

## **2. Contents of the Project**

### **2-1 Basic Concept of the Project**

#### **2-1-1 Overall Goal and Project Purpose**

In Vietnam, the forest area has been substantially reduced due to the long war and rapid population growth. To be more precise, the forest area of 14.3 million ha in 1945 fell to 9.3 million ha in 1993 and the forest area per capita in Vietnam is now the lowest among Southeast Asian countries.

To restore the green-rich national land, the Government of Vietnam formulated "the Forestry Development Strategy 2001–2010" as a long-term policy for the forestry sector and has been implementing National Five Million Hectare Reforestation Program (herein after referred as "5MHRP") as a priority program as part of its active commitment to forest conservation and afforestation/reforestation. This 5MHRP aims at implementing afforestation/reforestation work over an area of 5 million ha from 1998 to 2010. In particular, the urgent afforestation of 100,000 ha of coastal areas is called for to create coastal protection forests.

There are many sandy areas or sand dunes in the South Central Coast Region of Vietnam and agricultural crops and infrastructure facilities are often damaged by strong winds and shifting sand caused by typhoons and monsoons, severely affecting the lives of local residents. While the said areas with a high population density are believed to have high development potential, the damage caused by strong winds and shifting sand has been an obstacle for development efforts.

Table 2-1 shows the implementation situation of 5MHRP for the period from 1998 to 2005. Coastal protection forests fall in the category of "Protection Forests and Special Use Forests". The results have exceeded the mid-term plan by 3%, indicating the active commitment of the Government of Vietnam.

In April 2005, the Government of Japan completed the grant aid cooperation named "The Project for Afforestation on the Coastal Sandy Area in Southern Central Viet Nam", or PACSA, for the creation of 2,079.88 ha and 1,573.00 ha of protection forests in coastal sandy areas in Quang Nam Province and Phu Yen Province respectively in the South Central Coast Region as part of 5MHRP. Since the completion of PACSA, the Government of Vietnam has been conducting the creation of coastal protection forests in other areas using the planting techniques employed under PACSA. However, as PACSA excluded difficult planting sites (shifting sand sites, wind erosion sites, frequently flooded sites, etc.) where planting work would require advanced planting techniques, the Government of Vietnam is finding it

difficult to conduct afforestation without external assistance at these difficult planting sites.

Under these circumstances, the Government of Vietnam fully recognizes the importance of successfully implementing coastal afforestation projects through ancillary planting works at difficult planting sites and of extending nationwide the experience of creating protection forests at such sites in order to promote 5MHRP.

The Project aims at reducing the damage to agricultural and fishing villages due to shifting sand, strong winds, sand movement, etc. by means of creating coastal protection forests at those coastal sandy sites with a high technical difficulty, including difficult planting sites excluded from PACSA, in the South Central Coast Region of Vietnam.

<b>Overall Goal :</b>	Creation of coastal protection forests in coastal areas in Vietnam using the Project as a model
<b>Project Purpose :</b>	Reduction of the damage caused by shifting sand, strong winds, sand movement, etc. to agricultural as well as fishing villages in the coastal areas of Quang Nam Province and Quang Ngai Province

Table 2-1 Interim Results of National Five Million Hectare Reforestation Program (5MHRP)

Type of Forest	Target Area for 2010 (ha)	Target Area of Mid-Term Plan (1998-2005) (ha)	Result (1998-2005) (ha)	Achievement Rate of Mid-Term Plan (%)	Achievement Rate of 2010 Target (%)
Natural Regeneration Forest	1,000,000	1,000,000	723,450	72	36
Afforestation	4,000,000	2,000,000	1,401,667	70	35
Protection Forests and Special Use Forests	1,000,000	610,000	631,317	103	63
Production Forests	2,000,000	1,390,000	683,396	49	34
Industrial Material Forests and Fruit Forests	1,000,000	-	86,954	-	9
Total	5,000,000	3,000,000	2,125,117	71	43

### **2-1-2 Basic Concept of the Project**

The main components of the Project are afforestation work mainly conducted with the grant aid cooperation by the Government of Japan and the maintenance and protection of the newly created forests by mainly the Vietnamese side. The target areas are coastal sandy sites in Quang Nam Province and Quang Ngai Province (Table 2-2).

The afforestation work will also involve the construction of operation roads. The main components of the afforestation work will be purchase of seedlings from existing nurseries, planting at difficult planting sites accompanied by ancillary planting works to mitigate the effects of shifting sand and strong winds on the planted trees and tending (supplementary planting and top dressing (additional fertilization) of the planted trees. In addition, lookout towers and project information signboards will be constructed or erected for the purpose of maintaining/protecting the newly created coastal protection forests and introducing the Project.

The main components of the maintenance and protection work will be the forest patrol and guard which will be primarily conducted by local residents for the purpose of preserving and protecting the newly created protection forests.

Such work is expected to create healthy coastal protection forests at difficult planting sites. The scope of the Japanese assistance, i.e. APSA, for the Project are to cover the initial investment (for approximately the first five years of the Project) relating to the creation and improvement of coastal protection forests in two target provinces and to contribute to 5MHRP, the higher program for the Project, through such assistance.

Table 2-2 Main Components of the Project

<b>Inputs :</b>	Japanese Side	Grant aid cooperation by the Government of Japan
	Vietnamese Side	<ul style="list-style-type: none"> <li>i Required manpower</li> <li>ii Preparation of electric power lines and access roads</li> <li>iii Financial inputs relating to the maintenance and protection of newly created coastal protection forests and the operation and maintenance of the Project.</li> </ul>
<b>Activities :</b>	<ul style="list-style-type: none"> <li>i. Construction of operation roads</li> <li>ii. Procurement (production and purchase) of fine seedlings</li> <li>iii. Ancillary planting works (measures to prevent/reduce damage by shifting sand, flooding, etc.)</li> <li>iv. Planting of fine seedlings</li> <li>v. Tending of the planted trees</li> <li>vi. Patrolling and guarding of the coastal protection forests, primarily by local residents</li> <li>vii. Construction of lookout towers</li> <li>viii. Erection of project information sign boards</li> </ul>	
<b>Outputs :</b>	Creation of coastal protection forests to block shifting sand, strong winds, sand movement, etc. in the coastal areas of Quang Nam Province and Quang Ngai Province.	

## 2-2 Basic Design of the Requested Japanese Assistance

### 2-2-1 Design Policy

The basic design of the requested Japanese assistance is conducted in accordance with the design policies, described in Table 2-3, based on the field survey results to fully achieve the objective of the Project while verifying the outcomes of PACSA.

Table 2-3 List of Design Policies

No.	Item	Design Policies
01	Scope of Assistance	i The scope of assistance under the Project is the components of the original request which are judged to be appropriate for implementation as a grant aid project.
		ii The scope of assistance consists of the minimum activities and inputs required for the creation of coastal protection forests.
02	Site Selection (Potential Target Areas)	i Study area shall be the total area of 2,463.75ha, selected by the B/D study.
		ii Areas which already are utilized for other purpose or over-rapped by other land use plans shall be excluded from the project.
		iii All areas found by the Study in Binh Dinh Province shall be excluded from the project for the Prim Minister's decree which gives higher priority on titanium mining than afforestation.
		iv Transmigration plan and land development plan for tourism in Quang Nam Province are not in subtle planning stages; therefore, priority is given to the afforestation plan.
		v With criteria noted above, final target area is determined from the areas found by B/D study. The boundaries of the target areas are confirmed by GPS by the Study team.
		vi Total target area (compartment) is 1,009.97 ha, and 892.06 ha among it will be planted in two provinces.
		vi i Precise topographic surveys shall be necessary in detailed design stage in order to avoid discords with the stakeholders of existing plantation areas, cemeteries, and shrimp ponds in proximity of the compartments.
03	Site Selection (Project Target Areas)	i Sites with remarkably low cost effectiveness (i.e. sites with a very high cost) based on the project implementation cost analysis results shall be subject to be removed.
		ii If a site's is identified that the applicability as Japanese grant aid is too low, when checked against the required conditions for cooperation and other conditions, it shall be subject of removal from the project.
04	Classification by Type of Degradation	<p>i The project target areas will be classified into the following four types based on the field reconnaissance results.</p> <p>Areas with an especially high level of technical difficulty</p> <p>a. Frequently flooded areas</p> <p>b. Areas adjacent to the shoreline</p> <p>Areas with a high level of technical difficulty</p> <p>c. Ordinary sandy areas</p> <p>d. Dying forest areas</p>

No.	Item	Design Policies
05	Establishment of Compartments, Sub-Compartments and Planting Area	i Each project target area will be divided by commune boundaries.
		ii Each compartment will be further divided into sub-compartment according to the land degradation types.
		iii Sub-compartments exceeding 100 ha and extremely narrow and long sub-compartments will be further divided to create sub-compartments of a similar size to make the work easier.
		iv In the project implementation period, firebreaks will be installed by demarcating planting compartments and/or by installing operation roads which isolate planting areas.
		v The total planting area will be calculated by means of removing the area of firebreaks and left-over areas (depressed ground of a certain size, cemeteries, existing roads, etc. where planting cannot be conducted) from the total area of the project target areas.
06	Planting	i The local knowledge, pending issues and recommendations will be taken into consideration.
		ii The planting methods referred to in widely distributed documents (regulations, notifications, pamphlets, etc.) in Vietnam will be incorporated in APSA as much as possible.
		iii The opinions of the Vietnamese side (C/Ps and local residents) will be incorporated in APSA as much as possible.
		iv Since the plantation area will be limited to about 900ha, planting will be done in one year.
		v Deliberate consideration shall be made for installation of ancillary works and/or comparison of species for the areas adjacent to the coast and frequently flooded areas.
		vi Proposals on planting species from Vietnamese side shall be considered carefully.
		vi i Planting species in sites in Quang Nam: <i>Acacia crassicarpa</i> should be planted mainly than <i>Casuarina equisetifolia</i> . Because <i>A. crassicarpa</i> showed good growth in PACSA, and most of the existing trees in Quang Nam project site are <i>Casuarina equisetifolia</i> . Moreover, there are overwhelming requests from the residents. Planting species in sites in Quang Ngai: <i>Casuarina equisetifolia</i> shall be planted solely in the province due to the fact that growth of <i>Acacia crassicarpa</i> and <i>Anacardium occidentale</i> were poor in the coastal areas which is closer to the shore than sites in Quang Nam province.
07	Determination of number of trees	i Accordance with the natural environment and existing planted trees is at most importance.
		ii The numbers of trees are determined by the results of existing tree survey done by the study team.
08	Tending	i With considerations of the natural environment, tending under APSA will consist of only supplementary planting and top dressing.
		ii The tending period will be three years, which is in line with the relevant standard in Vietnam.
		iii The tending methods referred to in widely distributed documents (regulations, notifications, pamphlets, etc.) in Vietnam will be incorporated in APSA as much as possible.
		iv The opinions of the C/Ps and local residents will be incorporated in the APSA as much as possible. seedlings
09	Procurement of Planting Seedlings	i Seedlings for planting or supplementary planting are procured from existing nurseries adjacent to the sites.
		ii Regarding the types and standards of the seedlings, the relevant specifications referred to in widely distributed documents (regulations, notifications, pamphlets, etc.) in Vietnam will be adopted for APSA as much as possible.
		iii Use of clone seedlings shall be used less than 50% of actual quantity needed for planting in order to avoid spreading diseases and insect damages.

No.	Item	Design Policies
10	Operation Roads	i The operation road network density to minimize the planting and tending costs will be calculated to determine the total length for construction.
		ii The standards and structure of operation vehicle roads will correspond to "Public Road Class IV of Vietnam" or "Forest Road Class 2 of Japan".
		iii At those sites where a vehicle road cannot be introduced due to the shape and/or topographical conditions of the project target area but where it is judged that the work efficiency will significantly decline without a road, footpaths will be introduced.
		iv The standards and structure of operation footpaths will be employed in accordance with those of footpaths in general use around the project sites.
11	Lookout Towers	i The purpose of lookout towers is for finding forest fire, observation of vandalism and growth of the trees.
		ii The lookout towers will be concrete structures in view of their durability and long-term stability, taking considerations to the natural environment of the coastal area. .
12	Project Information Signboards	i The main purpose of signboards is to publicize/inform of the creation of protection forests under the grant aid project of Japan.
		ii The signboards will help local residents' understandings on the project and importance of the forest.
		iii There are two types of signboards, i.e. large signboards erected along National Road No.1 and small signboards erected along the access road to each project target area from National Road No.1.
13	Project Implementation Schedule	i One type of work (the production of seedlings) stretches to two fiscal years. APSA is, therefore, classified as a contract resulting in Treasury obligation and the entire project period is regarded as constituting a single phase instead of a project based on a fiscal year.
		ii In Vietnam, APSA is treated as a successive project for PACSA (completed in April, 2005). APSA is classified as a contract resulting in Treasury obligation which covers the detailed design as single year Treasury obligation and allows the commencement of the main work from the previous year.
		iii The workflow of the Project stretches five years. One year for the construction of operation road, contracts for procurement of seedlings and supervision of production of qualified seedlings. The second year for planting and the following three years for tending.
		iv As such, the continuity of the project from PACSA is called for. As it is essential to commence the Project as soon as possible
14	Policies Regarding the Use of Local Companies	i There are several afforestation and seedling production companies in Quang Nam Province and Quang Ngai Province. These companies have afforestation record from 20ha to 300ha per year and production record from 20,000 seedlings to 600,000 seedlings per year. Therefore, it is concluded that they have sufficient working capability as subcontractors for APSA works.
		ii Accordingly, it is assumed that the planting work etc. under APSA will be conducted by local companies working as subcontractors for the Contractor.
		iii Similarly, it is observed that the vigorous activities of more than one company in each field have been confirmed in each province, and they can well be incorporated to the activities of the project.
15	Policies Regarding Operation and Maintenance	i It has been confirmed that MARD and the provincial DARDs which will act as the implementation bodies as well as the responsible bodies for the Project have more than one engineer (graduate or equivalent) for afforestation, seedling production, etc. and these engineers are expected to be a member of MB in their own organization.
		ii The budget for MB management has already been requested and no problems are anticipated in regard to the operation and management capacity of the implementation bodies.

No.	Item	Design Policies
16	Policies Regarding Environmental Considerations	i The project sites have relatively low bio-diversity areas. Plantation and planting works should pay no extreme attention to the living environments.
		ii The creation of mixed forests will be planned at those planting sites with a low technical difficulty to secure biodiversity.
		iii Based on the existing tree survey, tree species which accord the environmental characteristics and the number of trees are calculated.
		iv The questionnaire survey conducted with local residents has found that the possibility of sea turtles visiting the shoreline to lay their eggs. Since it cannot be negated even though the number of individuals has plummeted, attentions should be paid to protect their spawning grounds.
17	Policies Regarding Facility Grade	i Facilities to be built by this project must have sufficient durability and safety
		ii The field survey for APSA has found a document suggesting the need for fertilizer application and soil improvement and the relevant requests made by the C/Ps. Height growth of the planted trees is essential for coastal protection forests to fully perform their functions and the necessary measures to ensure height growth must be examined.
		iii Not only the survival rate but also the height growth shall be the subject of the monitoring.
18	Policies Regarding Meteorological Conditions	i As the soil must be sufficiently moist for planting, the appropriate planting time will be determined based on local meteorological data.
		ii The planning of APSA corresponds to the characteristics of local winds (prevailing direction, season, etc.)
		iii As the seedlings will be produced to match the appropriate season for their planting, the construction of the temporary nurseries will take the meteorological conditions of such season into consideration.
19	Policies Regarding Maintenance (Protection) of Coastal Protection Forests	i The maintenance (protection) of the forests is conducted by local residents who received distribution of the plot from the government in general practices in Vietnam. In APSA, too, will follow the same system.
		ii The personnel who receive the plots shall be designated before the commencement of the project through discussions with the responsible governments.
		iii The cost of the maintenance (protection) by local residents during the implementation period of APSA will be borne by the Japanese side.
		iv Even if it is in project period, there is no individual work is in progress, the maintenance cost will be borne by the Vietnamese side.
		v After handing over of APSA to the Vietnamese side, the Vietnamese side will bear the entire maintenance and protection cost.
		vi By decided the individual persons to be responsible for the maintenance (protection) of coastal protection forests at an earlier stage than past experiences, it is intended to (i) develop a sense of ownership of coastal protection forests among local residents to facilitate their understanding of the necessity for these forests and (ii) stimulate public interest to create similar forests in areas adjacent to the project sites.

## 2-2-2 Basic Plan (Afforestation Plan)

### 2-2-2-1 Whole Picture of the Requested Japanese Assistance

The major components of the Japanese assistance are listed in Table 2-2 and the details of each component are described later. A major change from the original application made by the Government



of Vietnam is the omission of equipment procurement from the scope of the Japanese assistance.

Table 2-4 Major Components of Japanese Assistance

Component		Requested Items and the Volume	Results of Basic Design	Results of Implementation Review	Remarks	
Project Sites	Compartment Area	Total	9,480 ha	2,598.47 ha	<b>1,009.97ha</b>	1)
		Quang Nam Province	800 ha	594.82 ha	<b>595.48ha</b>	
		Quang Ngai Province	1,400 ha	414.06 ha	<b>414.49ha</b>	
		Binh Dinh Province	5,280 ha	1,589.59 ha	<b>0.00ha</b>	1)
		Khanh Hoa Province	2,000 ha	0.00 ha	<b>0.00ha</b>	
	Planting Area of the Above	Total	9,480 ha	2,463.75 ha	<b>892.06ha</b>	1), 2)
		Quang Nam Province	800 ha	570.52 ha	<b>482.81ha</b>	2)
		Quang Ngai Province	1,400 ha	409.61 ha	<b>409.25ha</b>	
		Binh Dinh Province	5,280 ha	1,483.62 ha	<b>0.00ha</b>	1)
		Khanh Hoa Province	2,000 ha	0.00 ha	<b>0.00ha</b>	1)
Major Components	Afforestation	Planting Area	9,480 ha	2,463.75 ha	<b>892.06ha</b>	1), 2)
		Operation Roads (Vehicle Roads)	60 km	19.8 km	<b>7.63km</b>	
		Operation Roads (Footpaths)	0 km	15.1 km	<b>15.19km</b>	
		Temporary Nurseries with Auxiliary Facilities	11	1	<b>0</b>	
		Lookout towers	18	4	<b>2</b>	1)
		Project Information Signboards (L)	0	6	<b>4</b>	1)
		Project Information Signboards (S)	0	17	<b>7</b>	1)
	Equipment Procurement	4 WD Wagons	5	0	<b>0</b>	
		4 WD Pick-Up Trucks	4	0	<b>0</b>	
		Motorbikes	18	0	<b>0</b>	
		Personal Computers	14	0	<b>0</b>	
		Printers	14	0	<b>0</b>	
		Scanners	5	0	<b>0</b>	
		GIS Software	14 sets	0 set	<b>0 set</b>	
		Digital Cameras	14	0	<b>0</b>	
Copy Machines	14	0	<b>0</b>			

Remarks: 1) Result of exclusion of Binh Dinh Province  
2) Result of exclusion of land use for other purposes within a compartment

### 2-2-2-2 Selection of the Project Sites (Compartments)

The detailed selection process of the project sites in accordance with the relevant design policies is given in Table 2-5.

Table 2-5 Changes of the Area of the Project Sites (ha)

Province	District / City	Requested Area	Area in M/D in Preparatory Study	Area in M/D in Field Survey	Perimeter Survey Results	Area of the Potential Target Areas	Area of the Project Target Areas	Compartment Area (B/D)	Planting Area (B/D)	Compartment Area (Review)	Planting Area (Review)
Design Policy Code		---	Category A,B	Category A Equivalent	02	02	03	04, 05	04, 05	04, 05	04, 05
Quang Nam	Thang Binh	800	810	570	595.0	595.0	594.82	594.82	570.52	595.48	482.81
Quang Ngai	Binh Son	340	205	160	---	---	---	---	---	---	---
	Duc Pho	1,060	745	430	422.5	422.5	414.06	414.06	409.61	414.09	409.25
	Subtotal	1,400	950	590	422.5	422.5	414.06	414.06	409.61	414.09	409.25
Binh Dinh	Hoai Nhon	120	---	---	---	---	---	---	---	---	---
	Phu My	2,590	1,425	1,053	1,086.3	1,086.3	1,031.45	1,031.45	972.73	---	---
	Phu Cat	860	239	182	561.5	561.5	558.14	558.14	510.89	---	---
	Tuy Phuoc	60	---	---	---	---	---	---	---	---	---
	Quy Nhon	1,650	---	---	---	---	---	---	---	---	---
	Subtotal	5,280	1,664	1,235	1,647.8	1,647.8	1,589.59	1,589.59	1,483.62	---	---
Khanh Hoa	Van Ninh	2,000	1,800	1,200	604.0	---	---	---	---	---	---
Grand Total	---	9,480	5,224	3,595	3,269.3	2,665.3	2,598.47	2,598.47	2,463.75	1,009.97	892.06

Maps indicating the location and shape of each compartment corresponding to the "Area of the Project target areas" and "Compartment Area" are given in "2-2-3 Basic Design Drawings".

The main change in connection with the selection of the project sites and their reasons are described below.

- Because it is confirmed that most of the project sites overlaps with titanium mining development plan in Binh Dinh province, the province is excluded from the project.
- The finalized compartment/sub-compartment area and area by degradation type are shown in Table 2-6 - Table 2-8. The locations of the compartments, sub-compartment and planting sites are given in "2-2-3 Basic Design Drawings".



Table 2-7 Compartment/Sub-Compartment Area and Area by Degradation Type

Province	District	Village	Com-partment	Sub-compartment	Characteristics of land	Species to be planted	Mixing Ratio	Area (ha)	Density (/ha)	# of Existing trees (/ha)	# of trees to be planted (/ha)	# of trees to be planted	
Quang Ngai	Duc Pho	Pho An	PA-1	(1)	Dying forest areas	CE	100%	69.95	1,600	318	1,282	89,676	
				(2)	Areas adjacent to the shoreline	CE		13.59	2,500	6	2,500	33,975	
				(3)	Dying forest areas	CE	100%	52.32	1,600	546	1,054	55,146	
				(4)	Dying forest areas	CE	100%	35.02	1,600	356	1,244	43,565	
				(5)	Areas adjacent to the shoreline	CE		5.47	2,500	92	2,500	13,675	
			Sub-total	Areas adjacent to the shoreline	CE		19.06			2,500	47,650		
				Dying forest areas	CE	100%	157.29			1,198	188,387		
							176.35			1,338	236,037		
			Pho Quang	PQ-1	(1)	Areas adjacent to the shoreline	CE		2.11	2,500	0	2,500	5,275
					(2)	Areas adjacent to the shoreline	CE		4.02	2,500	148	2,352	9,456
		(3)			Areas adjacent to the shoreline	CE		2.08	2,500	0	2,500	5,200	
		Sub-total	Areas adjacent to the shoreline	CE		8.21	2,500		2,428	19,931			
		Pho Vinh	PV-1	(1)	Areas adjacent to the shoreline	CE		17.49	2,500	15	2,500	43,725	
				(2)	Dying forest areas	CE	100%	82.46	1,600	911	689	56,815	
				Sub-total	Areas adjacent to the shoreline	CE		17.49			2,500	43,725	
						Dying forest areas	CE	100%	82.46		689	56,815	
						99.95			1,006	100,540			
		Pho Khanh	PK-1	(1)	Dying forest areas	CE	100%	12.18	1,600	852	748	9,111	
				(2)	Dying forest areas	CE	100%	64.83	1,600	502	1,098	71,184	
			PK-2	(1)	Areas adjacent to the shoreline	CE		14.76	2,500	0	2,500	36,900	
				(2)	Areas adjacent to the shoreline	CE		10.41	2,500	81	2,500	26,025	
			Sub-total	Areas adjacent to the shoreline	CE		25.17			2,500	62,925		
						Dying forest areas	CE	100%	77.01		1,043	80,295	
						102.18			1,402	143,220			
		Pho Chau	PC-1	(1)	Areas adjacent to the shoreline	CE		15.29	2,500	0	2,500	38,225	
				(2)	Areas adjacent to the shoreline	CE		7.27	2,500	0	2,500	18,175	
		Sub-total	Areas adjacent to the shoreline	CE		22.56			2,500	56,400			
		Total				Areas adjacent to the shoreline	CE		92.49		2,494	230,631	
						Dying forest areas	CE	100%	316.76		1,028	325,497	
						409.25			1,359	556,128			

\* CE: Casuarina AC: Acacia CA: Cashew NM: Neem MP: Mixed Plantation (CE:AC:CA:NM = 3:5:1:1)

Table 2-8 Compartment/Sub-Compartment Area and Area by Degradation Type

Characteristics of land	Species to be planted	Mixing Ratio	Area (ha)	Density (/ha)	# of Existing trees (/ha)	# of trees to be planted (/ha)	# of trees to be planted
			892.06			1,473	1,313,819
Frequently Flooded Areas	AC		149.18	2,500		2,382	355,366
Areas adjacent to the shoreline	CE		92.49	2,500		2,494	230,631
Ordinary sandy areas	MP(1)		333.63	1,600		1,206	402,325
Dying forest areas	CE		316.76	1,600		1,028	325,497

Total by Species	Species	Mixture Ratio	Number of Trees to be Planted
	AC	47.36%	622,270
	CE	44.51%	584,781
	CA	4.06%	53,384
	NM	4.06%	53,384
	-	100.00%	1,313,819

Quang Nam Province Only	Species	Mixture Ratio	Number of Trees to be Planted
	AC	82.13%	622,270
	CE	3.78%	28,653
	CA	7.05%	53,384
	NM	7.05%	53,384
	-	100.00%	757,691

Quang Ngai Province Only	Species	Mixture Ratio	Number of Trees to be Planted
	AC	100.00%	0
	CE	0.00%	556,128
	CA	0.00%	0
	NM	0.00%	0
	-	100.00%	556,128

### 2-2-2-3 Afforestation Plan

#### (1) Work Flow

The series of work related to afforestation is shown in Table 2-9.

Following works will be conducted in Term-1 and Term-2. Species, numbers, standards are to be confirmed (seedlings are procured by supply from existing local nurseries), in “01 Procurement of Seedlings”. Contracts to be made with construction firms for planned operation roads (roads for both automobiles and for walking) in “02 Construction of Operation Roads”. Contracts to be made with construction firms for construction of ridges in “03 Ridge works”. Dates and quantities, way of planting and fertilizing are to be determined with contractors in “04 Planting”. At the same time with planting period, contracts of maintenance works on budget of Japanese side are to be made, and to confirm the implementation of the contracts “Maintenance (by Japanese Side)”. Before handing over to C/P, examinations will be conducted by attendance of both sides and plantation area will be handed over to Vietnamese side (08 Examination). After handing over the planted area, the maintenance will be conducted by Vietnamese side which corresponds to “09 Maintenance by Vietnamese side”.

In Term 3, ridge works (03) will be conducted for supplementary planting (05), and additional fertilizing will be conducted (06). Appropriate conduct of maintenance works will be conducted in this period (07), and the tendered area will be handed over to Vietnamese side after examination. Term 4 and Term 5 will be the same procedure as Term 3 except supplemental planting is not conducted in Term 4 and Term 5.

Table 2-9 Flow Chart for Afforestation Work

Year	1												2												3												4												5																																			
Fiscal Year	(Term-1)												(Term-2)												(Term-3)												(Term-4)												(Term-5)																																			
Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3																								
Implementation Period																																																																																				
01. Procurement of Seedlings																																																																																				
02. Construction of Operation Road																																																																																				
03. Ridge Works																																																																																				
04. Planting																																																																																				
05. Supplementary Planting/Additional Fertilizing																																																																																				
06. Additional Fertilizing																																																																																				
07. Maintenance (by Japanese side)																																																																																				
08. Examination																																																																																				
09. Maintenance (by Vietnamese side)																																																																																				

\* hatching area indicates rainy season

(2) Planting

It has been decided to adopt the following planting method with the aim of creating higher quality coastal protection forests under the Project based on such request, experience and knowledge acquired and problems encountered in PACSA and field survey results for the Project.

1) Species

Acacia (*Acacia. crassicarpa*) was selected as main specie for planting in the sites of Quang Nam province. There are several reasons for the selection 1) the existing trees in the sites are Casuarina (*Casuarina equisetifolia*); 2) Acacia showed good survival and growth rates in PACSA; 3) the mature trees of Acacia would make dense forest, which is good for wind prevention function; and 4) there were strong requests from the local residents. Casuarina will then be planted as supplementary species to acacia. Cashew (*Anacadium occidentale*) was also added as a supplementary specie because the cash crop is valuable to the communities, and the Vietnamese government had also requested improvement of biodiversity in the area. Neem (*Melia azadirachta*) is also recommended by the government because of its adaptive capability to sandy area; however, plantation of Neem should be limited as pilot study, since the survival capability in extreme sandy condition is not fully known.

The B/D report concluded that objective species for sites in Quang Ngai province are Casuarina, Acacia as main planting species, with Cashew and Neem as supplementary species. However, it was found that Acacia and Cashew had failed to grow in sand moving area in the test planting sites done by the provincial government. As reasonable conclusion, together with Neem, which has no records of testing in Quang Ngai province, Acacia and Cashew should be excluded from the planting species for Quang Ngai province. Only Casuarina shows favorable results in extreme sand moving area adjacent to the shoreline. Hence, the favorable species for the sites in Quang Ngai province can be concluded as solely Casuarina.

Following Design Policies 06, objective species are selected as Table 2-10.

Table 2-10 Planting Species and Their Characteristics

Category	Species	Scientific Name	Characteristics	Design Policy under the Project
Target Species	Casuarina	<i>Casuarina equisetifolia</i>	The origin is Australia and now found in Africa, Asia and Oceania. This tree looks like a conifer but is a broad-leaved species. It is an evergreen tall tree with an average height and DBH of some 20 – 30 m and 30 cm respectively. It can withstand drought, flooding and tides and can grow on poor soil. Accordingly, it is planted as coastal erosion control forests, at roadsides, at domestic gardens, as perimeter trees around paddy fields and shrimp ponds.	This will be the main planting species under the Project and will be used for areas adjacent to the shorelines, ordinary sandy areas, and dying forest areas. Pure <i>C. equisetifolia</i> forests will be created in areas adjacent to the shoreline, and dying forest, all of which are characterized by such severe conditions as moving sand and tides, while mixed forests with other species will be created in other areas.
	Acacia	<i>Acacia crassiparva</i>	Came originally from Australia, this tree can withstand drought and seasonal flooding and can grow on poor soil. Accordingly, it is used for the afforestation of degraded areas and windbreak forests. In PACSA, this tree was used in Quang Nam Province.	From the experiences in Quang Nam, it can grow well in frequently submerged sandy land and sandy land adjacent to the shoreline, it is said Acacia is suitable to grown in the site of Quang Nam. With construction of ridges, pure Acacia forest will be created. At the same time, mixed planting with other species will be conducted in less technically difficult sites.
Supplementary Species	Cashew	<i>Anacardium occidentale</i>	Originally came from northwestern Brazil and now widely found in the tropical regions of Central and South America and Southeast Asia. This is an evergreen tall tree with a height of some 10 – 15 m. Large orchards are found in coastal sandy areas to produce edible Cashew nuts.	As this species is unsuitable for difficult planting sites, it will be planted along with other species in less technically difficult areas (ordinary sandy areas) in Quang Nam province. The locals are planting them by their own effort in some plots in Quang Nam.
	Neem	<i>Melia azadirachta</i>	An evergreen tall tree originating in India and now distributed not only in India but also in South Asia, Central/South America, and Africa. The height is some 15 – 20 m. Insecticide, medicines for external application to combat rheumatism and medicines for fever and inflammations to prevent the development of skin disease are widely extracted from the seeds, leaves, bark, etc. In recent years, the excellent effect and safety of its use as an insecticide for organic farming has been attracting much attention and is now popularly used in the America, Europe, Australia, India, Southeast Asia, China, etc.	As this species is unsuitable for difficult planting sites, it will be planted along with other species in less technically difficult areas (ordinary sandy areas) in Quang Nam province. Planting Neem can contribute as pilot planting in the area.

## 2) Planting Density and Standard of Mixing Ratio

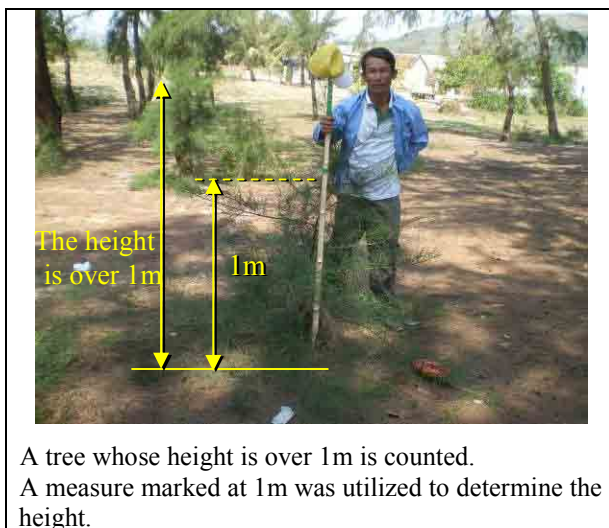
Existing tree survey was conducted in all project area, in order to determine planting density in sub compartment. The number of newly planting trees will be determined by existing number of trees, according to Design Policy 07.

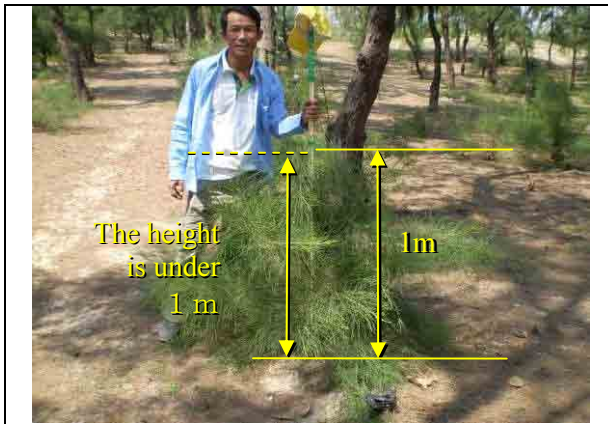


Followings are the procedure of existing tree survey. Sample plots were chosen randomly in every compartment.

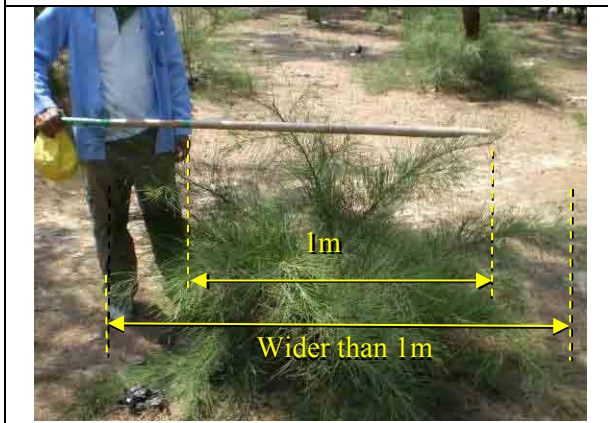
- ◆ Subject area : Every compartments in Quang Nam province and Quang Ngai province
- ◆ Ratio of area of sample plot: over 3% of the compartment area
- ◆ Ways of selection of sample plot: random sampling (clear cross points of latitudes and longitudes)
- ◆ Dimension of sample plot: 50 m x 50 m square
- ◆ Species to be counted: Casuarina, Acacia, Cashew, and others
- ◆ Criteria to be count as ‘one’ tree: a tree satisfy (or meet) the following criteria
  - a) Not dying (by eye observation)
  - b) The height exceeds one meter
  - c) Horizontal extension of the branches exceed one meter

Trees that satisfy the criteria were counted. The average number of existing trees in each compartment is estimated.





A tree, like in the left photo, lower than 1m would not count. However, if its horizontal length exceeds 1m, it is also counted.



The branches of this tree are spreading to the length more than 1m. It is counted as 'one tree' in this survey.



50m-square sample plot was marked by sticks at the corners and the margins are divided by ropes. Then the trees inside the ropes were counted. The sample plot was divided into further smaller lots by additional ropes to make sure the precise counting of trees.



A team member counting the trees in a sample plot with a measuring stick at hand.

Based on the existing tree survey, number of trees in each sub compartment was estimated and shown in

The number of trees planted in the coastal area of Vietnam is 5,000 trees/ha (interval is 1m x 2m) in severe environmental condition, and 3,333 trees/ha (interval is 1.5m x 2m) in less difficult condition.

The number of trees designed by PACSA was 2,500 trees/ha (interval 2m x 2m) or 2,000 (interval 2m x 2m or 1m x 4m). These settings were the results of study sought less costly, but still maintain function of protecting forest. This was true in the well-grown forest, however, the Vietnamese government pointed out that it is not practical in modification of planting tree species, maintaining of biodiversity, and pest control. As the results of further study, the B/D report concluded the number of the tree should be 2,500/ha (interval 2m x 2m) in the severe environment condition. In the area with less difficulty where tree can grow high, can decrease the number to 1,600/ha (2.5m x 2.5m). This study will follow these figures.

For the areas of high difficulties are designated as pure forest of Casuarina or Acacia, based on the results of the existing tree survey and standards of afforestation in Vietnamese coastal area. Meanwhile, for the area of less difficulty, mixed forest of Casuarina, Acacia, Cashew, and Neem is recommended in design policy of B/D study. Although this design policy should be respected, planting patterns in two provinces should be different as the trees' growing environments are different.

Since it is expected the existing trees will continue to grow, the number should be incorporated together to the design for the best results. Therefore, the number of trees in each plot was subtracted from the planed number of trees in B/D report, and shown in Table 2-11.

Table 2-11 Planting Density and Standard of Mixing Ratio by Degradation Type

Province	Land Type	Technical difficulties	Tree Species	Density	Standard mixture ratio
Quang Nam	Frequently Submerged area	Highest	<i>Acacia crassicaarpa</i>	2,500 /ha (subtracted by # of existing trees)	Acacia: 100%
	Sand dunes area	High	<i>Casuarina equisetifolia</i>	1,600 /ha (subtracted by # of existing trees)	Mixture of: Casuarina:30% Acacia:50% Cashew:10% Neem:10%
			<i>Acacia crassicaarpa</i>		
			<i>Anacardium occidentale</i>		
		<i>Melia azadirachta</i>			
Quang Ngai	Dying Forest	High	<i>Casuarina equisetifolia</i>	1,600 /ha (subtracted by # of existing trees)	Casuarina:100%
	Area adjacent to shoreline	Highest	<i>Casuarina equisetifolia</i>	2,500 /ha (subtracted by # of existing trees)	Casuarina:100

### 3) Planting Method

Planting method will follow ordinary planting manner in Vietnam, based on the interview survey results and the reference materials obtained in Vietnam as indicated by Design Policy 06.

Quantity of fertilizer is summarized in Table 2-12.

Table 2-12 List of Required Fertilizer Needed at Plantation in Vietnam

Species	Total	Manure	Organic Fertilizer	Earth Dressing	Buried Straw
Casuarina	4.50 kg	1.00 kg	100 g	3.00 kg	400 g
Acacia	3.83 kg	375 g	50 g	3.00 kg	400 g
Cashew	8.70 kg	5.00 kg	300 g	3.00 kg	400 g
Neem	4.00 kg	500 g	100 g	3.00 kg	400 g

#### ■ Size of Planting Hole

The minimum size of the planting hole shown in Table 2-13 has been determined to reflect the characteristics of the species, the groundwater level in the rainy season and the degree of drought in the dry season.

Table 2-13 List of the Minimum Planting-Hole Sizes by Species

Species	Geographical Area	Minimum Planting Hole Size
<i>Casuarina equisetifolia</i>	Quang Nam Province	Ø30cm x 30cm deep
	Quang Ngai Province	Ø30cm x 60cm deep
<i>Acacia</i>	Quang Nam Province	Ø30cm x 30cm deep
<i>Anacardium occidentale</i>	Quang Nam Province	
<i>Melia azadirachta</i>	Quang Nam Province	

■ Planting Method According to the Species

The planting method by species is given in "Standard Drawing of Planting D-301" through "D-303" in "2-2-3 Basic Design Drawings". Since numbers of trees vary according to the compartments, they should be used as typical figures.

4) Planting Time

Planting will be conducted in two months (60 days) in the first half of the rainy season to ensure a sufficient period of growth after planting. Planting area and number of trees are summarized in Table 2-6 (Quang Nam), Table 2-7 (Quang Ngai), and Table 2-8 (total).

(3) Ancillary Planting Works

Compared to PACSA, the technical difficulty of planting under the Project is much higher and, therefore, the employment of ancillary planting works is planned to overcome such difficulty.

1) Ridge Work

If a planting site in a frequently flooded area is relatively large and the water depth is shallow, ridges are created to the extent that no hindrance occurs to the future development of the root system. Planting is then conducted on these ridges. Refer 2-2-3 Basic Design Figures, D-302. Area of ridge works total 149.18ha.

2) Shield Stick Work

Shield sticks are attached to the planted trees to prevent the damages to the planted trees from shifting sand and/or strong winds in Quang Ngai province. The areas total 92.49ha.

(4) Tending

Tending will be conducted in tandem with planting for the purpose of reducing the death rate of the

planted trees and improving the growth rate. The tending planned under APSA consists of supplementary planting and top dressing as referred to in Design Policy 08. Tending under the APSA will be conducted three times, i.e. once a year for three years for following reasons.

- Planting is often conducted at difficult planting sites posing a high level of technical difficulty.
- Tending once a year for three years is the general practice adopted by the technical standards in Vietnam.
- There has been a strong request for tending once a year for three years by DARD in each province.

#### 1) Supplementary Planting

Supplementary planting intends the replacement of those trees which have died after planting. This will be conducted in a two month period at the beginning of the rainy season one year after initial planting. The standards for the seedlings and quantity of fertilizer application for supplementary planting will follow the standard planting method for each species.

A supplementary planting rate of 15% (excluding existing trees) was adopted by PACSA based on a death rate of some 15% of the planted trees for afforestation work in coastal sandy areas in southern central Vietnam. The same supplementary planting rate of PACSA of 15% is adopted for APSA despite afforestation being conducted at sites with a higher level of technical difficulty than PACSA sites because it is assumed that operation and management technique of the government, local residents and firms had improved after PACSA. The supplementary planting area by province and term is shown in Table 2-14.

Table 2-14 Supplementary Planting in Provinces

Province	Area (ha)	Number of trees
Quang Nam	72.42 ha	113,655
Quang Ngai	61.39 ha	83,420
Total	133.81 ha	197,075

#### 2) Top Dressing

Top dressing will be conducted one year after the initial fertilizer application at the time of planting or supplementary planting or the previous top dressing as the effect of fertilizer application and top dressing wears out for a period of three years. As the best timing for top dressing should coincide with the plant growth season, it will be conducted in the first half of the rainy season.

The top dressing area by province and term is shown in Table 2-15.

Table 2-15 Top Dressing Area by Province and Term (ha)

Province	Planting	Supplemental Planting	Second Year	Third Year	Total
Quang Nam	482.81	482.81	482.81	482.81	1,931.24
Quang Ngai	409.25	409.25	409.25	409.25	1,637.00
Total	892.06	892.06	892.06	892.06	3,568.24

The quantity of top dressing by species is shown in Table 2-16. Quantity of dressing for the third year of Cashew will be increased for it will obtain fruits in the year.

Table 2-16 List of Top Dressing Quantities by Species

Species	Type of Fertilizer	Quantity of Top Dressing		
		1st Year	2nd Year	3rd year
Casuarina	Organic Fertilizer	100 g	100 g	100 g
Acacia	Organic Fertilizer	50 g	50 g	50 g
Cashew	Manure	20kg	20kg	30 kg
Neem	Organic Fertilizer	100 g	100 g	100 g

#### (5) Procurement of Seedlings

##### 1) Number of Required Seedlings

The total number of seedlings required for planting and supplementary planting is shown in Table 2-17, and required quantity of seedlings in Table 2-18.

Table 2-17 Number of Seedlings to be Planted

Province	Species	Planting	Supplementary Planting	Total
Quang Nam	Casuarina	28,653	4,298	32,951
	Acacia	622,270	93,341	715,611
	Cashew	53,384	8,008	61,392
	Neem	53,384	8,008	61,392
	Total	757,691	113,655	871,346
Quang Ngai	Casuarina	556,128	83,420	636,548
	Total	556,128	83,420	636,548
Total	Casuarina	584,781	87,718	672,499
	Acacia	622,270	93,341	715,611
	Cashew	53,384	8,008	61,392
	Neem	53,384	8,008	61,392
	Total	1,313,819	197,075	1,510,894

Table 2-18 Quantity of Seedlings Required

Province	Species	Planting	Supplementary Planting	Total
Quang Nam	Casuarina	35,817	5,373	41,190
	Acacia	777,838	116,677	894,515
	Cashew	66,730	10,010	76,740
	Neem	66,730	10,010	76,740
	Total	947,115	142,070	1,089,185
Quang Ngai	Casuarina	695,160	104,275	799,435
	Total	695,160	104,275	799,435
Total	Casuarina	730,977	109,648	840,625
	Acacia	777,838	116,677	894,515
	Cashew	66,730	10,010	76,740
	Neem	66,730	10,010	76,740
	Total	1,642,275	246,345	1,888,620

Meanwhile, Table 2-19 shows the estimated number of producible seedlings by the existing nurseries based on the nursery surveys and interviews.



Table 2-19 Number of Producible Seedlings by Existing Nursery

Province	District	Name of Nursery	Size (ha)	Production of Seedlings at Present				Capability of Seedling Production				Distance to the Site	
				Casuarina	Acacia	Cashew	Neem	Casuarina	Acacia	Cashew	Neem	Compartment	Distance (km)
Quang Nam	Thang Binh	Binh Tri Commune Agricultural Product and trading Co-operative	1.30	0	550,000	40,000	500	150,000	800,000	60,000	60,000	BM-1	6.00
	Thang Binh	PACSA N-6 Nursery	3.00	0	0	0	0	400,000	2,000,000	120,000	120,000	BM-1	15.00
	Tam Ky	Quang Nam Extension Center	10.00	1,500,000	500,000	500,000	1,000	800,000	4,000,000	250,000	250,000	BM-1	25.00
	Total		-	-	-	-	-	1,350,000	6,800,000	430,000	430,000	-	-
Quang Ngai	Duc Pho	Plant Seed Enterprise	1.00	0	1,000,000	0	0	250,000	80,000	30,000	30,000	PK-1	10.00
	Quang Ngai	Plant and Animal Breeding Center of Quang Ngai	23.00	100,000	1,000,000	200,000	8,000	1,000,000	500,000	200,000	200,000	PA-1	50.00
	Total		-	-	-	-	-	1,250,000	580,000	230,000	230,000	-	-

Comparison of the figures in Table 2-18 and Table 2-19 indicates that the required number of seedlings for every species can be supplied by the existing nurseries in Quang Nam Province. Nurseries in Quang Ngai province have sufficient capabilities (scale of facilities, labor force, technique) for producing required number of seedlings, if they switch the producing species: Acacia to Casuarina.

## 2) Types and Standards of Seedlings

In accordance with Design Policy 09, the seedlings of *C. equisetifolia* will consist of 50% of seedlings nursed from seeds (collected from local elite trees) and 50% of rooted cuttings (Chinese 601 and 701). While the rooted cuttings can be nursed using those selected from excellent production sites, they can be simultaneously damaged by disease, insects or particular weather conditions due to their nature of being clones inheriting the same qualities. To avoid this risk, half of the seedlings will be produced from seeds. This 50–50 ratio will equally apply to both the purchased seedlings and produced seedlings and these two types of seedlings will be evenly distributed to each sub-compartment for mixed planting.

In regard to other species, seedlings (sowed seedlings, rooted cuttings and grafts) are procured locally.

The seedling standards by species are given in Table 2-20.

The seedling production method for each species will follow the technical procedure for seedling production set forth by MARD.

Table 2-20 Seedling Standards by Species

Species	Type	Height	Nursing Period	Minimum Pot Size
<i>C. equisetifolia</i>	Sowed seedlings Rooted cuttings	60 - 100 cm	6-8 months	Ø10cm × 20cm (H)
<i>A. crassicarpa</i>	Sowed seedlings	25 - 45 cm	2.5-3 months	Ø 4cm × 10cm (H)
<i>A. occidentale</i>	Grafts	50 - 70 cm	6 months after grafting	Ø10cm × 20cm (H)
<i>M. azadirachta</i>	Sowed seedlings	25 - 45 cm	4-5 months	Ø10cm × 20cm (H)

## (6) Operation Roads

Operation roads will be constructed at the project target areas as in the case of PACSA to efficiently conduct planting, tending and maintenance (as well as post-planting protection). Under APSA, either vehicle roads or footpaths will be introduced depending on the shape and topographical conditions of each project site as stated in Design Policy 10. All operation roads should be opened prior to such work as planting, tending, construction of the temporary nursery, etc. The road will be handed over to the Vietnamese side at the end of APSA to withdraw.

### 1) Operation Vehicle Roads

The following conclusions have been reached as a result of the density of the operation road network and filed surveys as indicated by Design Policy 10. One precondition is that no operation vehicle road will be constructed in long and narrow compartment(s), typically represented by the project sites in Quang Ngai Province as such a road would reduce the planting area.

- In the case of large compartment(s) with an area of some 600 ha, the construction of operation vehicle roads will keep the overall cost at a low level and the optimal density of these roads is 10.38 m/ha.
- In the case of small compartment(s) with an area of 150 ha or less, the construction of operation roads will increase the overall cost. Accordingly, no operation roads will be constructed in these compartments.

Based on the above conclusions, operation vehicle roads will be constructed in all compartments in Quang Nam province (BM-1 – 3, BD-1 – 3 and BH 1 – 2 with a total area of 595.48 ha),

The alignment determined by the local topography, distribution of existing roads, etc. is shown in

"D-201" in "2-2-3 Basic Design Drawings". The total length of new operation vehicle roads is 7.63 km. It will be constructed in a total area of 1,918.83 ha, the average density of operation vehicle roads will be 12.80 m/ha.

The length of access roads which will be constructed by the Vietnamese side is less than 250m on the north side, from concrete road to 'A1' point; less than 330m to the south side, from concrete road to 'A18' point.

The standards and structure of operation vehicle roads will correspond to "Public Road Class IV of Vietnam" or "Forest Road Class 2 of Japan" in accordance with Design Policy 10. The details of the design standards are given below. For the structure, refer to the "Standard Drawing of Operation Road D-501" in "2-2-3 Basic Design Drawing".

The course of the operation road is design to be on the boundary of the villages; however, it will detoured for hedging the obstacles, refer to the in "2-2-3 Basic Design Drawings". Completion of the operation roads should be before the commencement of the pkaning works.

- ◆ The design vehicles are ordinary trucks (loading capacity of 6 tons).
- ◆ The standard design speed is 30 km/hr.
- ◆ The total width of an operation road is 4.0 m, consisting of a roadway of 3.0 m and a shoulder of 0.5 m on each side of the roadway.
- ◆ The slope gradient for cutting and banking is 1:1.8.
- ◆ The surface of the operation vehicle roads is paved with gravel and the subbase thickness is 40 cm, consisting of an upper subbase of 10 cm and a lower subbase of 30 cm.
- ◆ The road surface has a cross-sectional grade of 4%.
- ◆ The minimum curve radius of the operational vehicle roads is 20 m.
- ◆ The maximum longitudinal gradient is 10%.
- ◆ In principle, a turnout is introduced every 500 m or less of an operation vehicle road which also functions as a turning point for vehicles.

The subbase will be fully compacted. The material for the upper subbase will be equivalent to crusher run for a road (C-40: crushed stone size of 0- 40 mm). The material for the lower subbase will be good quality soil with gravel, which can achieve sufficient compaction, and the gravel size will be 0-150 mm.

For the maintenance and repair of the operation vehicle roads, leveling work (leveling only) and repair work (supplementation of gravel and leveling) will be conducted. Leveling work will be

---

conducted during each rainy season when these roads are most frequently used (four times, once every year). The repair work will be conducted in the dry season at a same frequency as that for leveling work. The quantity of supplementary gravel, which is equivalent to the surface pavement, will be 15% of the quantity of the gravel originally used.

## 2) Operation Footpaths

As each project site in Quang Ngai Province forms a long and narrow stretch with a width of some 100 – 300 m, the construction of operation vehicle roads would reduce the width of the coastal protection forests to be created, resulting in possible failure to achieve the expected windbreak and sand control effects. In addition, these long and narrow sites are some distance from existing roads and the access points are limited. At such sites, there is concern in regard to poor work efficiency due to access on foot and, therefore, operation footpaths will be introduced to improve the access and work performance.

The standards and structure of these operation footpaths are based on local standards as indicated in Design Policy 10. The width and subbase thickness will be 0.8 m and 20 cm respectively and only subbase work using the material for the lower subbase (good quality soil with gravel) used for the operation vehicle roads will be conducted.

Alignment of the operation footpath will be set along side of shrimp farms for convenience of the operation staffs and other locals. The course of the footpath is laid on coast side. The construction should be completed before the commencement of the plantation works.

The alignment determined by the local topography, distribution of the existing roads, etc. is shown in "Compartment Maps D-202" through "D-204" in "2-2-3 Basic Design Drawings" and the total length is 15,190 m (Table 2-21). For the structure, refer to the "Standard Drawing of Operation Road D-501" in "2-2-3 Basic Design Drawings".

Table 2-21 Total Length of Operation Footpaths to be Created

Province	District	Compartment	Total (km)
Quang Ngai	Duc Pho	PA-1	4.69
		PV-1	2.86
		PK-1	4.74
		PK-2	2.90
Total			15.19

## 2-2-3 Basic Design Drawings

## INDEX

## DRAWING LIST

DWG. NO.	SHEET / JOB TITLE	DRAWING TITLE	SCALE
D-101	LOCATION MAP	LOCATION MAP OF VIET NAM AND TWO PROVINCES	
D-102	LOCATION MAP	LOCATION MAP OF COMPARTMENTS IN QUANG NAM PROVINCE	1/500,000
D-103	LOCATION MAP	LOCATION MAP OF COMPARTMENTS IN QUANG NGAI PROVINCE	1/500,000
D-104	LOCATION MAP	LOCATION MAP OF COMPARTMENT NUMBER BM-1~3, BD-1~3 AND BH-1~2	1/50,000
D-105	LOCATION MAP	LOCATION MAP OF COMPARTMENT NUMBER PA-1 AND PQ-1	1/50,000
D-106	LOCATION MAP	LOCATION MAP OF COMPARTMENT NUMBER PQ-1, PV-1 AND PK-1	1/50,000
D-107	LOCATION MAP	LOCATION MAP OF COMPARTMENT NUMBER PK-1~2	1/50,000
D-108	LOCATION MAP	LOCATION MAP OF COMPARTMENT NUMBER PC-1	1/50,000
D-201	SITE PLAN	COMPARTMENT MAP OF BM-1~3, BD-1~3 AND BH-1~2	1/25,000
D-202	SITE PLAN	COMPARTMENT MAP OF PA-1 AND PQ-1	1/25,000
D-203	SITE PLAN	COMPARTMENT MAP OF PQ-1, PV-1 AND PK-1	1/25,000
D-204	SITE PLAN	COMPARTMENT MAP OF PK-1~2	1/25,000
D-205	SITE PLAN	COMPARTMENT MAP OF PC-1	1/25,000
D-301	PLANTING	STANDARD DRAWING OF PLANTING, NP-CE-25 (Normal Planting, Casuarina)	1/20, 1/100 (1/25), (1/125)
D-302	PLANTING	STANDARD DRAWING OF PLANTING, NP-AC-25 (Normal Planting, Acacia)	1/20, 1/100
D-303	PLANTING	STANDARD DRAWING OF PLANTING, MP-T1-16 (Mixed Planting)	1/20, 1/100
D-401	PLANTING ANCILLARY WORKS	STANDARD DRAWING OF BAMBOO SHIELD STICK	1/20, 1/100
D-501	OPERATION ROAD	STANDARD DRAWING OF OPERATION ROAD	1/50, 1/25, 1/200
D-601	LOOKOUT TOWER	STANDARD DRAWING OF LOOKOUT TOWER	1/100
D-701	SIGN BOARD	STANDARD DRAWING OF SIGN BOARD	1/100

