

5.2.2 Financial

1) Upgrading of the Existing Financial Facilities

(1) Reassessment of the Revenue Requirement of the Phatthaya City

Recommendation

Based on the demarcation of the duties and powers for the administration of Phatthaya, the revenue requirement for the City should be reassessed. The necessity and degree of enhancing the autonomous revenues as well as its measures should also be examined.

Explanation

i) DOLA of MOI, Revenue Department of MOF and PCG as well as other departments and agencies concerned should be involved for the reassessment.

(2) Enhancement of the Total and Autonomous Revenues of the Phatthaya City

Recommendation

The current level of the total revenues of the City which is 147.2 million bahts in 1988 seems not sufficient considering the huge requirement for the infrastructure development. The amount and the share of the autonomous revenues which is 39.9 million bahts or about 27% of the total also seems low to take prompt actions against swiftly degrading conditions of the environment.

Explanation

i) The appropriate level of enhancing the total and autonomous revenues should be in line with the Thai Government policy for decentralization and the distribution of duties and powers for infrastructure development. It still may be advisable to enhance the total and autonomous revenues of the PCG so that the local government can cope with and solve the indigenous urban problems.

- ii) In case the PCG staff is reinforced reflecting the actual number of resident population and visiting tourists, the financial requirement for meeting recurrent expenditures would sharply be increased.

(2) Examination of Locally-Levied Taxes

Recommendation

The locally-levied taxes, particularly the house and land tax which is the biggest tax revenue item among all the taxes, should be examined including tax exemption clause and incorporation of the actual market value of the land appurtenant to the house. Taxation rates of the local development tax should also be examined.

Explanation

- i) The framework of the taxes should be formed in due consideration of public finance, optimum resource allocation (economic development), equity capability for payment and other relevant aspects, taking also into account the fees and charges imposed for public services. In this study, however, the aspect of public finance is mainly studied. Detailed study and examination should be carried out, taking all of the above aspects.
- ii) The house and land tax, which is imposed based on the annual rental value of the house and the appurtenant land, has an exemption clause that the owners of the houses for their resident purpose are exempted from this tax and the rate is decreased to one third for the buildings for manufacturing purpose. It may be advisable that whether or not these exemptions should remain should be examined.
- iii) Currently, the rental value is based mainly on the building. It may be advisable that the rental value of the appurtenant land should fully be taken into account, considering the sharply raised market value of the land in Phatthaya.
- iv) The tax rates per rai of land applied in the local development tax remain the same for long years. It may be advisable that appropriate level of rates should be examined, considering the sharply raised market value of the land.

(3) Examination of Surcharge Taxes

Recommendation

Phatthaya City is legally authorized to add a surcharge of 10% to such national taxes as business tax, gambling tax and liquor tax. To enhance the financial base of the City, it may be advisable to increase the surcharge rate.

Explanation

i) In 1988, the share of the business tax revenue, which is the principal surcharge tax, in the total tax revenue was 38.6%. If the surcharge rate should be raised, the business tax revenue would sharply be increased and give positive impact on the finance of the City.

(4) Examination of the Allocation Rule of Shared Tax

Recommendation

It may be advisable that the present allocation rule for the vehicle tax should be examined from the viewpoints of the contribution of each local government to the tax generation as well as the revenue requirement.

Explanation

i) The vehicle tax, which is a shared tax, is distributed among provincial government (25%), sanitary districts (25%) and 6 municipalities (50%) in the case of the Chon Buri Province where the Phatthaya City is located. Distribution among the 6 municipalities is even for all and the City is given one twelfth of the total, although its contribution to tax generation and the need for revenue may be bigger.

(5) Examination of Collection Fee For Tax Collection

Recommendation

Surcharge taxes are collected by the local representative of the Revenue and Excise Department, MOF and 5% of it is deducted for covering collection expenses. It may be advisable that whether or not the present

collection fee is appropriate compared with the actual expenses should be examined.

Explanation

- i) It may be advisable that the collection fee, after examination of the actual expenses incurred for tax collection, should be revised based on the actual costs.

(6) Improvement of Tax Collection Rate

Recommendation

In order to improve the current low level of tax collection rate, it is advisable that various countermeasures should be taken including:

- Strengthening of tax map and property registration systems;
- Reinforcing the competent personnel of PCG for collecting locally-levied taxes as well as preparing collection manuals and necessary equipments;
- Ensuring stronger coordination among the departments and divisions of the Central Government and PCG for tax collection.

Explanation

No data are available with regard to the collection rates of taxes for Phatthaya while it is around 40% according to the survey carried out 5 towns in Thailand. The rate may be higher for Phatthaya but still big incremental revenues could be obtained by improving the collection rate.

(7) Augmentation of the Central Government Grants for Subsidy

Recommendation

It is advisable that the special grant given from the Central Government to be used for supplementing the development expenditure of the Phatthaya City should substantially be increased from the current 30 to 40 million baht level, considering the urgent need for the public sector investment on infrastructure development in Phatthaya.

It is also advisable that the general grant should be increased by increasing per head grant from the current 60 bahts and by being based

on the actual population rather than the current registered population basis.

Explanation

i) The increase should also reflect the rate of inflation in the past years.

(8) Examination of the Levels of the Fees For Utilities

Recommendation

It may be advisable that the sewerage service fee should be established and collected from the beneficiaries or people and entities. The level of the fee should be determined, taking into account consideration an appropriate level of cost recovery and the principle of beneficiary-to-pay. The level of the solid waste and nightsoil collection fees should also be examined.

Explanation

i) Currently PWD is conducting a feasibility study for a sewerage development of Phatthaya which encompasses a study for sewerage tariff. Whether or not fees should be imposed and their levels should, therefore, be determined based on the results of the above study.

ii) From the viewpoint of efficient resource allocation including averting wasting of the resources, certain level of cost recovery, covering the operation and maintenance costs for instance, and beneficiary-to-pay principle are advised to be considered.

iii) In 1988, 10,372 thousand bahts were disbursed on the solid waste and night soil collection services in Phatthaya, including personnel expenses, expenses on new equipments and materials, repair and fuel and oil. Whereas only about 933 thousand bahts were collected, meeting only about 9% of the costs. It may be advisable that the fees should be raised and collection rate of fees should be improved.

(9) Flexible Use of Income Receiving Facilities

Recommendation

According to APCA, besides the tax and grant revenues, Phatthaya City may receive:

- incomes from commercial undertakings of Phatthaya City;
- incomes from the sale of bonds after the approval of MOI and MOF has been obtained and ordinance thereof has been enacted;
- loans after the approval of MOI and also that of MOF in case of foreign loan;
- incomes from properties of the State or State enterprises which engage in the business for the profits in Phatthaya City.

It may be advisable to use these financial facilities flexibly particularly from the viewpoint of tourism promotion and strengthening the business function of the City as the center of ESB region.

Explanation

- i) In utilizing the above facilities, feasibility of the undertakings, repayability of loans and bonds as well as the management capacity of the City should duly be taken into account.

2) Introducing New Financial Facilities

(1) Allocation of Income Taxes

Recommendation

Corporate and income taxes are national taxes and are not allocated to the local governments including PCG. In order to enhance the revenue base, it may be advisable to allocate a portion of the collected revenues to the local governments.

Explanation

- i) Allocation may be based on contribution to the tax generation and the needs of the local communities.

(2) Introduction of Environment Conservation Tax

Recommendation

In order to upgrade promptly the environmental conditions of Phatthaya, it may be recommended to introduce an Environmental Conservation Tax having the characteristics that

- The collected tax revenue should be used for improving the environmental conditions of Phatthaya including water quality and sanitary conditions;
- This tax should be a local tax applicable only to Phatthaya, the PCG being tax collector and receiver of the revenue as well;
- This tax should be an indirect tax, private enterprises being direct tax payers who lay the equivalent sum on the users of facilities and consumers;
- This tax is imposed for a specified period during which the purpose of the tax should be attained.

Explanation

- i) Tax payers would mainly be hotels, restaurants and shops who then lay the payment on the tourists and other visitors. These final tax payers would receive benefits through the upgrading of the environment.
- ii) Based on the condition in 1987 when 1,417 thousand tourists visited Phatthaya with the average length of stay of 4.02 days, about 285 million would be generated annually, assuming 50 bahts per tourist day of tax.

(3) Introduction of Property Tax

Recommendation

The present house and land tax is based on the rental value of the buildings and the land appurtenant to the buildings. In order to directly reflect the enhanced value of the real estate of Phatthaya on the City's finance, it may be advisable to introduce the property tax system,

replacing the present house and land tax. Property tax should be a local tax.

Explanation

- i) The property tax may be more effective than house and land tax due to the more direct assessment of taxable value.

(4) Introduction of Capital Gain Tax

Recommendation

To enhance the finance of the governments, it may be advisable that capital gain tax for the real estate should be introduced. By applying higher tax rates for these tax payers who have held the estate for short period, reduction of the transaction of land and buildings on speculation may also be expected.

Explanation

- i) Appropriateness of the introduction of capital gain tax and its characteristics should be examined by the departments and agencies concerned.

5.2.3 Legal

1) Enactment of Laws, Royal Decrees and Ordinances

In order to materialize and support the institutional and financial reforms recommended in this Study, amendments of the existing laws, Royal Decrees, Ordinances, etc. should be made, if the Government of Thailand so decides. In some cases, enactment of new laws and other legal actions should be taken. The relevant laws would include:

- i) Enhancement and Conservation of Natural Environmental Quality Act, B.E. 2518
- ii) Public Health Act, B.E. 2584
- iii) Town Planning Act, B.E. 2518
- iv) Building Control Act, B.E. 2522

- v) Administration of Phatthaya City Act, B.E. 2521
- vi) Municipal Act, B.E. 2496
- vii) Royal Decree of Municipal Officials, B.E. 2519
- viii) Municipal Revenue Act, B.C. 2497
- ix) House and Land Tax Act, B.E. 2475
- x) Local Development Tax Act, B.E. 2508

2) Specific Recommendations

Careful and in-depth study should be carried out on the necessity and the way to amend the current legal setting of Phatthaya and the country in order to upgrade the present environmental conditions of Phatthaya and to realize its integrated development effectively.

These laws directly concerned with the institution and financial recommendations should accordingly be amended. Hereunder several specific recommendations are made:

(1) Enhancement and Conservation of Natural Environmental Quality Act

Recommendation 1

It is recommended that the types and sizes of projects or activities requiring Environmental Impact Assessment (EIA) report to be submitted under the Act regarding the measures for the prevention of and remedy for the adverse effect on the environmental quality should include hotels and resort facilities with less than 80 rooms.

Explanation

- i) Under the Act, the official who is invested by law the power and duty to consider and grant a permit or renewal of a permit to any person in order to enable him to carry out any project or activity shall submit a report concerning the study and measures for the prevention of and remedy for the adverse effect on the environmental quality. This, however, is applicable to the hotels and resort facilities with 80 or more rooms. No preventive measures are, therefore, assured for the smaller ones.

- ii) This may be done by revising by the Ministerial Notification of the Ministry of Science Technology and Energy.

Recommendation 2

It is recommended that the level of fines against the violation of the Act should be examined so that they reflect the value of violation, i.e., the benefit which violator could get and the value of damage caused. The power of promoting and maintaining the environmental quality and natural resources should be given to the Phatthaya City.

Explanation

- i) There exists criticisms that some sewage treatment plants installed in the hotels and resort facilities are not operated after the installation. It is recommendable that the Act should also ensure the operation of the installed facilities.

(2) Public Health Act

Recommendation

It is recommended that the solid waste and nightsoil collection fees should be raised by revising the Regulation of the Ministry of Public Health, B.E. 2528 issued under this Act so that certain level of cost recovery as well as the principle of beneficiary-to-pay should be attained.

Explanation

In 1988, about 10.4 million bahts were disbursed by the Phatthaya City, whereas only about 0.9 million bahts or 9% of the total expenditure were collected by collection of the fee.

(3) Town Planning Act, B.E, 2518

Recommendation 1

In order to expedite the expropriation of land or immovable property in the enforcement of the Specific Plan, the compensation to be paid to the owner or the occupier of the property to be expropriated should be prescribed according to the fair price of the property as of the date of the enforcement of the Town Planning Act enforcing the Specific Plan,

instead of the date of the enforcement of the Royal Decree prescribing the area of land for the making of the Plan.

Explanation

- i) In case that a Royal Decree is issued, prescribing the area of land for making the Specific Plan, the compensation shall be prescribed according to the fair price of the property expropriated as of the date of the enforcement of the Royal Decree. When there exists large discrepancy between the dates of the enforcement of the Royal Decree and the Act, there exists usually big gap between the prices of the property at these dates, causing troubles by these who do not agree with the prescribed prices.

Recommendation 2

It is recommended that the penalty prescribed in the Act should be strengthened in order to make its enforcement more effective. The amount of the fines should be based on the benefit derived from using the land or modifying or altering the immovable property differently from that prescribed in the Act enforcing the Specific Plan or Ministerial Regulation enforcing the General Plan.

Explanation

- i) Phatthaya area is prosperous at present and expected to be developed further in the future. The benefits which could be derived from the use of land and altering the immovable property differently would far exceed the prescribed fines. The fines should be high enough so that the violation can be prevented.

(4) Making of a General Plan for the Study Area

Recommendation

In order to guide the rapid development which is prevailing at present and expected to continue in the coming years in the Study Area, it is recommended that a General Plan should be prepared and made for Jomtien, The Farang, Bang Sare and Ko Lan which are not covered by the existing General Plan for Phatthaya (see Fig. 5.2.1). A Ministerial Regulation should be declared subsequently to enforce the Plan. If deemed appropriate, the

present General Plan should also be revised so that it is in harmony with the new Plan.

Explanation

- i) The current development in Phatthaya is not confined in the land area of the Phatthaya City any more for which General Plan has already been in force, but expanding to the adjacent areas, Jomtien in particular and expected to expand further. Unless General Plan covers the whole of the developing area, disorderly development and the urban problems would continue to prevail over the wider area.
- ii) The General Plan should be made either by PCG or the Office of the Town Planning as stipulated by the Town Planning Act.

(5) Making of a Specific Plan

Recommendation

In order to achieve the orderly and efficient development as well as to secure the public safety and security and environmental conservation, it is recommended that a Specific Plan should be prepared and made for the Study Area, keeping consistency with the General Plan. The Specific Plan should be effected by enacting an Act subsequently. It is worth consideration that the Specific Plan should be made without making of A General Plan for the area where a General Plan has yet to be made, in order to expedite the making of a Specific Plan.

Explanation

- i) Preparation and making of a Specific Plan is recommendable considering that with an Act it can be more effective in enforcement than General Paln, having the provisions of land expropriation and removal and demolition of the buildings.

(6) Building Control Act, B.E. 2522

Recommendation 1

In order to meet the objective of the land classification stipulated in the General Plan and Specific Plan, the following control measures should

additionally be provided through the modification of the Building Control Act.

- Building coverage ratio
- Floor area ratio
- Absolute height
- Other measures appropriate for better town planning

Explanation

- i) Possible application of the control measures are shown in Table 5.2.1.

Recommendation 2

It is also recommended that types of buildings should be regulated in the Building Control Act, which are allowed to be constructed in the tracts where alternative land use other than specified in the General Plan is allowed by the Town Planning Act.

Explanation

- i) At present, due to the 30% allowance of alternative land use provided by the Town Planning Act, the objective and policy envisaged by the General Plan could be jeopardized. The proposed provision for the Building Control Act would improve the situation.

Recommendation 3

With a view to more effective execution and enforcement of the Act, it is recommended that the Local Competent Officer, City Manager in the case of the Phatthaya City, who is authorized to issue a building licence or give disapproval order thereof should also be empowered or at least involved to consider and impose fines against violations for which penalty is a fine only.

Explanation

- i) At present, the Act stipulates that Cases Comparison Committee shall consider the fine to be imposed against violation for which penalty is a fine only. The involvement of the Local Competent Officer would make law enforcement more effective.

(7) Building permit with stronger coordination with infrastructure development

Recommendation

In order to avoid the discrepancy between building construction and infrastructure development and provision of public services, due consideration should be paid in the execution of Building Control Act for the resulting requirement for public services, when the license is issued for building construction and modification.

Explanation

- i) The main reason of the current urban problems in Phatthaya is the rapid private investment for land and buildings and inability of public sector investment to cope with despite that they should be developed in harmony.
- ii) Strong coordination should be maintained particularly between the local competent officer who is Phatthaya City Manager and the Office of the Buildings Control Committee as well as the departments and authorities in charge of the provision of public services.

(8) Promotion of favorable development

Recommendation

It is recommended that preferential treatment should be given to these well-fit to the development policy of Phatthaya. The preferential measures may include :

- Legal measures
- Financial incentives

Explanation

- i) Legal measures should include the easement of the control measures including building coverage ratio, floor area ratio and absolute height.
- ii) Financial incentives may include the preferential tax treatment including exemption and reduction of taxes.

5.3 Other Relevant Recommendations

1) Taking Population Census

Recommendation

It is strongly recommended that a comprehensive population census should be carried out as soon as possible by the Central Government in cooperation with PCG in order to improve the accuracy of infrastructure development planning as well as to upgrade the institutional and financial strength of the Phatthaya City.

Explanation

- i) In 1989, about 52,000 population was registered at the Phatthaya City. It is certain, however, there exist substantial number of non-registered population which is assumed at about the same size as of the registered in this Study, making the total population in the City at about 100,000. However, no accurate statistical data is available for population and number of employments. Population census should be taken at the earliest timing as possible to serve for:
 - ① Effective planning of the infrastructure development which largely depends on the accuracy of the current and forecast population sizes;
 - ② Number of civil servants including police force and amount of general grant from the Central Government as well as excise and liquor tax are determined based on the size of the registered population. If they are revised to be based on the actual size of population, the institutional and financial strength of the Phatthaya City would largely be upgraded.
- ii) The first census should be a comprehensive one including geographical distribution of the population, number of employees by industry as well as number and sizes of the establishments. The census should be carried out regularly thereafter.

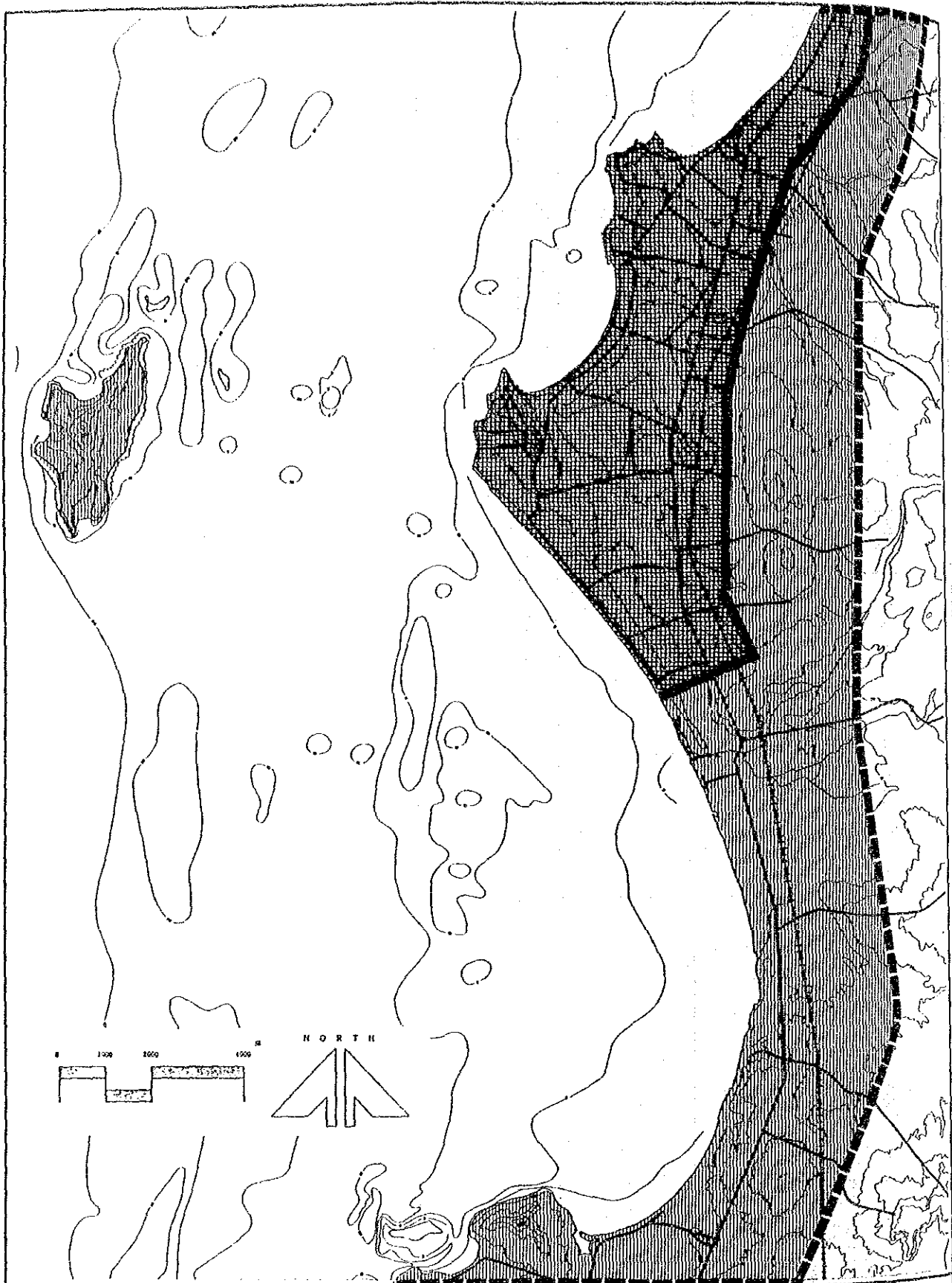
Table 5.2.1 Required Control Measures

Facilities	Low Density Resid. Area	Med. Density Resid. Area	High Density Resid. Area	Commercial (I)	Commercial (II)	Industrial Area	Gov. Area	Open Space Agricultural
<u>Density Control</u>								
Building Coverage Ratio	Max	Max	Min		Min	Max	Max	Max
Floor Area Ratio	Max	Max	Min		Max	Max	Max	Max
Absolute Height	Max	Max	Max		Max	Max	Max	Max
<u>Restriction of Building</u>								
Building Use	○	○	○	○	○			○
Materials of Exterior Wall								○
Structure								○
Securing Access	○	○			○	○	○	○
<u>Special Control</u>								
Building Style								○
Colour								○
Number of Floor	○							○
Signboards	○							○
Vegetation	○							○
Fencing	○							○
Openspace								○

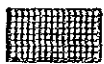
Remarks: /1 "Max" and "Min" means maximum level and minimum level of the ratios should be limited, respectively.
 /2 "Commercial (I)" is under the category of "High Density Residential/Commercial".

Table 5.2.2 Types of Buildings Permitted in the Allowance Area

Facilities	Low Density Resid. Area	Med. Density Resid. Area	High Density Resid. Area	Commercial (I)	Commercial (II)	Industrial Area	Government Area	Open Space Agricultura
Residential Unit	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/> Gov.	<input type="checkbox"/>
Condominium		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Employee	<input type="checkbox"/> Housing	
Educational								
- Kindergarten	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
- School	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
- University	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Public Facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medical								
- Clinic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
- Hospital		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	
Commercial								
- Small scale shop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
- Department store			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
- Film Theatre			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
- Entertainment				<input type="checkbox"/>	<input type="checkbox"/>			
- Parking		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Park	<input type="checkbox"/>	<input type="checkbox"/>	Pocket Park			Pocket Park	<input type="checkbox"/>	<input type="checkbox"/>
Industrial Facilities								
- Workshop		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- Large Scale Industry						<input type="checkbox"/>		<input type="checkbox"/>



LEGEND



Present General Plan Area



Proposed General Plan Area
in 2006
2Km from Sukhumvit Highway

THE MASTER PLAN STUDY FOR
THE DEVELOPMENT OF PHATTHAYA AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.2.1 Proposed General Plan Area
in the Study Area

6. PROJECT DESCRIPTION

6.1 Waterfront Improvements

6.1.1 South Phatthaya Land Reclamation and Port Facilities

1) General

The following waterfront improvements, all located in South Phatthaya, are categorized as priority projects for completion by 1996:

- land reclamation
- tourist port
- jetfoil/hydrofoil berth

The existing entertainment area in South Phatthaya, although an essential part of Phatthaya's commercial success and prosperity, suffers from unhygienic conditions and causes pollution of seawater in the bay. Waterfront land in Phatthaya is scarce and additional land obtained by reclamation around the entertainment area would be potentially valuable: if leased on commercial terms it would provide funds to finance the overall scheme. The port developments would provide essential facilities for local and Bangkok - Phatthaya sea transport where none exist at present.

An integrated development as shown in Fig. 6.1.1 offers the opportunity to re-vitalize and improve the waterfront of the most highly developed part of Phatthaya, thus contributing to the success of the many hotels and commercial establishments in the area, and of Phatthaya generally.

2) Land Reclamation

(1) Impact on Coastal Stability

Any reclamation project which changes the shape of the shoreline has a potential impact on coastal stability. The Eastern Seaboard coastline was discussed in 4.2.2 and attention was drawn to the characteristic spiral shape of the bays between Sattahip and Chon Buri. It was noted that the coastline is in a state of dynamic equilibrium and that small longshore movements of sand occur, the direction of movement varying with the seasonal wind direction and the inclination of waves to the coastline.

If reclamation is carried out, an adverse impact on the coastline is unlikely if two criteria are met. Firstly the characteristic shape of the bays should be maintained as far as possible, and secondly the reclamation should be in an area which is sheltered from the prevailing southwesterly wave direction. The plan shape and location of the proposed reclamation shown in Fig. 6.1.1 satisfy both these criteria.

In Japan, numerous reclamation projects were undertaken in the past. According to these experiences, reclamation projects of relatively small scale impose no major impacts on coastal erosion and natural environment and environmental impact assessment is not required to be conducted for the reclamation projects with less than 50 ha of area according to the present regulation of the Government of Japan. The South Phatthaya Reclamation Project with 19 ha of area is, therefore, expected to impose only minor impact on the surrounding environment.

The effects of potential erosion, if any, could be accommodated by supplying small quantities of sand at selected locations. In any case, most of the sand movement takes place along the existing beach between the north headland of Phatthaya bay and the edge of the entertainment area. There is very little sand under the structures of the entertainment area, so reclamation in this location would not deplete other parts of the bay of a sand source.

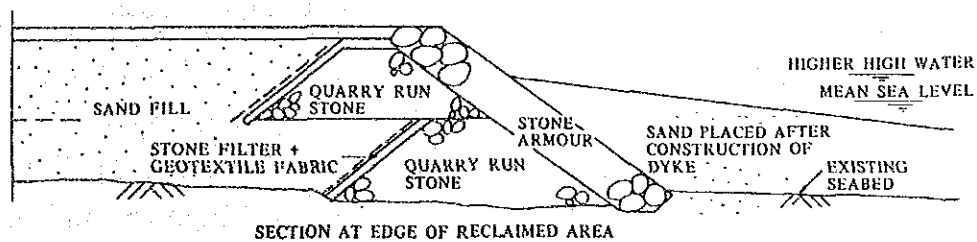
(2) Project Description

The proposed reclaimed area will occupy a total length of approximately 1900 m., measured along the existing curved coastline. It will be tapered at the two ends near the junction of Phatthaya Beach Road/South Phatthaya road and Laem Phatthaya respectively, but at its widest portion between Khlong Phatthaya and the Siam Bayshore Hotel it will be 180 m. wide. The total area reclaimed (excluding the additional piece which provides the operational area of the tourist port described in 3)) will be 19 hectares.

Reclamation will be carried out within a rubble mound dyke placed around the seaward perimeter of the area to be reclaimed. The dyke will be constructed of quarried stone placed to slope. A rubble mound structure with a sloping face is proposed in preference to a vertical faced structure as it is cheaper and will also cause less wave reflection, reducing the risk of

scour of beach material in front of it. The outer face of the dyke will be protected by natural stone armoring. The northwest is the predominant wave direction for design of armoring, since the reclamation site is protected from southwesterly and westerly waves. Taking account of likely maximum wind speed from the northwest, fetch in this direction and wave refraction, the rock armor should be designed for wave height not less than 1.5 m.

Fill should be granular material - preferably sand with a "fines" content (material of particle size less than 0.074 mm.) not exceeding 15%. The fill could either be hauled and placed using land-based equipment, or transported by sea and pumped into the area to be reclaimed using dredging equipment. The latter method is to be preferred as transportation of large quantities of sand through Phatthaya City would cause unacceptable traffic congestion.



Fill material which is placed will be up to 5 m. deep in some areas and will require compaction to minimize settlement. If free draining granular fill is used, material placed within the tidal range, i.e. up to a level of approximately +3.0 m. (/1), will be compacted by the rise and fall of the tide. Above this level, the fill should be placed in layers spread by bulldozers and compacted by conventional road construction equipment.

Two areas of the site require special consideration during detailed planning and design of the reclamation project.

- (i) Reclamation under the existing structures of the entertainment area : these structures are supported on piles which will continue to have a load-bearing function. Fill should, however, be placed underneath the ground floor slabs of the structures to avoid an area of stagnant

/1 level relative to lowest low water

water which will be environmentally unacceptable and a health hazard. The lower layer of fill (below mean sea level) will probably be pumped between the piles, using small diameter pipes so that the fill is placed evenly and in small quantities, thus minimizing lateral forces on the piles. The final layers may have to be placed through openings made in the ground floor slabs of the existing structures, causing some disruption and inconvenience to occupants. Execution is likely to be slow and expensive, with a high manual labour content, and this will be reflected in a high unit cost for this part of the work.

- (ii) Extension of Khlong Phatthaya : Khlong Phatthaya currently discharges into the south corner of Phatthaya Bay. It will be necessary to extend the river channel so that the river discharge is directed to a suitable location on the edge of the reclaimed area. The flow is at present highly polluted and improvement of water quality will be required, else the presence of a discoloured, foul-smelling river channel will diminish the value of the reclamation.

(3) Sources of Sand Fill

Two inland sources of sand for reclamation have been identified within reasonable transportation distance of Phatthaya. Sand is available at Nong Ko and also at Ma Prachan. Examination of sand samples and grain size distribution curves from laboratory tests indicates that both sources can provide reclamation fill of good quality with a very low "fines" content, well below the 15% limit recommended earlier.

In order to avoid road traffic congestion and environmental nuisance in Phatthaya City, the use of marine equipment for reclamation is advisable. If sand from a land source is used it will be necessary to transport it to a loading point on the coast (probably Laem Chabang) for transfer to marine plant and transport by sea to Phatthaya. The costs of double handling incurred by this method could be avoided if a suitable offshore source for dredged sand were located. A key aspect of the feasibility study for the reclamation project would be site investigations to search for offshore deposits of sand within reasonable sea transport distance of Phatthaya.

The use of a trailing suction hopper dredger would be appropriate if the source were more than 5 km. from the reclamation site. If a source

nearer to Phatthaya were available, sand could be pumped directly to reclamation by a cutter suction dredger.

3) Tourist Port

(1) Demand for Port Facilities

The demand for port facilities was assessed in 4.2.2 and it was concluded that the proposed tourist port should be suitable for a projected peak total of 5,200 round trips/day, provided by 150 active excursion boats from a total fleet of 180 - 200 boats.

(2) Facility Type

At present excursion boats anchor in Phatthaya bay or Ko Lan at night or during the day when not in use. For an existing and future projected total of 180 - 200 boats, it would not be a practical or economic proposition to provide moorings at berths for the full vessel fleet. Besides, as the construction of breakwaters to provide sheltered conditions should be avoided (in order to minimize capital costs and potential coastal engineering problems) the most effective method for boats to cope with occasional bad weather is to lie at anchor, aligned to the prevailing winds and waves. If they were moored at open berths they would have to leave their moorings or run the risk of damage to boats and berth structure.

The type of facility proposed is a port with a number of berths where excursion boats would moor for periods sufficient only for passengers to disembark and embark. No boat would stay at a berth for a longer period : instead it would vacate the berth after completing passenger disembarkation/embarkation, and at busy periods each berth would be occupied by a number of boats in rotation. Essentially the facility would be similar to a multi-user bus terminal.

The proposed facility would comprise a number of finger piers which berth vessels on both sides of each pier. The piers would extend seawards from a port operating area containing port buildings, vehicle parking, ticketing offices, canteen, toilets and amenities. Pier dimensions and clearances, minimum water depth and number of berths required are discussed in (4).

(3) Design Vessel Characteristics

The principal dimensions of existing excursion vessels are shown graphically in 2.5.1. The maximum dimensions of the larger vessels are 40 m. length \times 12 m. width \times 1.7 m. draft. There is a wide variation in vessel dimensions for the full range of vessels which were surveyed, but the average dimensions were 20.5 m. length \times 5.2 m. width \times 0.9 m. draft.

For port planning purposes, maximum design dimensions for two sizes of vessels are required : the larger vessels which carry 100~200 passengers and all the rest, with passenger capacities ranging from 12~75. The following vessel characteristics are proposed :

	Large vessel (meters)	All other vessels (meters)
Length	40	20
Width	12	7
Loaded draft	1.7	1.2

The port layout will be such that berths for large vessels are located at the seaward end of each pier where deeper water exists, and other smaller vessels will berth at the inshore portion of each pier.

It will be noted that the proposed maximum dimensions for large vessels are based on current maximum size and there is no allowance for possible increase in size. This is based on the premise that 200 passengers and 1.7 m. loaded draft (which is the critical dimension for port planning) are realistic maxima, bearing in mind the service these vessels provide to Ko Lan and other islands. The vessels must be suitable for the proposed destination as well as Phatthaya, and any vessel with loaded draft greater than 1.7 m. would experience difficulty in coming close inshore at Ko Lan's beaches.

(4) Berth Planning

The number of berths required is estimated thus :

(i) Peak Passenger Handling Rate

- passenger round-trips, peak rate = 5,200/day
- 75% of departures take place in the morning between 08:00~11:00, the rest at other times throughout the day
- 75% of arrivals take place in the late afternoon and early evening between 15:00~18:00, the rest at other times
- peak departure and arrival times do not coincide

$$\begin{aligned} \text{Peak passenger handling rate} &= \frac{0.75 \times 5200}{3} \text{ departures} + \\ &\quad \frac{0.25 \times 5200}{6} \text{ arrivals} \\ &= 1300 \text{ departure} + 220 \text{ arrivals} \\ &\quad (\text{or } 1300 \text{ arrivals} + 220 \\ &\quad \text{departures}) \end{aligned}$$

(ii) Vessel Turn-around Time

For vessel leaving between 0800~1100 :

Vessel comes alongside berth, secures mooring lines and lowers passenger gangway	7 min
Passengers disembark (few in number)	5 min
Passenger embark (large number)	15 min
Raises gangway and leaves berth	5 min

32 min
(say 35 min)

Turn-around time for vessels arriving between 15:00~18:00 would be similar or slightly less since disembarkation is quicker than embarkation.

(iii) Number of Berths

The peak number of 1300 departing passengers per hour are assumed to travel as follows:

Boat type/size	Proportion A	No. of Passengers (80% max. capacity) B	A×B
Big	0.18	0.8×136	19.6
Medium	0.42	0.8×33	11.1
Speed	0.25	0.8×15	3.0
Other	<u>0.15</u>	0.8×19	<u>2.3</u>
	1.00		36.0

Average number of passenger per boat = 36
 Number of boats per hour $1300 \div 36 = 36$
 Boat frequency (35 min. turn-around) = 1.7 per hour
 Number of berths required $36 \div 1.7 = 21$

In addition to the above berths for public services, berths should also be provided for rescue services (life-saving, fire-fighting, etc.), marine police and port operational vessels. Nine extra berths are proposed, making a total of 30 berths.

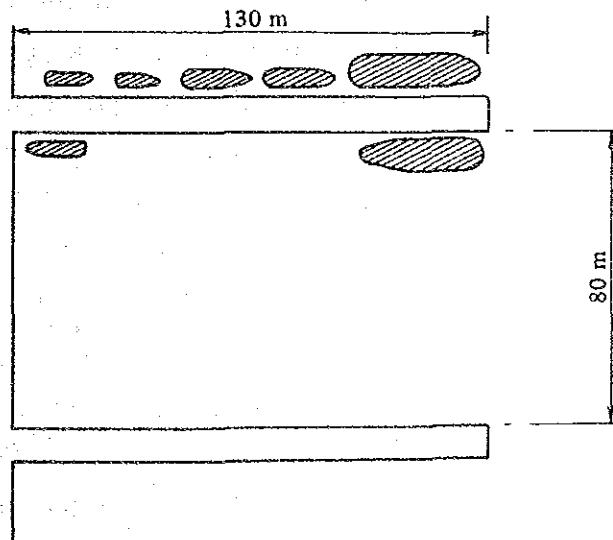
This estimated total of 21 public service berths (for 960,000 round types per year in 2006) may be compared with 33~40 berths (for 470,000 round trips per year in 1986) which were estimated in the 1978 JICA feasibility study. Although the two estimates appear to conflict, the difference is readily explained. The 1978 estimates were based on smaller vessels (length 7~20 m. only) and an average of 9 passengers per boat. The current estimate is based on an average of 36 passengers per boat which takes account of the introduction of larger vessels of length up to 40 m. and passenger capacity up to 200.

(iv) Berth Dimensions & Layout

The water depths and seabed levels required alongside the berths are:

	<u>Big boats</u>	<u>All other boats</u>
Loaded draft	1.7 m.	1.2 m.
Underkeel clearance	<u>+0.3 m.</u>	<u>+0.2 m.</u>
Minimum water depth	=2.0 m.	=1.4 m.
Seabed level (relative to LLW)	-2.0 m. or deeper	-1.4 m. or deeper

The typical berth layout is shown below. Ten (5×2) berths will be provided by each 130m. long pier, 5 on each side for one 40 m. long boat, two boats 20m. long and two 15 m. long. The big vessels will berth at the seaward end of each pier (seabed level -2.0m. or deeper) and the other vessels at the inshore part where the water is less deep. Three piers will be required for 30 berths. The piers will be arranged with a clear width of 80m. between piers, to allow other vessels sufficient space to pass alongside the big boats moored at the ends of piers and to manoeuvre between piers.



Although each pier face is nominally intended for 5 vessels, the 130 m. long continuous berthing face will allow more vessels to be berthed at any time if their lengths are shorter than those assumed for planning purposes.

The two berths at the end of the eastern pier should be allocated for regular scheduled services (if introduced) and the west face of the

western pier for rescue service and marine police boats, so that these vessels can depart and arrive at berth quickly in emergency, without having to manoeuvre between piers and moored vessels.

The pier structure will be a piled structure of conventional concrete construction, comprising pairs of prestressed or reinforced concrete piles at 4.0 m. spacing which support a reinforced concrete pier deck. Landing steps for passenger embarkation and disembarkation will be provided on either side of the pier and these will be staggered so that at any transverse section of the pier there is only one landing. Protective handrailing will be required around the landing recesses, and the usual marine fixtures such as fenders, bollards and mooring rings at regular intervals along the pier length. Outline details of the pier structure are shown in Fig. 6.1.2.

(5) Tourist Port Location

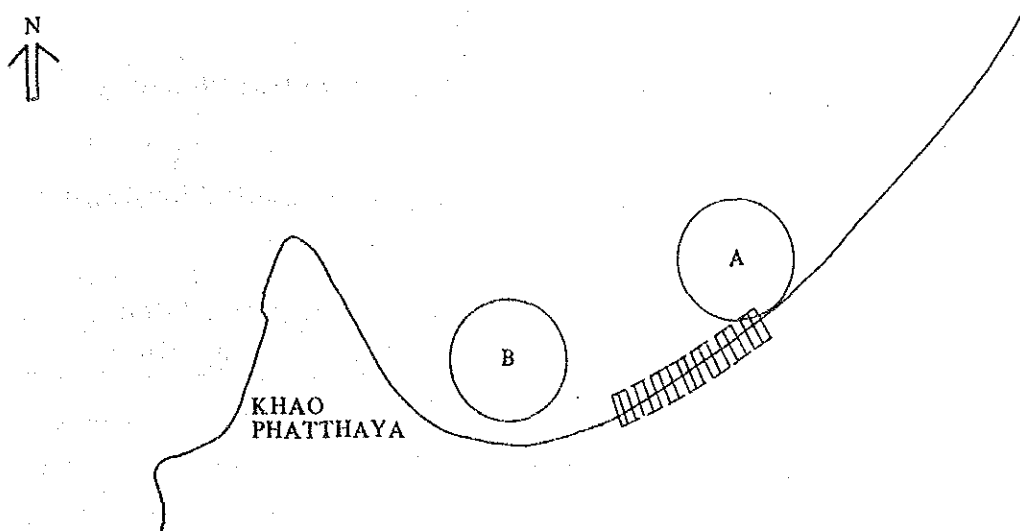
In general terms the only satisfactory location for the construction of a tourist port at Phatthaya is in the southwest part of Phatthaya bay, which is sheltered by the Laem Phatthaya headland and Ko Lan from the prevailing southwesterly and westerly waves. The suitability of this location is demonstrated by the siting of the old fishing village and piers here : the seafaring community, with its intimate knowledge of local conditions would tend to choose a good area which provided shelter and sufficient water depth for their operations.

In this southern part of the bay, however, there are two possible locations:

Location A : Near the east end of the entertainment area, seawards of the junction of Phatthaya Beach Road and South Phatthaya Road; this was the location recommended in the 1978 JICA Feasibility Study.

Location B : Between the west end of the entertainment area and Khlong Phatthaya.

The two alternative locations are shown in the figure below.



Conditions have changed since the 1978 Study, which was based on the assumption that the illegal buildings and structures on the seafront (the "entertainment area") would be removed and a small area of reclamation carried out to provide land for port facilities serving the piers. The downtown district including the entertainment area has developed appreciably and is now an established feature of Phatthaya which would be difficult to remove or re-locate. Extensive reclamation around the area is now being considered as a means of containing the problem, thus controlling pollution and providing a more attractive waterfront. Another factor to be considered is that the average size of excursion boats has increased : these require deeper water for berthing.

In these circumstances the port location previously proposed needs to be re-examined. In terms of marine factors, location B is the more favourable. It enjoys good shelter from waves from all directions except the NW and NNW, and waves from these directions occur only infrequently. Based on the limited hydrographic survey data available, it is also closer to deeper water. On the other hand a port at this location, if it is to achieve its full potential is dependent on the reclamation described in 2) being implemented eventually, and at present there is no suitable access to the site. A port at location A is less dependent for its suitability on reclamation as described in 2), and road access would be available from existing roads, albeit they are already congested. The relative merits and demerits of the two locations are :

LOCATION B	LOCATION A
<u>Merits</u>	
<ul style="list-style-type: none"> - good shelter from waves and wind provided by headland and hill - close to deep water, particularly if reclamation is executed - back-up land available for facilities associated with port - near to suitable sites for jetfoil berth, boat yard, anchorage area, so integrated marine development is possible 	<ul style="list-style-type: none"> - closer to central Phatthaya area - road access available from existing roads - implementation not dependent on execution of reclamation
<u>Demerits</u>	
<ul style="list-style-type: none"> - no suitable road access at present (existing road narrow and congested) - About 1 km. from downtown area - not within easy walking distance - large scale reclamation necessary to exploit full potential of site 	<ul style="list-style-type: none"> - some shelter from waves and winds but not as good as B - far from deep water, piers would be long (and expensive) - isolated facility not forming part of integrated development - access from highly developed downtown area would be congested, potential problems at peak traffic periods.

Location B has much to commend it, but a major existing disadvantage is a lack of satisfactory road access. This is currently being remedied, as Phatthaya City has started construction of a road to the west side of Khlong Phatthaya, on the lower slopes of Khao Phatthaya, which will connect the inland area to the seafront. Location B is therefore selected for the proposed tourist port.

Another possible alternative has been considered but rejected for the reasons outlined below. This is an island type facility connected to land by an access bridge or causeway. The island would be situated in a part of

Phatthaya bay which had adequate water depth and reasonable shelter from wave action. The island structure could be of two alternative types :

- of open construction over the water, comprising a deck supported by piles
- of solid construction, comprising a reclaimed island with quays alongside or piers extending from it.

The first type is technically acceptable but the construction cost would be high. The second type would impede waves approaching the shore, altering the sensitive stability of the coastal regime and possibly causing erosion at some parts of the shore; in view of the problems being experienced at Phatthaya this should only be considered if the island is at a location where it has a minor effect only on waves approaching the shoreline. Besides, both types suffer from the basic disadvantage of an island facility - the bridge or causeway is a potential bottleneck for traffic at peak periods. An artificial island for the tourist port is thus rejected as a long-term solution, but could be considered as a first phase in a staged development at location B.

The integrated waterfront development scheme shown in Fig. 6.1.1 includes a tourist port at Location B.

(6) Port Buildings and Utilities

Buildings and other facilities serving the tourist port and related activities will be located on the reclaimed land south of the excursion boat piers. The buildings required will include the following :

- port operations building for control of berthing movements and anchoring of boats, port cleaning, maintenance and repair etc.
- port terminal building containing passenger hall, ticket kiosks, tour operator offices, washrooms and toilets
- passenger amenities : restaurant, refreshment booths
- tourist authority office, marine police station, coast guard base, sea rescue service

Utilities will include potable water supply, water for firefighting purposes, electrical power for the buildings and for illumination of piers,

roads and parking areas. Telephone connections will be required to the buildings and to pay-phones for public use. A bunkering point with a fuel supply line should be provided at a suitable location on one pier only, where all fueling is carried out using equipment and procedures complying with safety requirements. An efficient sewage collection and disposal system should be provided and boat owners encouraged to dispose of sewage and solid waste via this system; rather than overboard as happens at present.

Navigation aids should include marker buoys to indicate the limits of the approach channel and navigation lights to guide vessels after dark. These should comply with Harbour Department requirements.

4) Jetfoil/Hydrofoil Berth

(1) Jetfoil and Hydrofoil Services

Proposals have recently been put forward by private operators to provide hydrofoil services linking Phatthaya with Bangkok and other destinations. It is reported that a service using Soviet hydrofoils will start in early 1990. It has also been reported that privately owned pier facilities at Jomtien or at Wong Amat beach will be used for this service.

In general terms there will be a need for a jetfoil/hydrofoil berth at Phatthaya. If any of the proposals mentioned above are implemented the berth which is required at Phatthaya will presumably be provided by private interests. If, however, the current proposal does not materialize it would be sensible to include a suitable berth in Phatthaya bay along with the other marine facilities described earlier.

The excursion boat piers described in 3) are not suitable for jetfoils or hydrofoils. Such craft have a draft at berth (that is, when the hull is in contact with water and not foil-borne) of 3.5m. to 5.0m., depending on size and type of vessel. Some vessels can reduce their draft by raising their struts for berthing, but nevertheless about 4 m. water depth is the minimum required, or 2 m. greater than the large excursion boats described earlier.

Typical principal dimensions and other details of jetfoils and hydrofoils are given below, although variations are possible, depending on country of origin and manufacturer:

	<u>Jetfoil</u>	<u>Hydrofoil</u>
length	27.4m	28.7 ~ 31.0m
width	9.1m	6.1 ~ 6.2m (hull) 10.7 ~ 12.6m (foils)
draft	5.3m or 3.1m (struts raised)	3.5 ~ 3.7m
passenger capacity	250	125 ~ 180
maximum speed	40 knots	32 ~ 35 knots

The only area in Phatthaya bay where the -4 m. depth contour is reasonably close to shore is off the south headland of Laem Phatthaya. It is proposed that the berth be sited there. The location is somewhat exposed, so the berth would be a "fair-weather" facility - in rough seas vessels would be unable to use the berth. However, this limitation should be accepted as construction of breakwaters in Phatthaya bay would be unduly expensive and may have undesirable consequences in terms of coastal engineering.

An outline plan of the jetfoil/hydrofoil berth is shown in Fig. 6.1.2. An essential requirement is that the structure should be of open-piled construction : a solid structure such as a rock causeway would alter the direction of waves which are diffracted around the headland and could cause erosion in some locations on the Phatthaya shoreline. The proposed facility comprises an approach trestle about 160 m. long by 5 m. wide (4 m. wide roadway and 1 m. wide footpath) which leads to the berthing head. The trestle structure would consist of a reinforced concrete deck supported on pairs of prestressed or reinforced concrete piles at 8~10 m. spacing.

The berthing head would be about 40 m. long by 10 m. wide and also of open-piled construction : reinforced concrete deck on vertical and raking (inclined) concrete piles to support vertical loads and also resist

operational and environmental horizontal forces. The berth would be provided with fenders, bollards and other marine equipment to suit the type of vessels which operate to it.

Construction of the jetfoil/hydrofoil berth as part of the integrated marine development in the south corner of Phatthaya bay would enable passengers to disembark or embark close to the centre of Phatthaya and be transported by mini-bus to the tourist port area or directly to their hotels.

(2) Alternative Use for Berth

Although the berth is primarily intended for jetfoil or hydrofoil services and the site location has been selected to permit berthing of such vessels without restriction by tidal variation, the berth could also be used occasionally by cruise ships or other large vessels. The berth will have 4m water depth at extreme low water, which means that 6m depth will be available at mid-tide and over 7m at high water. A vessel arriving at Phatthaya would moor offshore and wait for the rising tide to come alongside the berth for passenger embarkation and disembarkation.

Since cruise vessel visits are infrequent, occasional use as described above should not interfere with scheduled jetfoil/hydrofoil services and the new berth would be a useful common-user marine facility for Phatthaya.

5) Land Use of Reclaimed Land

Integrated land use plan including tourist port and hinterland is represented in Fig. 6.1.3. Total area of the reclaimed land is approximately 19 hectares (118 Rais) of which 5.4 hectares (30%) is allocated to the port facilities, 5.1 ha (27%) to roads and the rest of 30% to the commercial facilities and the urban amenities. Table 6.1.1 and Table 6.1.2 also show detail contents and dimension of facilities proposed to be introduced into the reclaimed land.

(Major Points in Land use Plan)

- ① To reserve the existing commercial buildings and combine with the new commercial building, so that building owners can easily cooperate to the project and the progress of project could be accelerated.

(See Typical section figure in Lan Use Plan)

- ② To utilize the existing road with width expansion work without land acquisition as a main access road lead to the tourist port in order to save construction costs and appreciate project's feasibility. To avoid the traffic congestion between port traffic and commercial traffic, submain access directed to the commercial area should be also installed.
- ③ To realize the amenity, water front promenade, restaurants and shopping malls surrounding the new and old commercial buildings are proposed as shown in typical section in Lan Use Plan.
- ④ Parks and a library for the civil service and an event square, event hall, concert hall and others for the event function are proposed to be introduced.
- ⑤ Car parking space should be purchased as possible considering of the shortage of parking area in South Phatthaya. Demand projections of parking area in the project are shown in Table 6.1.3 and 6.1.4.

Table 6.1.1 AREA DISTRIBUTION OF RECLAIMED LAND

ITEM	AREA		REMARKS
	(m ²)	(Rai)	
1. Port terminal area			
① Terminal building	9,200	5.8	Symbol tower are included.
② Administration area	4,100	2.6	
③ Main access road	1,400	0.9	
④ Sub road	4,700	2.9	
⑤ Pedestrian way	5,600	3.5	
⑥ Car parking	16,000	10.0	Bus terminal is included.
Sub total	41,000	25.7	21.7
2. Commercial build.	9,500	5.9	4.8 Building area only
3. Restaurant	5,000	3.1	2.7 Car parking area shown in below 10 is exclusive.
4. Art center	6,500	4.1	3.4 Car parking (1,500m ²) is included.
5. Concert hall, Theater	6,000	3.8	3.2
6. Event hall	5,000	3.1	2.7
7. Event square	13,300	8.3	7.1
8. Park	29,200	18.2	15.6 Library, (building area 1,000m ²), children club (building area 400m ²) and river (1800m ²) are included.
9. Boat yard	14,200	8.9	7.5 Ramp yard is included.
10. Road			
① Access main	3,400	2.1	Improvement of 720m from 2nd beach road to entrance will be additionally needed.
② Sub road	20,000	12.5	
③ Pedestrian	18,400	11.5	
④ Car parking	8,900	5.6	
Sub total	50,700	31.7	26.9
11. Spot park	3,200	2.0	1.7
12. Others	5,000	3.1	2.7
Total	188,600	117.9	100.0

Remarks : Area of piers of excursion boat and jetty of jetfoil are not included.

Table 6.1.2
CONTENTS AND DIMENSION OF FACILITIES IN RECLAIMED LAND

Name	Facilities	Scale
1. Tourist Port	Excursion boat pier	5,200 tourists per day
2. Commercial build. etc.	Shopping, Restaurant, Entertainment	Commercial build. $9,500 \text{ m}^2 \times 4\text{F} = 38,000\text{m}^2$ Restaurant $4,000 \text{ m}^2 \times 2\text{F} = 8,000\text{m}^2$ Art Center $2,500 \text{ m}^2 \times 4\text{F} = 10,000\text{m}^2$ Total 56,000m² $56,000 \text{ m}^2 \times 0.1 \text{ person/m}^2 = \underline{5,600 \text{ persons/}}$ peak time
3. Concert hall & Theater		$2,000\text{m}^2 \times 2\text{F} = 4,000\text{m}^2$ $1 \text{ person}/2\text{m}^2 \rightarrow 2,000 \text{ persons/peak time}$
4. Event hall	Conference room, Trade fair hall, Exhibition, etc.	$2,500\text{m}^2 \times 4\text{F} = 10,000\text{m}^2$ $1 \text{ person}/3\text{m}^2 \rightarrow \underline{3,000 \text{ persons/peak time}}$
5. Event Square	Lawn field	Capacity $13,300\text{m}^2/1\text{m}^2/\text{cap} = \underline{13,000 \text{ persons}}$
6. Park	Field/carving park Library Children's house	Visitors per year 75,000 persons (estimated based on the area of park) Maximum daily visitors: $75,000 \times 0.03 = \underline{2,250 \text{ persons}}$

Table 6.1.3
CAR PARKING DEMAND FOR PORT FACILITY

1) Number of passengers handled by piers --- 5,200 persons per day

2) Composition by types of vehicles used

tour bus	10%
hotel bus	35%
private car	30%
song taew	10%
motor cycle	15%

3) Average occupancy by vehicle type

tour bus	30%
hotel bus	7%
private car	4%
song taew	5%
motor cycle	1.5%

4) Demand of car parking

tour bus	$5,200 \times 0.1/30 = 20$ vehicles
hotel bus	$5,200 \times 0.35 \times 0.1$ (service ratio)/7 = 25
private car	$5,200 \times 0.3/4 = 400$
song taew	$5,200 \times 0.1 \times 0.1/5 = 10$
motor cycle	$5,200 \times 0.15/1.5 = 500$

5) Area for car parking

tour bus	$20 \times 100\text{m}^2 =$	2,000m ²
hotel bus	$25 \times 30\text{m}^2 =$	750m ²
private car	$400 \times 30\text{m}^2 =$	12,000m ²
song taew	$10 \times 30\text{m}^2 =$	300m ²
motor cycle	$500 \times 1.5\text{m}^2 =$	750m ²

car parking total $15,800\text{m}^2 = 16,000\text{m}^2$

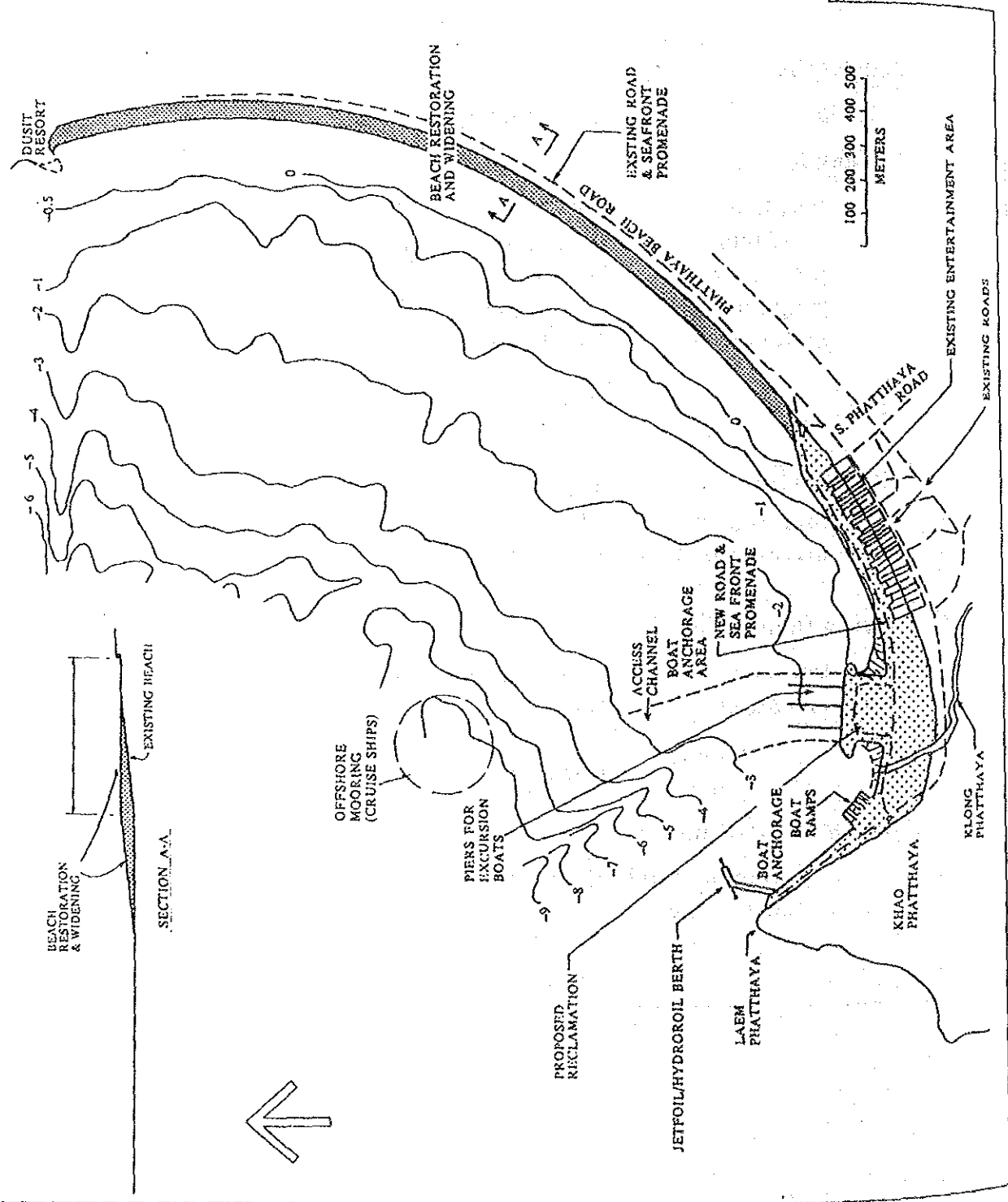
Table 6.1.4
CAR PARKING DEMAND FOR COMMERCIAL BUILDING

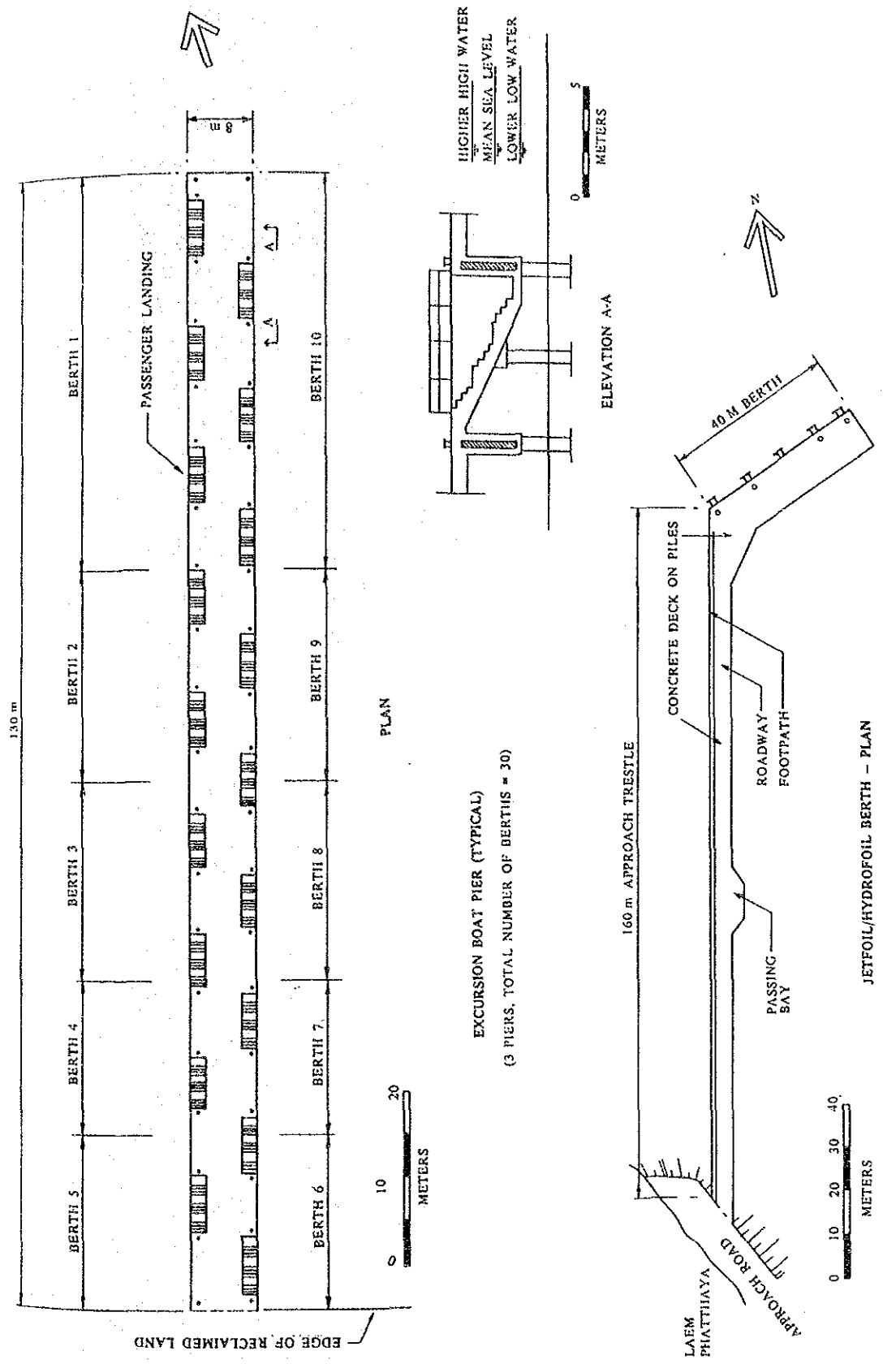
1) Number of Guest		
- Commercial build.	$38,000\text{m}^2 \times 0.10 \text{ guest/m}^2 =$	3,800 guest
- Restaurant	$8,000 \times 0.10 =$	800
Art center	$10,000 \times 0.10 =$	1,000
	Total	5,600 guests
2) Model Split		
- Walk	$50\% \times 5,600 =$	2,800
- Vehicle		
tour bus	$50\% \times 10\% \times 5,600 =$	300
hotel bus	$50\% \times 35\% \times 5,600 =$	1,000
private car	$50\% \times 30\% \times 5,600 =$	800
song taew	$50\% \times 10\% \times 5,600 =$	300
motor cycle	$50\% \times 15\% \times 5,600 =$	400
	Total	2,800 guests
3) Number of Cars		
tour bus	$300 \div 30 \text{ guest/car} =$	10 vehicle
private car	$800 \div 2 =$	400
4) Parking Demand		
tour bus	$10 \times 50\text{m}^2/\text{vehicle} =$	500
private car	$400 \times 25 =$	10,000
	Total	10,500 m ²
5) Area for car parking		
commercial build, Restaurant		8,900m ²
art center		1,500m ²
	Total	10,400m ²

LEGEND

1. SEALED CONTOURS IN METERS
RELATIVE TO LOWEST LOW WATER
TIDAL DATA
2. TIDAL DATA
HIGHEST HIGH WATER -4.28
MEAN HIGH WATER -3.21
MEAN SEA LEVEL -2.48
MEAN LOW WATER -1.63
LOWEST LOW WATER 0
3. RECLAIMED LAND
BEACH RESTORATION &
WIDENING

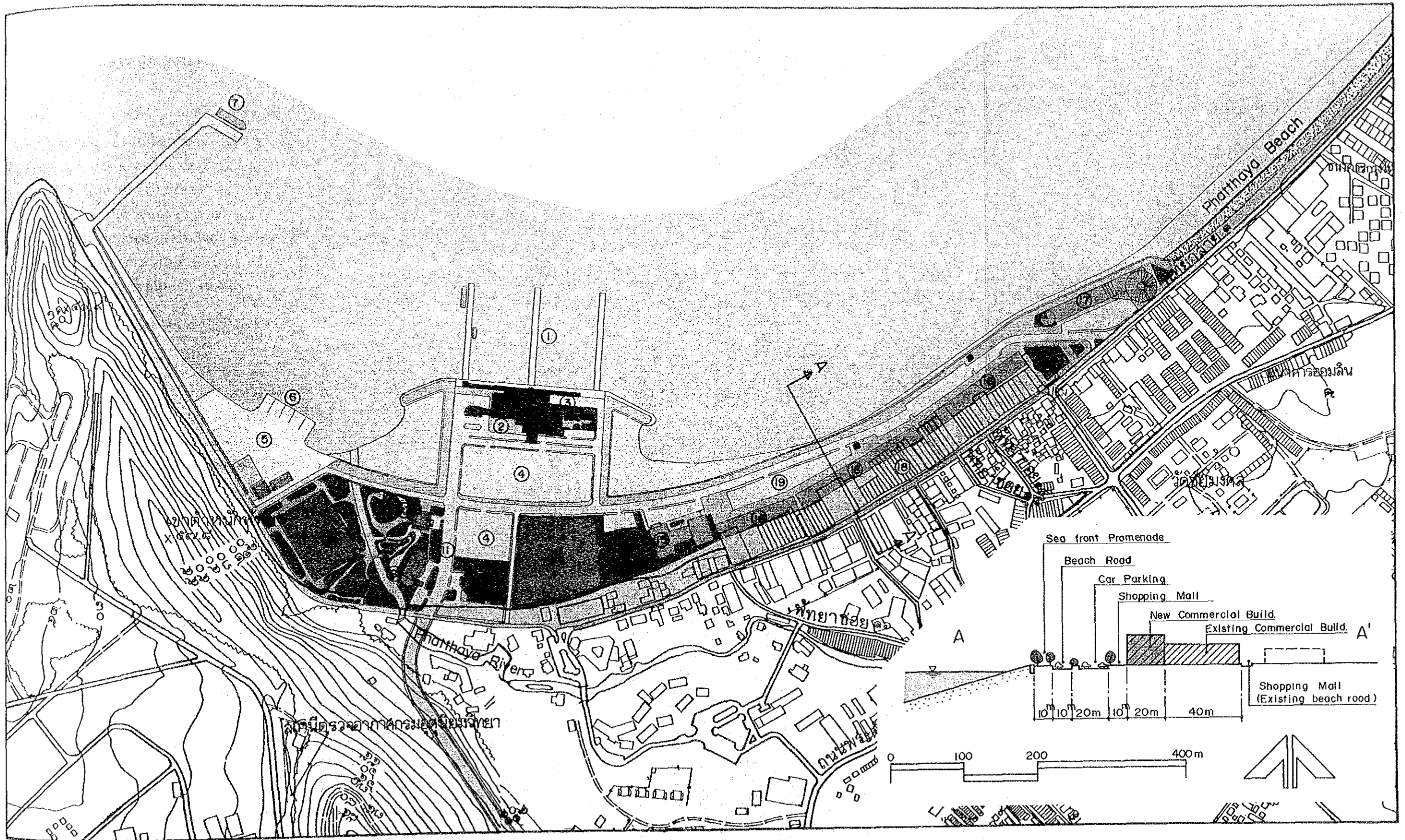
THE MASTER PLAN STUDY FOR
THE DEVELOPMENT OF PHATHTHAYA AREA
JAPAN INTERNATIONAL COOPERATION AGENCY
Fig. 6.1.1
Waterfront Development
Plan Phatthaya





EXCURSION BOAT PIER (TYPICAL)
(3 PIERS, TOTAL NUMBER OF BERTHS = 30)

Fig. 6.1.2 Excursion Boat Piers and Jetfoil Berth



Legend

- | | | | | |
|--|--|--------------------------|--------------------------------------|--------------------------------|
| ① Piers for excursion boat | ⑤ Boat yard | ⑨ Library | ⑬ Event square | ⑰ Restaurants |
| ② Terminal building & operation building | ⑥ Ramp | ⑩ Children house | ⑭ Event hall | ⑱ Existing commercial building |
| ③ Governmental office | ⑦ Pier for jetfoil (open piled construction) | ⑪ Main access road | ⑮ Art center (Craft souvenir center) | ⑲ Car parking |
| ④ Car parking & bus terminal | ⑧ Park | ⑫ Concert hall & theater | ⑯ New commercial building | ⑳ Spot park |

THE MASTER PLAN STUDY FOR
THE DEVELOPMENT OF PHATTHAYA AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.1.3

Land Use Plan of Reclaimed Land

6.1.2 Phatthaya Beach Restoration

1) General

Restoration of the beach in Phatthaya bay is urgently required to protect the coast against erosion caused by construction encroachment beyond the natural shoreline and prevent further loss of recreational beach. The causes of coastal erosion, the locations where it has occurred and the justification for beach restoration were included in Part I. The proposed project involves beach nourishment using suitable sand, and refurbishment of the coastal promenade. The project location is shown in Fig. 6.1.1.

2) Principles of Beach Nourishment

Beach nourishment is increasingly finding favour in many countries as a method of protecting coastlines and countering the effects of coastal erosion. Nourishment is adopted in preference to "hard" methods, such as the construction of revetments or sea walls, which protect buildings, promenades etc. on the seafront but often lead to further loss of material from the beaches fronting the structures. Alternative methods such as the construction of offshore breakwaters are also successful but costs are high and water circulation close to shore is reduced. In Phatthaya, which already suffers from sea water pollution due to discharge of untreated sewage into the bay, any reduction in natural circulation which helps to disperse the polluting materials would be undesirable.

Beach nourishment is thus considered to be the most suitable of the possible alternatives. Many coastal engineers now believe that coastline protection should not alter natural processes and rebuilding beaches artificially (beach nourishment) to replace lost material allows the equilibrium governed by natural forces to be restored. The success of beach nourishment schemes depends on achieving a close match between the naturally occurring sand (the "native" sand) and the sand which is used for artificial replenishment. For preference a slightly coarser material - which will be more stable than the native material - should be used. This requirement, however, has to be balanced against those of a recreational beach - the sand should be of acceptable texture, grading (not too coarse or abrasive) and colour.

The material which is placed, if correctly selected, will stabilize at the slope of the existing foreshore at Phatthaya which is approximately 1:10. Some

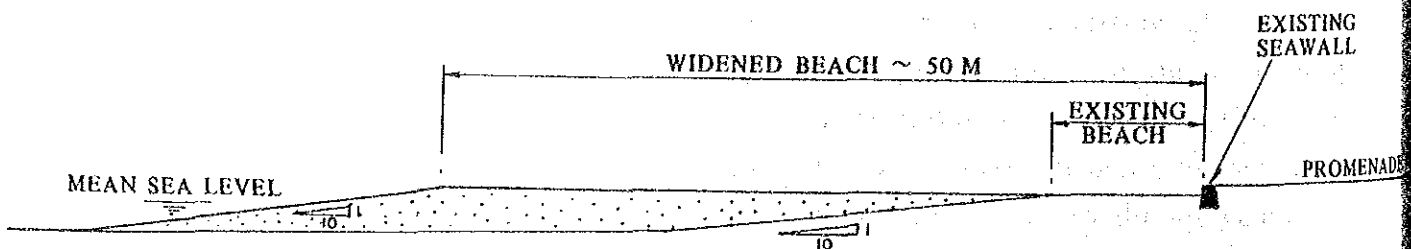
loss of sand in the early stages will occur under natural processes as the placed material stabilizes. Later there will be smaller losses so some periodic replenishment will be necessary, but if good matching of the native and artificial materials has been achieved, further supply will only be required at long intervals.

3) Project Description

Factors favouring coastal protection by beach nourishment at Phatthaya are:

- mild wave climate
- naturally occurring beach sand which is reasonably coarse and thus stable at a fairly steep slope (1:10)
- rocky headlands at both ends of the bay which confine longshore movement within the bay and prevent losses to the north or south.

It is proposed that the existing beach, which at present has a backshore (the flat portion landward of the sloping foreshore) of width varying from 0 to 15 m along the length of Phatthaya bay, should be widened to provide a backshore of 50 m uniform width. The widened beach would follow the natural curve of the coastline so that the characteristic spiral shape of the bay is maintained. A cross-section after the placed material has stabilized under natural processes is shown below. The restored beach will be about 2.7 km long, extending from the Dusit Resort Hotel and along the Phatthaya Beach Road up to its junction with the South Phatthaya Road.



SECTION

The construction method to be adopted will depend on whether offshore or land sources for sand are used. Preferably, an offshore source should be used if material of suitable particle size, grading and texture can be found within

reasonable distance of Phatthaya. If such source exists a trailing suction hopper dredger (with pump-ashore capability) could be used to dredge and transport sand to Phatthaya. It would moor offshore in water sufficiently deep for the loaded dredger and use submerged and floating pipelines to pump the sand onto the beach. Assuming a dredger of 3000 cu.m. hopper capacity and a twice-daily operational cycle, the work could be completed in 4~5 months if executed outside the monsoon season, when weather conditions are favourable.

If a land source is used, sand would be transported by trucks or conveyor to a loading point for transfer to barges which take the material to Phatthaya bay. It would then be pumped ashore via a pipeline as described above. The unit cost using a land source is likely to be higher than for an offshore source, because of the costs incurred in mobilizing and using both land and marine equipment for transport.

Most of the material which is placed by pipeline at Phatthaya will be spread by the pumping process, as sand pumped as a solids/water mixture adopts a slope of around 1:10, similar to the natural beach slope. However, some re-distribution and final shaping using bulldozers and a dragline may be necessary.

4) Sand Sources

Laboratory tests on the naturally occurring beach sand at Phatthaya were carried out during the 1978 JICA Study and grain size distribution curves were included in the study report. The current Master Plan Study did not include field investigations and laboratory tests but small samples of beach materials were taken by the study team at various points of the beach for visual examination and particle size determination. Descriptions are given below:

<u>Location</u>	<u>Visual Description</u>	<u>d50 size</u>
Phatthaya Beach (Dusit Resort)	brown, medium (tending to coarse) sub-angular uniformly graded sand	0.5 mm
Phatthaya Beach (Phatthaya Palace)	brown, medium (tending to coarse) sub-angular uniformly graded sand	0.55 mm
Phatthaya Beach (edge of entertainment area)	brown, medium sub-angular uniformly graded sand.	0.36 mm

The visual examination and tests suggest that the material is somewhat finer at most locations than that indicated by the grain size distribution curves of the 1978 JICA Study Report. In particular, the material at the edge of the entertainment area is finer and contains some silt. However, it should be noted that at the time of sampling (December 1989) longshore movement in recent months was in a southward direction and the upper layer of the beach in this area consisted of material which had recently been transported into the area by natural processes.

Two land sources, at Map Prachan and Nong Ko for the supply of sand have been identified. The material at Map Prachan is coarser and is more likely to be stable than that from Nong Ko. Grain size distribution curves for sand from these sources are plotted on Fig. 6.1.4. Visual inspection of the Phatthaya beach materials suggests that reasonable matching would be achieved by the use of Map Prachan sand but this should be checked by laboratory testing of bulk samples taken from Phatthaya beach.

Sand samples from Map Prachan and Nong Ko contain about 10% and 20% respectively of material less than 0.16 mm particle size. These percentages are useful indicators of the amount of overfill required for initial losses, as experience indicates that fines below 0.16 mm are likely to be lost. Some fines are lost in the handling process, the rest stay in the fill but are washed out under wave action. Nong Ko sand with a higher proportion of fines is unsuitable in this respect and Map Prachan would be the preferred source. Map Prachan is situated about 10 km east of Phatthaya.

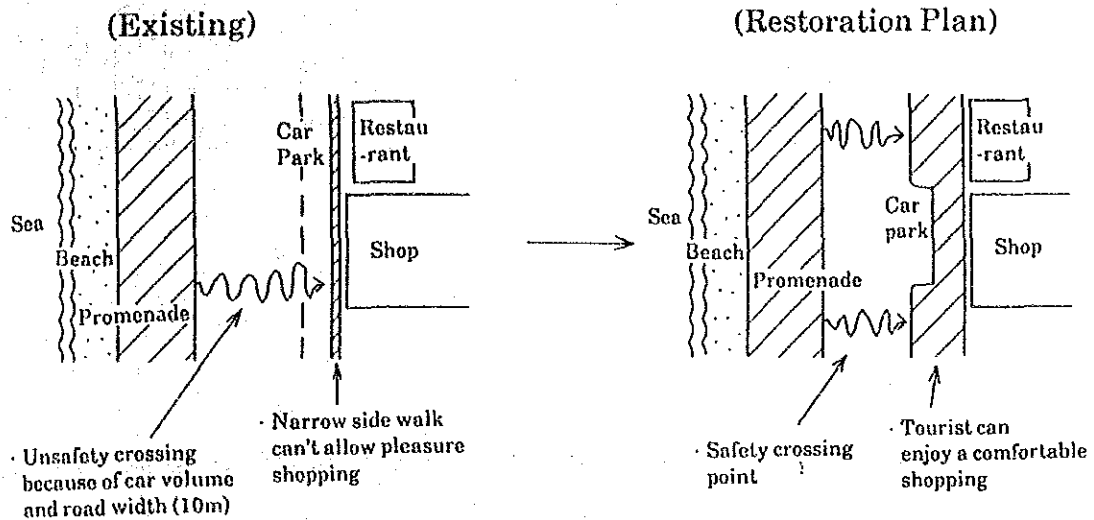
There are no known offshore sources and an offshore investigation to find a suitable deposit, from which sand could be taken without detriment to the surrounding environment, would be a key item for study of project feasibility including an accurate cost estimate.

5) Restoration of Phatthaya Beach Promenade

(1) Basic Idea

As explained in Section 4.2.3, the landside promenade in Phatthaya beach road is too narrow to enjoy a shopping stroll for tourist. In addition to the sea front promenade which was constructed a few years ago, following landside pedestrian way are essentially needed to create a safe and comfortable beach front in Phatthaya beach.

- A wide pedestrian way in landside along beach road in order to serve for tourists as a comfortable shopping mall.
- Some safety crossing points in beach road considering of traffic volume, car speed and long distance width (10 m).



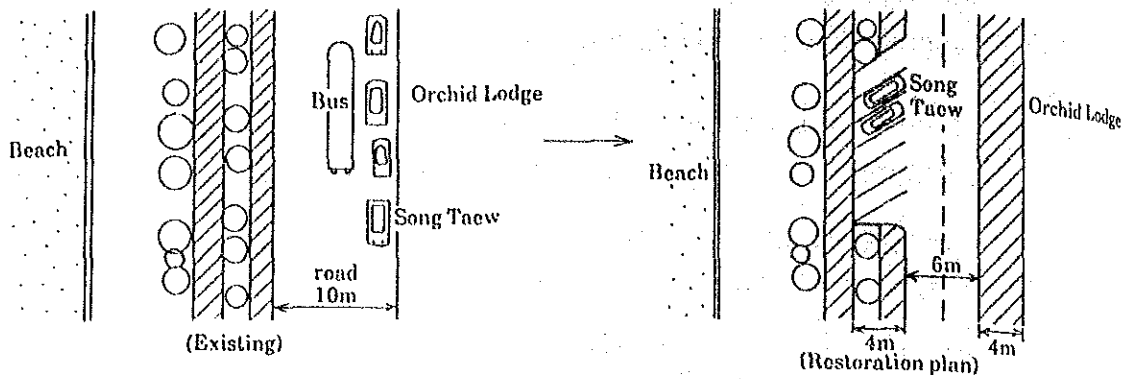
(2) Detailed Plan

Based on the reconnaissance survey of detail land use in hinterland - distribution of commercial facilities, following three types of restoration are proposed.

Type A

Section ① : Orchid Lodge (See Fig. 6.1.5 Location Map)

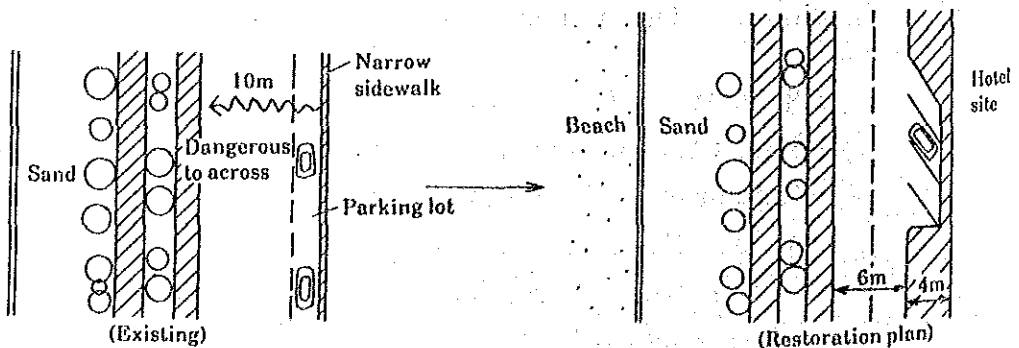
- No footway at present
- Song Taews gather waiting passengers
- Temporary utilized as the bus stop
- ① Install a landslide pedestrian way.
- ② Construct a Song Taew pool in beach side of road.
- ③ Restrict the bus stop.



Type B

Section ②, ③ : Cruise Hotel ~ Phatthaya Palace & Merlin Patheya
~ Ocean View HL

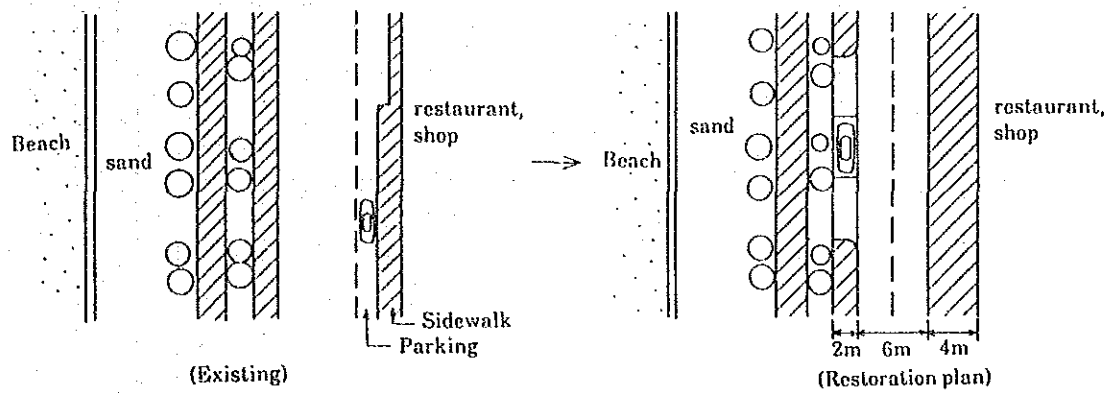
- Narrow sidewalk available now.
- Widening of sidewalk is needed according to hinter landuse.
- Considering of a few parking demand in this section, existing parking lot could be reduced and diagonal parking lots are proposed as the suitable parking method.
- Widening of landside pedestrian way makes a crossing distance short and reduce the dangerousness of traffic accident for aged people and children who feel difficult to across beach road because of high speed and continuous car flow.



Type C

Section ④, ⑤ : Siam Bay View ~ South Phatthaya Junction

- A lot of tourist are strolling and enjoying in existing landside pedestrian way which has not enough width for the demand.
- Sequent and wide pedestrian way in landside is proposed and existing parking lot must be relocated to the opposite beach side shown as below.



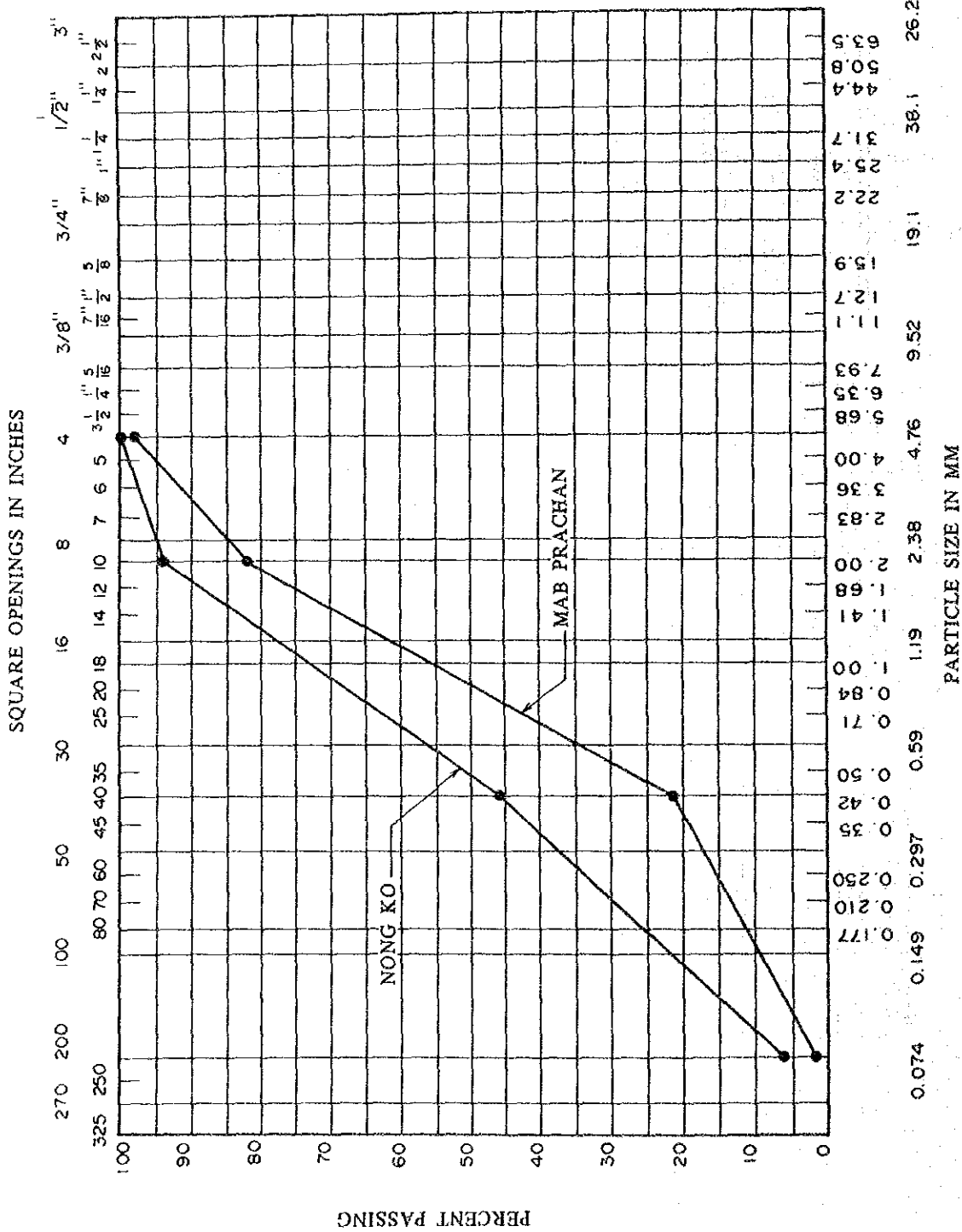
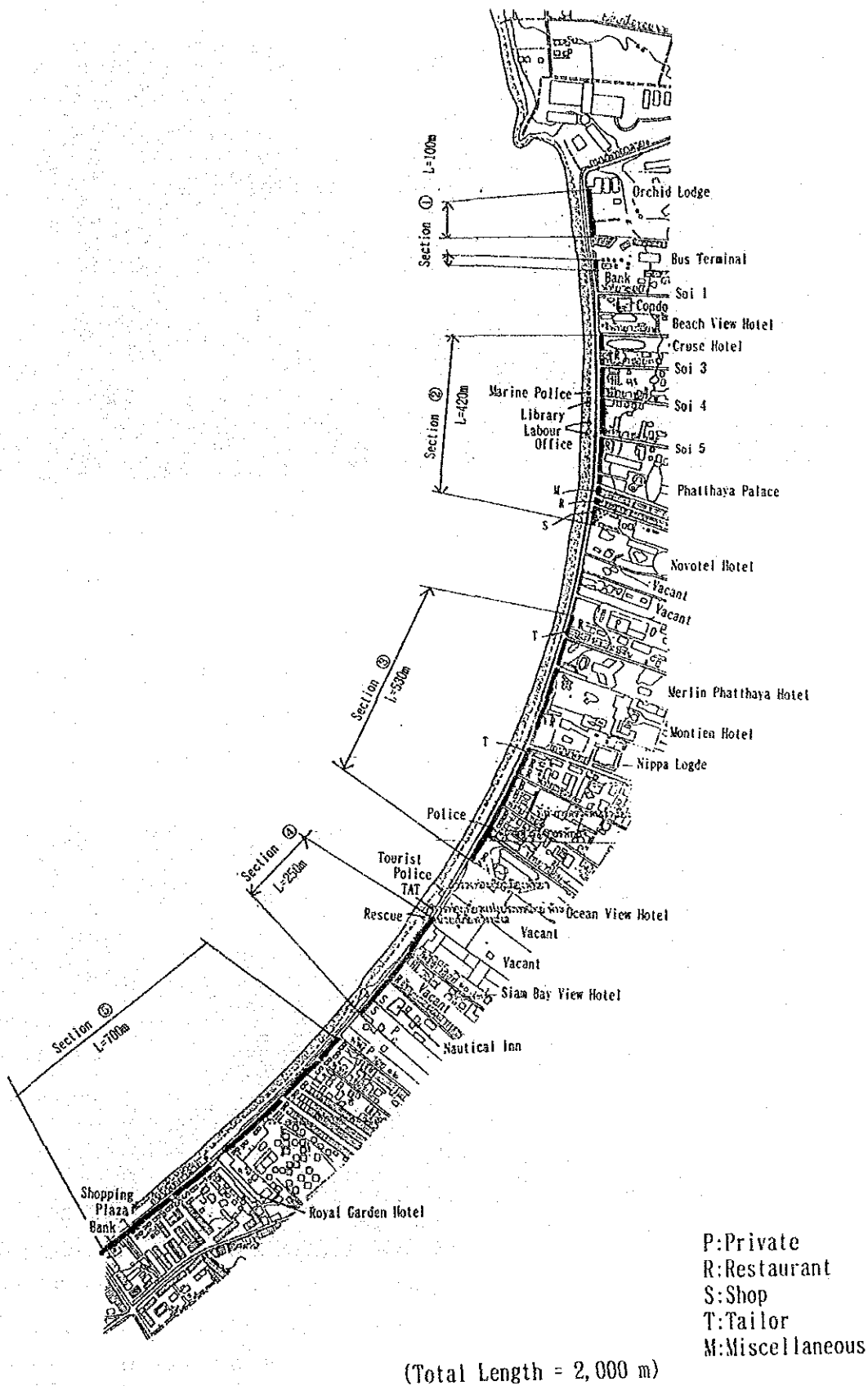


Fig. 6.1.4 Beach Restoration Project
- Sand Sources

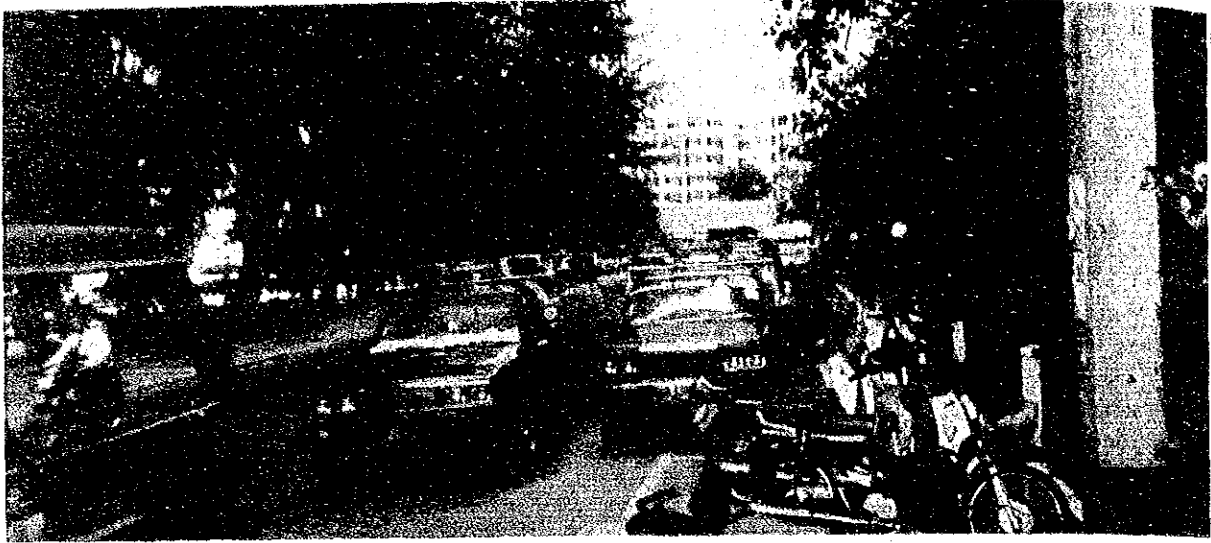
CLAY SILT		SAND			GRAVEL					
FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COARSE				
0.074	0.149	0.297	0.59	1.19	2.38	4.76	9.52	19.1	38.1	26.2

GRAIN SIZE DISTRIBUTION CURVES OF SAND FROM INLAND LOCATIONS



THE MASTER PLAN STUDY FOR
THE DEVELOPMENT OF PHATTHAYA AREA

Fig. 6.1.5 Location Map for Phatthaya
Beach Promenade Restoration



Existing Condition of Section ①: Front of Orchid Lodge



Existing Condition of Section ⑤

6.1.3 Ta-Van Pier

1) Site Location

The only fixed facility for berthing small boats at Ko Lan is a pier offshore of Ban Ko Lan, the fishing village on the east side of the island. The three public beaches, which are all on the island's western coast, have no piers for passenger embarkation and disembarkation. It is proposed that a pier should be constructed on Ta-Van beach, which is currently the most developed beach on the island and which also has access to the interior.

Ta-Van beach is located in a 700m long north-facing bay on the western side of Ko Lan inland. The beach lies between two rocky headlands and its east end is conveniently located at the foot of a saddle in the hilly ridge which extends from the north tip of the island to the extreme south. Concrete steps for pedestrians lead up from the beach to higher ground, from which there is a concrete blockwork paved road to Ban Ko Lan suitable for small four-wheeled drive motor vehicles and motor-cycles.

The nautical chart of the sea around Ko Lan indicates that the -2m depth contour is located about 100~150m from the west and east headlands, appearing to be somewhat closer to the west headland than to the east. At the centre of the bay, however, the seabed slopes more gradually and the -2m contour is up to 400m from shore.

The headlands, which are both reasonably close to the -2m contour, are suitable alternative locations for a pier; in terms of marine considerations the west headland appears marginally better, since it is closer to deep water and is also more sheltered from westerly waves. This was the location proposed for a pier in the 1978 JICA feasibility study. However, both locations are satisfactory in principle, subject to survey and site investigation.

As mentioned in 4.2.2, a design for a pier at Ta-Van has already been prepared by PWD for PCG. The location of the pier in PWD's design is off the east headland near Ta-Van beach. The PWD's reasons for selecting this location in preference to the west headland are not known, but presumably there are local site factors or existing facilities which influenced the decision. One of these is the existing pedestrian way at the east end of the beach to the interior of the island, which if connected to the pier will make the latter a useful landing point for other parts of the island and not just the beach.

The location of the pier proposed by PWD is shown in Fig. 6.1.6.

2) Project Description

The PWD's design for the Ta-Van pier consists of three elements :

- (i) A rockfill causeway, 3.0m wide, which runs along the foot of the hill from the east end of Ta-Van beach to the tip of the headland, of total length approximately 300m.
- (ii) A 4.0m wide by 185m long rockfill causeway extending out from the headland towards the sea.
- (iii) A reinforced concrete pier (4.0m wide concrete deck supported on piles) of total length 107m. This is L-shaped in plan, the first part extending seawards from the causeway being 56m long and the final part 51m. At the end of the pier is a passenger landing down to low water level with three flights of steps and two intermediate landings. Two boats will be able to berth simultaneously at the pier for passengers to embark or disembark.

A plan of the pier is shown in Fig. 6.1.6.

PWD's estimated total construction cost for the project is Baht 21.8 million, made up as follows :

	<u>Baht</u>
accessway parallel to shore (300 m)	3.1 million
rock causeway (185 m)	14.6 million
pile supported deck (107 m)	<u>4.1 million</u>
	21.8 million

It is understood that the high estimated cost of the rock causeway results from high assumed unit costs for quarrying and transporting rock to Ko Lan, and that the long length of rock causeway (185 m) has been specified because the rocky shore precludes pile driving. In view of the large difference in average unit cost (Baht 78,900/m for rock causeway and Baht 38,300/m for pile supported deck) it is suggested that the rock causeway should be reduced in length and pile supported deck increased. Anticipated pile driving problems could be overcome by the use of a boring or chiseling rig to form holes in the rock strata prior to installing piles. The high estimated unit cost of quarried

rockfill would justify the mobilization and use of specialist boring equipment in order to reduce the total volume of rockfill required for the project.

If the rock causeway were shortened by 100m and the pile supported deck lengthened by a corresponding amount the pro-rata reduction in total estimated cost is approximately 18%. Taking account of the additional cost of specialist equipment for pile installation a saving of around 10% of the current total estimated cost of the pier could be achieved.

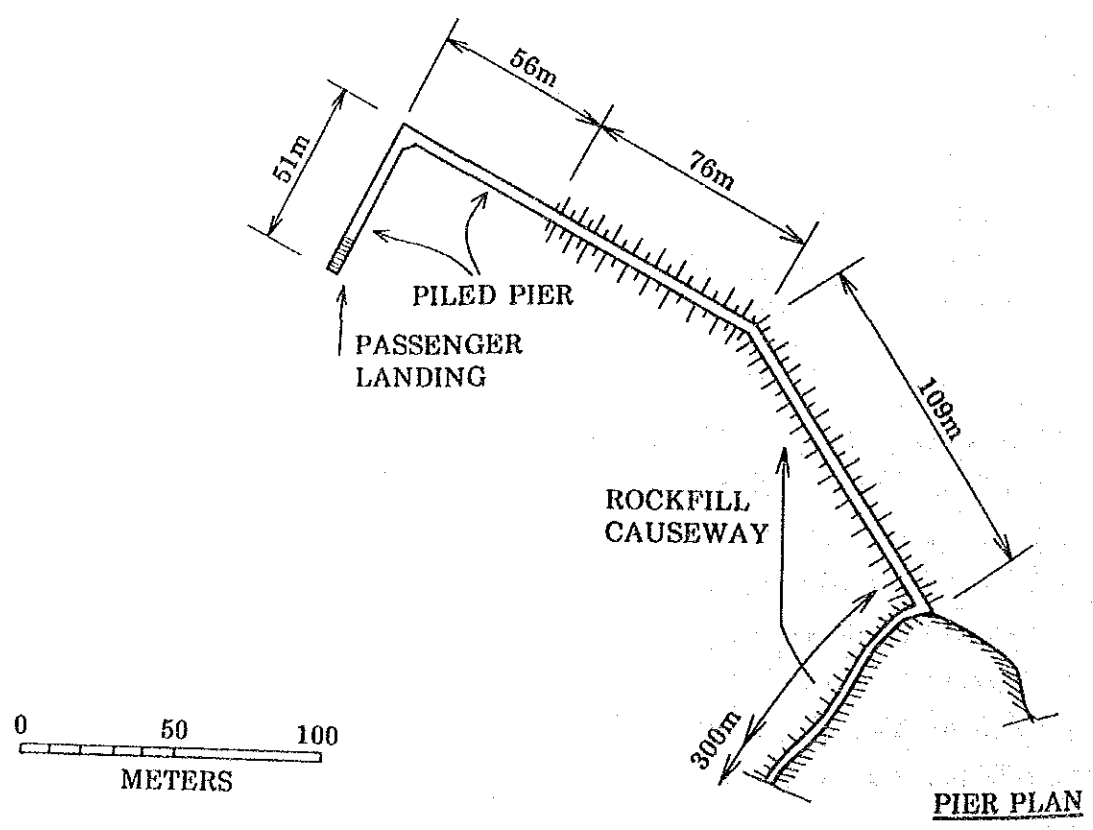
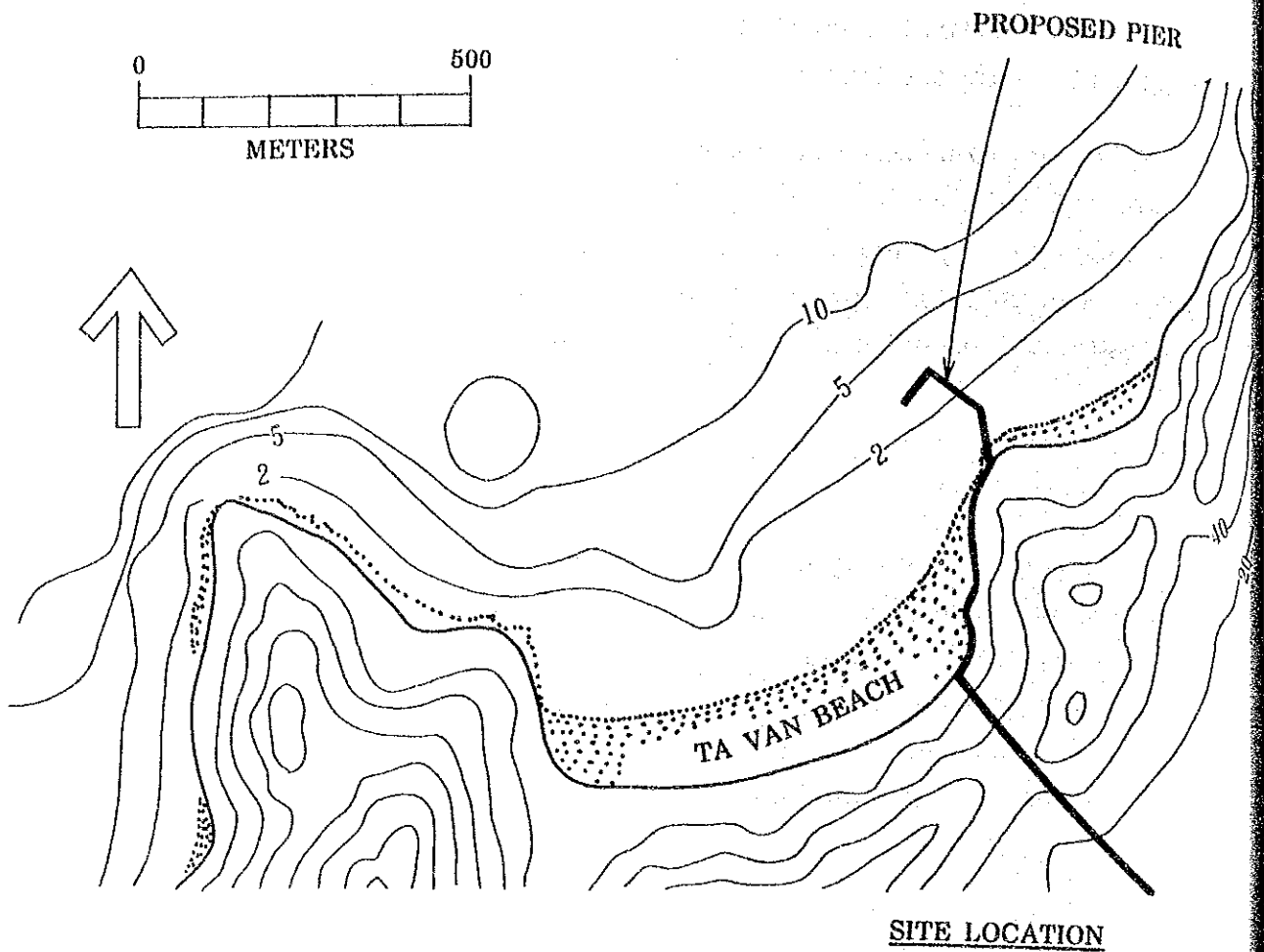


Fig. 6.1.6 Ta Van Pier