1,971	17,121	7,060	17,512	43,663
15	1,971	17,121	45,859	16,938	81,889	1,971	17,121	0	17,512	36,604
16	1,971	17,121	43,311	16,938	79,341	1,971	17,121	0	17,512	36,604
17	1,971	17,121	40,763	16,938	76,794	1,971	17,121	0	17,512	36,604
18	1,971	17,121	38,215	16,938	74,246	1,971	17,121	0	17,512	36,604
19	1,971	17,121	35,668	16,938	71,698	1,971	17,121	0	17,512	36,604
20	1,971	17,121	33,120	16,938	69,150	1,971	17,121	0	17,512	36,604
21	1,971	17,121	30,572	16,938	66,603	1,971	17,121	0	17,512	36,604
22	1,971	17,121	28,025	16,938	64,055	1,971	17,121	0	17,512	36,604
23	1,971	17,121	25,477	16,938	61,507	1,971	17,121	0	17,512	36,604
24	1,971	17,121	22,929	16,938	58,960	1,971	17,121	0	17,512	36,604
25	1,971	17,121	20,382	16,938	56,412	1,971	17,121	0	17,512	36,604
26	1,971	17,121	17,834	16,938	53,864	1,971	17,121	0	17,512	36,604
27	1,971	17,121	15,286	16,938	51,317	1,971	17,121	0	17,512	36,604
28	1,971	17,121	12,738	16,938	48,769	1,971	17,121	0	17,512	36,604
29	1,971	17,121	10,191	16,938	46,221	1,971	17,121	0	17,512	36,604
30	1,971	17,121	7,643	16,938	43,674	1,971	17,121	0	17,512	36,604
31	1,971	17,121	5,095	16,938	41,126	1,971	17,121	0	17,512	36,604
32	1,971	17,121	2,548	16,938	38,578	1,971	17,121	0	17,512	36,604
33	1,971	17,121	0	16,938	36,030	1,971	17,121	0	17,512	36,604
Total	57,159	496,509	942,647	491,215	1,987,530	57,159	496,509	388,287	507,835	1,449,790

(b) Pumping Station

The expense for full-scale operation of the pumping station to be constructed in the IMT is estimated at Rs 11.43 million/year, and this annual expense is assumed proportional to the volume of water supply.

(5) Investigation on Profitability

The computation results under the assumed conditions are listed in Table 11.1.15 (Profit & Loss Statement and Cashflow Table of Case-A1 is shown in Appendix V.6). The calculated water charge for both Cases are higher than the current price of industrial water at Rs 2.5/m^3, and financial support will be necessary.

Table 11.1.15 Water Charge and the IRR

	Water Charge (Rs/m^3)	ROI(b/tax)	ROI(a/tax)	ROE(b/tax)	ROE(a/tax)
Case-A1	6.83	12.6 %	9.9 %	10.0 %	3.9 %
Case-A2	8.13	15.6	12.4	10.5	3.9
Case-B1	5.26	12.2	9.6	9.5	3.6
Case-B2	6.22	15.5	12.6	9.9	3.9

11.1.6 Sewage Treatment

(1) Sewage Volume

The volume from the IMT is assumed equal to the volume of water supply.

(2) Disbursement Schedule

The start-up of sewage operation will be in the 5th year to meet the schedule of water supply. Similarly, the construction period is assumed as three years, and the respective disbursement percentages will be 10%, 30%, and 60% of the construction costs.

(3) Operating Expenses

The expense for full-scale operation of the wastewater treatment facilities is estimated for the wastewater treatment plant: Rs 8.72 million/year and the sludge treatment plant: Rs 39.07 million/year, and the amount is assumed proportional to the volume of wastewater.