Tableau A-1-8-1 Résultats des Activités de la SECREN

SOCIETE D'ETUDES, DE CONSTRUCTION
ET DE REPARATION NAVALES (SECREN)
- ANTSIRANANA -

SERVICE CONTROLE DE GESTION

CHIFFRE D'AFFAIRES SECREN

		UNITE	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
CA en FMG	- NATIONAUX	M. FMG	565	578	931	1.004	1.702	1.843	1.929	1.836	3.671	2.725
	- THONIERS	M. FMG		138	872	1.642	3.579	5.691	6.054	6.555	3.892	2.910
	- AUTRES ETRANG	M. FMG	172		53	165	189	1.004	2.159	6.231	3.177	6.206
	- C.N.	M. FMG	49	170	259	53	96	184	497	703	266	0
	- DIV.	M. FMG	274	143	161	405	521	793	648	1.211	633	365
			1.060	1.029	2.276	3.269	6.087	9.515	11.287	16.636	11.639	12.205
NBRE DE NAVIRES	-NATION.-PECHE		22	25	30	38	44	39	38	36	39	33
	-MILIT.		8	7	3	6	5	4	3	2	2	0
	-AUTRES		12	9	9	9	10	5	9	10	11	8
	-ETRANG.-TH FRA			4	16	10	11	14	13	10	7	10
	-TH ESP				2	5	5	7	6	7	8	2
	-AUTRES		2			2	2	3	6	4	4	2
			44	45	60	70	77	72	75	69	71	55

Tableau A-1-8-2 Orientation de Développement Regional (Ouest du faritany d'Antsiranana 1/2)

Blocking Factors	Development Factors	Objective and Actions	Projects to be Promoted
• Low productivity of agricultural products and particularly food crops • Non profitable farm gate prices • Ever-increasing input costs • Lack of storage regulations • Monopoly and guaranteed income in some collecting and supply channels • Difficulty in obtaining agricultural loans • Weak leadership and inconsistent objectives • Fluctuating international prices of exports • Superannuation of the irrigation networks and stagnation of managed areas • Generally deficient communication routes combined with a high transport cost • Weakness of farmers' organization in collecting information and defending their interests	• Great diversity of crops and implementarily among the sub-zone • Availability of plain that can be managed(20,000 ha) • Available funds connected with the trade of income-generating products • Possibility to export zebus from Vohémar • Promising projects either at a cruising speed like Soavoanio or at a launching phase like the Antalaha oil palm trees • Same experience of NGO in fishery and profession training • Existence of towns(of more than 20,000 inhabitants); Vohémar, Sambava, Antalaha as solvent outlets for the farmers' products • Existence as regards vanilla of association of products and processors capable of better organizing the profession	• Short term program of rehabilitation of the most vital communication routes in connecting with high productive potential areas • Enforcement of a coherent cost/price policy which ensures a minimum income to farmers • Reform of the trade network and control of middlemen's abuse • Urging the organization within the Association of defence and promotion of farmers(ADPE) • Decentralization of the agricultural credit and easing of credit grant terms • Control the problem of international price fluctuation of a stabilization policy • Initiate important rural development and environment protection works which will release at the same time a supplementary income as a support to the farmers	• Management of the plains of: • Antenina, Antanamangakitro, Ambendrnana in the Fivondronana of Andapa • Anjana, Ankorena, Anipanga in the Fivondronana of Sambava • Ambalajombilana in the Fivondronana of Vohémar • Valambanina, Ifaho VF, Ambinanifaho VF, Isahana VF of a global area of 3,600 ha and a management total cost of 611 billion FMG • Installation of a rice-processing factory at the Biblical school of Soavinandriana • Rehabilitation of the windmills for the supplying of troughs • Construction of an artificial insemination center
• Poor definition of the functions of the various urban centers. Potential conflict between Antalaha and Sambava over the fundamental role of the zone • Weakness if not absence of suitable port developments for Sambava and Antalaha, the 2 largest centers for shipping and receiving goods • Quasi-absence of industrial units apart from Soavoanio which has launched a small coconut oil extraction plant • Inadequacy of urban community means and technical services to structure the cities does not make them play their training pole role • Lack of social leader ship in training and promotion particularly for young people that are more and more rejected by the educational system without any prospect	• Existence of 2 urban centers of sub-regional dimensions; Antalaha(pop.48,000) and Sambava(pop.30,000) and the latter has experienced a consistent demographic dynamism(+5.4% per year) • Support to towns through a secular trade experience related to the income-generating crops and the zebu export in Vohémar • Productive diversity of the agricultural hinterland which has resulted in a continuity of trade and services in the cities • A good air link with Sambava on whose airport a B727 can land • Existence promotional projects such as the "alcohol project" of Antalaha which can contribute to the energization of the region	• Definition of an urban development planning for the zone which allows a frame of organization and the assembling of the different city functions • Development of important facilities, parti-cularly ports to sustain the commercial and fishery functions of the cities • Rehabilitation of service networks to accompany urbanization dynamics which is most noticeable in Sambava • Strengthen public and private organizations involved in social aid and solidarity • Repair of public service equipment, particularly those of health and primary education sectors • Strengthening of the decentralized community means and technical services as they go along with development	

Tableau A-1-8-3 Orientation de Développement Regional (Ouest du faritany d'Antsiranana 2/2)

Blocking Factors	Development Factors	Objective and Actions	Projects to be Promoted
* Precariousness of the people's living conditions: • Decrease of 3% per year in the total number of students • An average of 10 schools per year close down • Increase of morbidity for all kinds of disease • Hygiene and water problems for 80% of the population • Malnutrition; perceptible when certain kinds of diseases develop • Precariousness of socio-collective means particularly those of public health • Medicine shortage	* A strong aspiration to better social living conditions: • Providing the youth of the population with the prospect of social mobility, particularly at the level of urban growth of Diego and Nosy-Be • Social leadership at the decentralized community level with a view to reducing social difficulties • Presence of NGOs which attempt to compensate for the inadequacy of the public service	* Rehabilitate the socio-collective public service and the social network of solidarity: • Restore State's capacity to intervene in the social field • Specifically, ensure minimum service in health and basic education • Restore human and material capacities of the decentralized communities for social matters • Energize the basic human network of social solidarity • Introduce new association approaches of the social and the productive for the process durability	* Social projects targeted to strata with most precarious conditions: • Provision of medicine for the whole Fivondronana for one year; these provisions should be given to NGO to ensure good distribution • Improvement of drinking water supply at Miadana, Mahazandry, Ambanoro, Mangirankirano, Betsiaka, Matsabory-Ilaidama, Anivorano-Nord, Sakaramy as well as the digging of 18 wells in the Fivondronana of Ambanja • Rehabilitation of health centers in Ambanja; the city of Diego, Ambilobe, Sirama • Rehabilitation of educational centers in Hell-Vill and Ambilobe • Setting up of a village community pharmacies in Diego II • Setting up of a nutritional recuperation center for about 360 children/year in Diego I
* Advanced degradation of the road transport network and the telephone communication network: • Difficult connection between the whole Faritany and its spatial neighborhood, particularly near Mahajanga • Difficult connection between Diego, the regional capital and the Faritany territory • Difficult connection from East to West between the two halves of the province • Disastrous consequences on the hemmed-in position of peripheral zones, on the product distribution and on the supply of the population in public service	* A strong dynamism of port and air transport activity: • Control up to 10 to 15% of the national air and sea transport by the West-Antsiranana planning zone • Strong participation through this in the Malagasy effort towards export(30% of the national volume) • Existence of a commercial tradition and an opening to foreign countries • Predisposition of the region to tourism	* Global system balance of flow and exchange for the internal link and the road network: • Rehabilitation of the North-South(RN 6) road trunk connecting the city of Diego to Faritany of Mahajanga • Rehabilitation of the East-West(RN 5a) trunk • Operating road information service antenna in contact with settlement and production zones • Establish an intervention team for road maintenance and good service	* First road transport difficulty-freeing related projects: • A 22 km track at Ambahivahibe • A 12 km road on the trunk Ambanja-Ankatafa • Rehabilitation of a road of 8 km on the trunk Ambanja-Analavory-Antsatsaka • Rerepairment of a road of 12 km on the trunk Ambalavelona-Ambalahonka-Ambiky • Rehabilitation of the link road Ambalafary-Anjiaboky(8 km) • Development of the trunk Ambaliho-Nosy Faly(8 km)

Tableau A-1-8-4 Orientation de Développement Regional (Ouest du faritany d'Antsiranana 1/3)

Blocking Factors	Development Factors	Objective and Actions	Projects to be Promoted
* Problems in communication facilities • Acute problems in telephone connections • Quasi-absence of telex connections		* Rehabilitation of communication facilities: • Rehabilitate telephone network • Make the region have access to the higher service of telex and other modern means of communication which are necessary for project development	• Rehabilitation of the link road Antsiratsika-Ambohitrandriana • Repairment of the Namakia bridge • Rehabilitation of the Beramanja-Analavana road • Remaking of 2 tracks; Beramanja-Anaborano(25 km) and Siranonkova-Madiromiarina(8 km) • Rehabilitation of the roads... Bemanondrobe(6 km) Andrianakonko-Mahazandribe(6km) Andrianakongo-Mahazandry(5 km)
* Weakness of productivity and agricultural food production: • Poor rice crop yield zone despite its potential • Low average yield in rice-farming; about 1.2 ton • Limited rice-field area(70,000 ha) in relation to the population's needs • Extensive animal breeding; 300,000 heads for more than 400,000 ha of pasture • Increase of input cost and low monetary surplus per hectare(about 60,000 FMG for rice) • Strong pressure on land due to shortage of arable land(average arable land; 3 ha per farm)	* Realizing existing potential of agricultural areas and improvement of agricultural methods: • Only 200,000 ha are now cultivated from a potential estimated at 1,000,000 ha, 400,000 of which stand as pastures for animal breeding • As for irrigable areas, only half of the potential of 10,000 ha is irrigated • There are some reserves of fertile land which can be cultivated through leadership and rural extension	* Implement a development strategy for the productive potential in agriculture: • Defend against potential calamities; tavy(slash-burn), bushfires, erosion... • Start a hydro-agricultural management process on the rice-farming plains in the rich basins of the Mahavavy and the Sambirano • Urge cashew-growing which is easily adapted to the region's ecological conditions and yields a nut with a high commercial value • Implement a cattle-breeding intensification policy through fodder-growing and enclosure layout • Improve agricultural methods, particularly in respect to the seasons	* Management of some plains as a start for the potential development process: • Rehabilitation of the hydro-agricultural network of Andrianakonko(200 ha) • Rehabilitation of the hydro-agricultural network of Ampasindava(50 ha) • Plain management of Navetsy • Plain management of Mahabe(50 ha) • Plain management of Andrahibo(50 ha) • Plain management of Masovariaka(100 ha) • Construction of 2 irrigation canals in Amparihy and Ambahivahibe • Rehabilitation of a "husking" plant and an irrigation canal in Sadjoavato • Remaking of an Ampamakia polder(50 ha) • Hydro-agricultural rehabilitation of the Ankinaka plain • Hydro-agricultural management of 3 plains in the Fivondronana of Ambilobe

Tableau A-1-8-5 Orientation de Développement Regional (Ouest du faritany d'Antsiranana 2/3)

Blocking Factors	Development Factors	Objective and Actions	Projects to be Promoted
• Only 20% of the road network can be managed under normal and cost standard conditions • Some problems exist in the current road network in terms of connections between the city of Diego and the rest of the Faritny, the eastern half of the province with the western half, and the whole region with the rest of the country • The low road traffic(3.5% of the national volume) reinforces Antsiranana's reliance on exports to generate income and in the long run this will have a detrimental effect on natural economy • The other networks of service(drinking water, electricity, telephone) suffer from the same inadequacy as that of the road network and thereby constitute a serious stumbling block for the region	• Existence of a know-how in huge public works and development capable of-if materials become available-rehabilitating the network and organize its permanent maintenance • Existence of some social credit for non-free services on condition that rates reflect real costs • Existence of a productive potential capable of justifying the economic profitableness of road, hydraulic electrical... infrastructures to be developed and rehabilitated • Existence of an urban network(of 8 towns of more than 15,000 inhabitants over an area of 44,000 km²) which account for the existence network as regards space	• Drawing up of a sub-regional road development planning to work as an organizational frame with the national road and priority layout planning on the regional and local scale • Implementation of a common service of road maintenance for the different Fivondronana of the zone which could be organized as association of communes • Intensive intervention on the matter of drinking water in view of its consequences on health due to the inadequacy of the service • Electrification planning of urban centers and rural networks • Rehabilitation of the telephone communication network as main support to the new projects development and promotional activities	• Rehabilitation of: • 6 road links in the Fivondronana of Andapa • 3 bridges in the Fivondronana of Andapa • 3 road links in the Fivondronana of Sambava • of a pole ferry-boat in the Fivondronana of Sambava • of a port(Tanambo-Doana) in Sambava • 4 links in the Fivondronana of Vohémar • 3 links in the Fivondronana of Antalaha
• Unfavorable tendencies are seen in the educational system; the total number of pupils is decreasing, schools are closing down, more incidents of students repeating grades are observed, and the dropout rate has risen sharply while enrolment rate has fallen under 50% • A healthcare system near collapse, only covering 20% of the needs in medicine and care • Growing morbidity connected to under nourishment, lack of drinking water, hygiene problems in areas without proper Sanitation facilities • Lack of a professional trainning policy which can help increase opportunities of integrating young victims of the failing educational system • Absence of a social solidarity program, of a program aiming at helping the most deprived and protecting children	• Existence of medical personnel(377 agents) hardened by the difficulties and capable of progressively improving their medical service performances should practical means be made available to them • The same applies to the "educational" leadership where the number of teachers and administrative personnel is over 1,700, which means an important human potential though still insufficient as far as needs are concerned • The existance of actions of social solidity which demands to be coordinated and above all reinforced to assure their continuity in the time as well as in the territorial space	• Implement a program that is necessarily national and can stop in a first phase the unfavorable change in the basic social services and in a second phase start to straighten out the situation whose effects can become worse and be so for a long time if no forceful intervention is made • Favor at the local and regional scale the action of solidity by making participate by effort those who profit the most by the effects of the "libéralisation" and by the first results of the growth	• Building of 6 drinking water conveyance in the Fivondronana of Andapa • Donation of medicaments to the 4 Fivondronana of the zone • Contribution to the arrangement of the Fivondronana and Firaisana premises in Andapa • Rehabilitation of a SAFF and the high school of Andapa • Rehabilitation of health centers in Sambava • Rehabilitation of 2 SFF in Sambava • Support to the community in Sambava • 1 laying on water in the Fivondronana of Vohémar • Food production project • Rehabilitation of Vohémar HS • Laying on water in 11 Fokotany in Antalaha • Rehabilitation of the public school administration premises • Lodgings for the saint Jean private school pupils • Animation and production projects for young people and women in Antalaha • Rehabilitation of the equipment of the Fivondronana premises in Antalaha

Tableau A-1-8-6 Orientation de Développement Regional (Ouest du faritany d'Antsiranana 3/3)

Blocking Factors	Development Factors	Objective and Actions	Projects to be Promoted
• Interference of the scope of activities between decentralized communities who are supposed to have the "decisionmaking power" on the regional scale on one hand and the decentralized technical services which depend on ministries on the other hand • Lack of a drawing-up and follow-up frame of a regional development strategy • Inadequacy of the decentralized community means with nominal budgets • Weakness of the local associative movement which could have played the development partner role • Multiplicity of operators without obligation of coordination and without referring to a hierarchy of the objectives	• Existence of a regional "consciousness" and a will of the elites to review the structures and modernize the production and service apparatus • Existence of some experience in regional and local administration even if the means are inadequate and the prerogatives not always specified • The regional representation of the Ministry of the Planning in the absence of other executives, can promote a coherent approach to regional development	• Elaboration on the regional and sub-regional scale of a strategy of territory and socio-economic development articulated to the national strategy • Setting-up of a institutional frame on the regional(or sub-regional) scale in charge of the follow-up of this strategy implementation • Substantially improve the means of intervention of decentralized communities • Support the emergence of an associative and representative movement that is capable of setting itself up as a genuine development partner and arousing the population's concern to the general problems of the region • Favor the sectorial decentralization policies particularly those related to credits and in the long run the emergence of a regional credit capable of taking responsibility for the specific conditions of project promotion	

Tableau A-1-8-7 Zone Franche Economique des Philippines (EPZ)

Table Cacite EPZ Performance

	1987	1988	1989	1992
Number of Firms Operating	1	4	14	90
Average Employment	99	323	3294	20204
Salaries and Wages (P000)	876	6017	43497	711316
Local Sales (P000)			1364	
Local Purchases (P000)		277	4418	
Exports (US$000)	739	3021	15306	251855
Imports (US$000)	712	2843	11631	232668
Trade Balance (US$000)	27	178	3675	19187

SOurce: EPZA

Table Features of the Operating Companies by PSIC code (As of Aug., 1991)

PSIC Code	Number of Company	(%)	Average Employment per Firms (Persons)	Average Area (m2) per Firms	Total Employment (Persons)	(%)	Total Land Area Occupied (m2)	(%)
312	1	1.7		5,000	0	0.0	5,000	1.1
321	3	5.2	142	8,333	425	3.3	25,000	5.4
322	23	39.7	216	4,689	4,317	33.6	107,836	23.3
331	1	1.7		5,000	0	0.0	5,000	1.1
341	2	3.4	98	4,002	195	1.5	8,003	1.7
355	1	1.7	2034	31,077	2,034	15.8	31,077	6.7
356	1	1.7		5,000	0	0.0	5,000	1.1
369	1	1.7		5,000	0	0.0	5,000	1.1
371	1	1.7	7	10,000	7	0.1	10,000	2.2
372	1	1.7	40	10,000	40	0.3	10,000	2.2
381	5	8.6	113	10,000	565	4.4	50,000	10.8
382	2	3.4	293	11,642	586	4.6	23,284	5.0
383	8	13.8	580	18,725	4,062	31.6	131,076	28.4
384	1	1.7	26	5,000	26	0.2	5,000	1.1
385	1	1.7	39	3,003	39	0.3	3,003	0.6
390	6	10.3	113	6,331	564	4.4	37,984	8.2
	58	100.0	308	8,110	12,860	100.0	462,263	100.0

Source: EPZA.

Note: PSIC (Phipipine Standand Industrial Classification)

312	Food	371	Iron & Steel Basic Products
321	Textiles	372	Non-ferrous Metal Products
331	Wood & Wood Product	381	Fabricated Metal Products
332	Furniture & Fixtures	382	Mashinery except electrical
341	Paper & Paper Produ	383	Electrical Mashinery
351	Industrial Chemical	384	Transport Equipment
355	Rubber Products	385	Other Equipment & Infrastructure
356	Plastic Products	390	Other Manufacturing Industries
369	Non-metalic Mineral Products		

A-2.2 Trafic de Cargaisons et Installations Portuaires

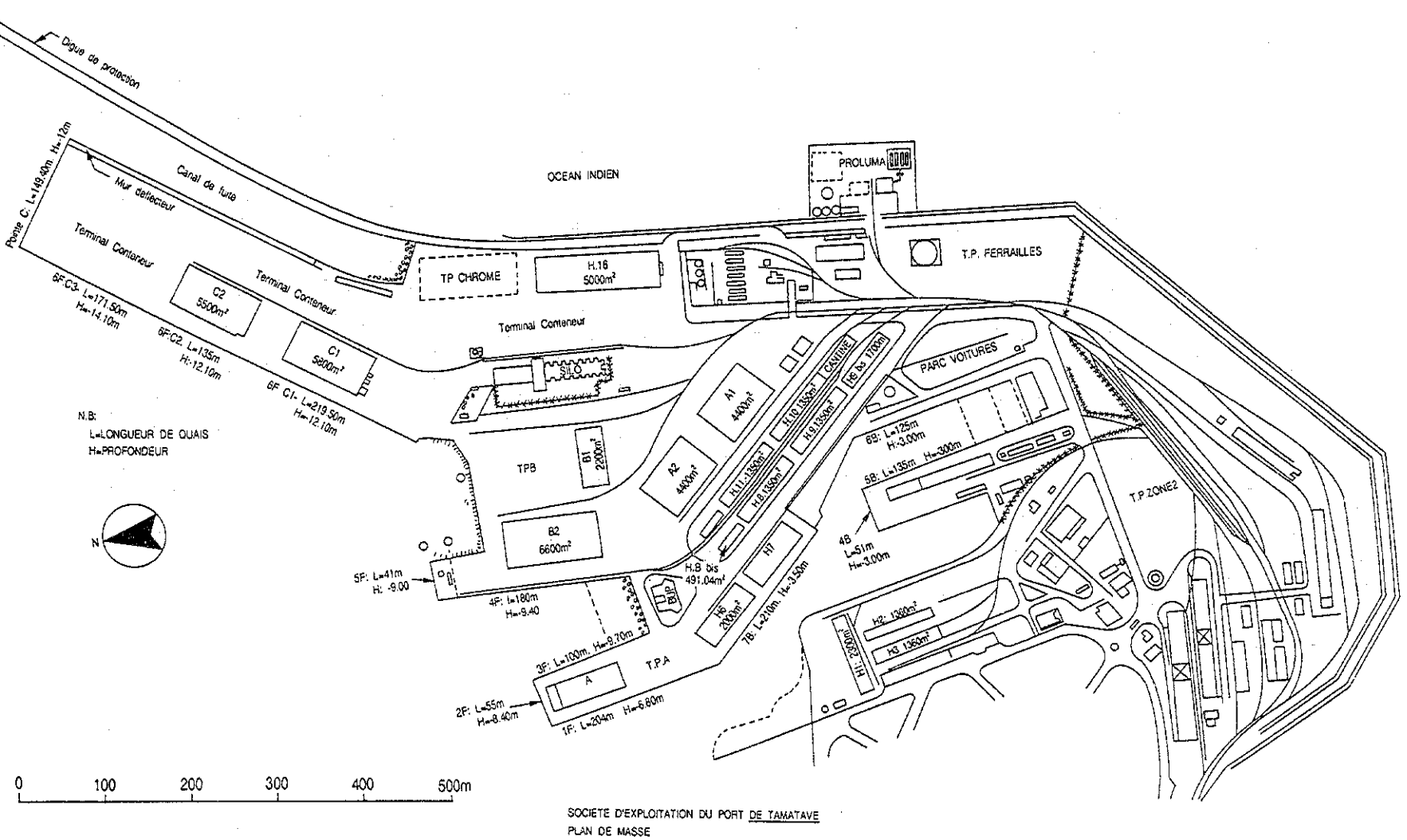


Figure A-2-2-1 Plan d'Implantation du Port de TAMATAVE

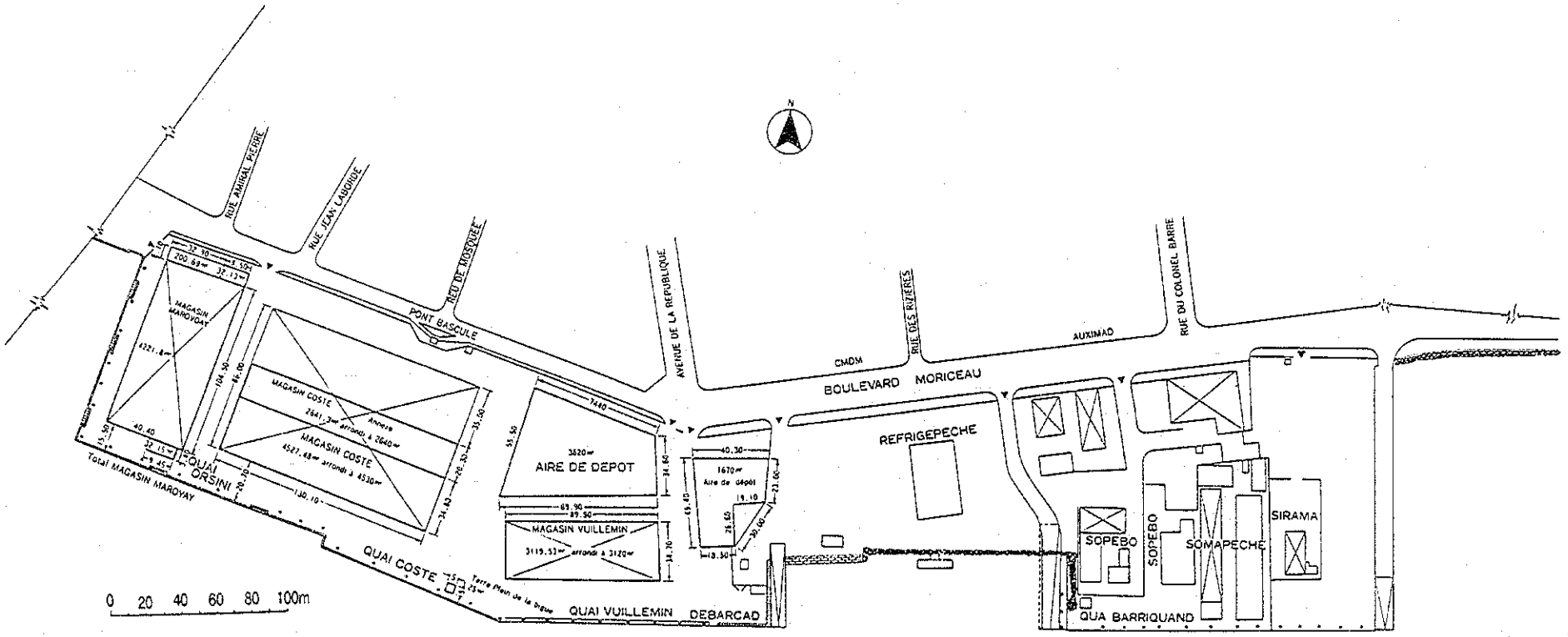


Figure A-2-2-2 Plan d'Implantation du Port de MAHAJANGA

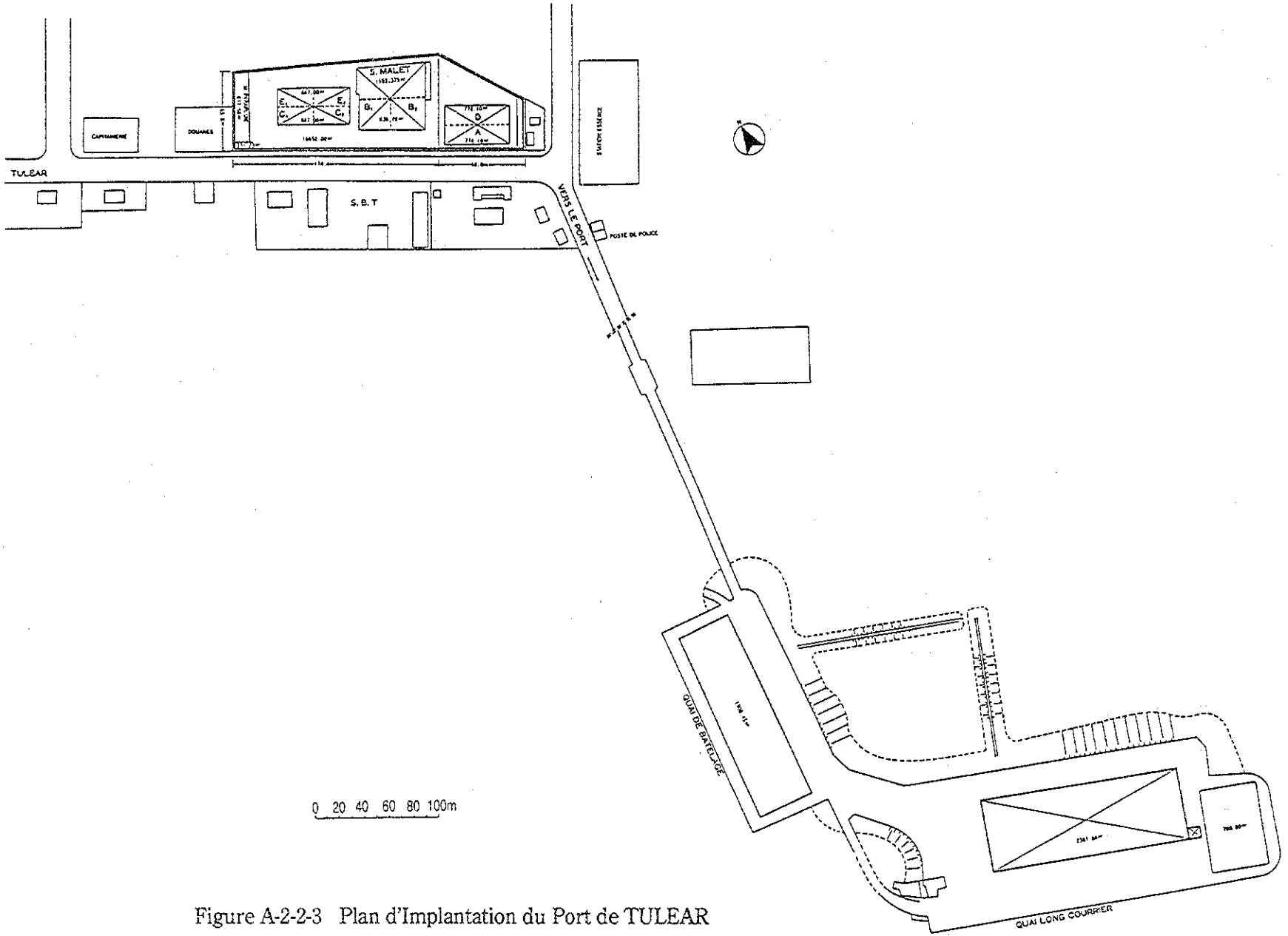


Figure A-2-2-3 Plan d'Implantation du Port de TULEAR

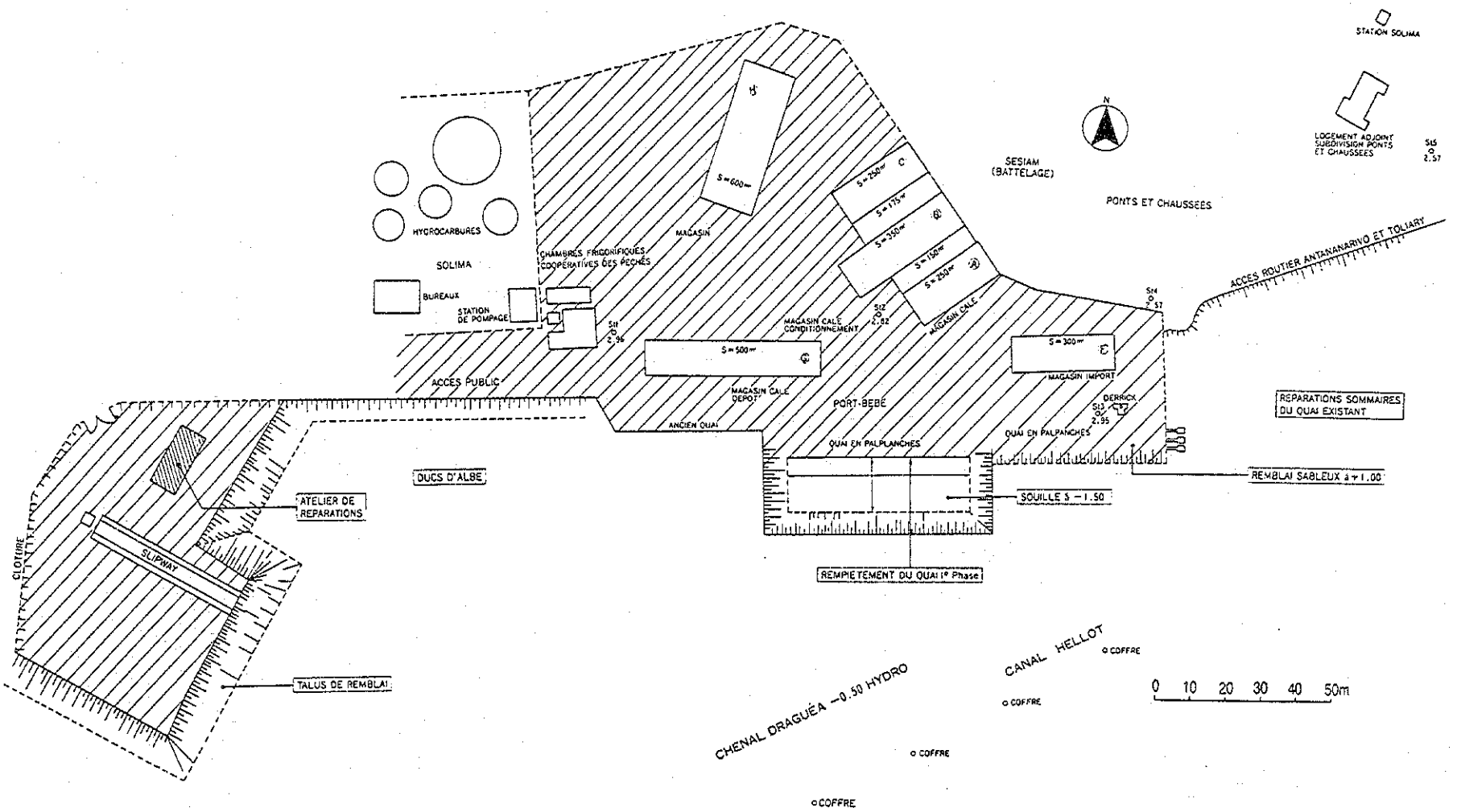


Figure A-2-2-4 Plan d'Implantation du Port de MORONDAVA

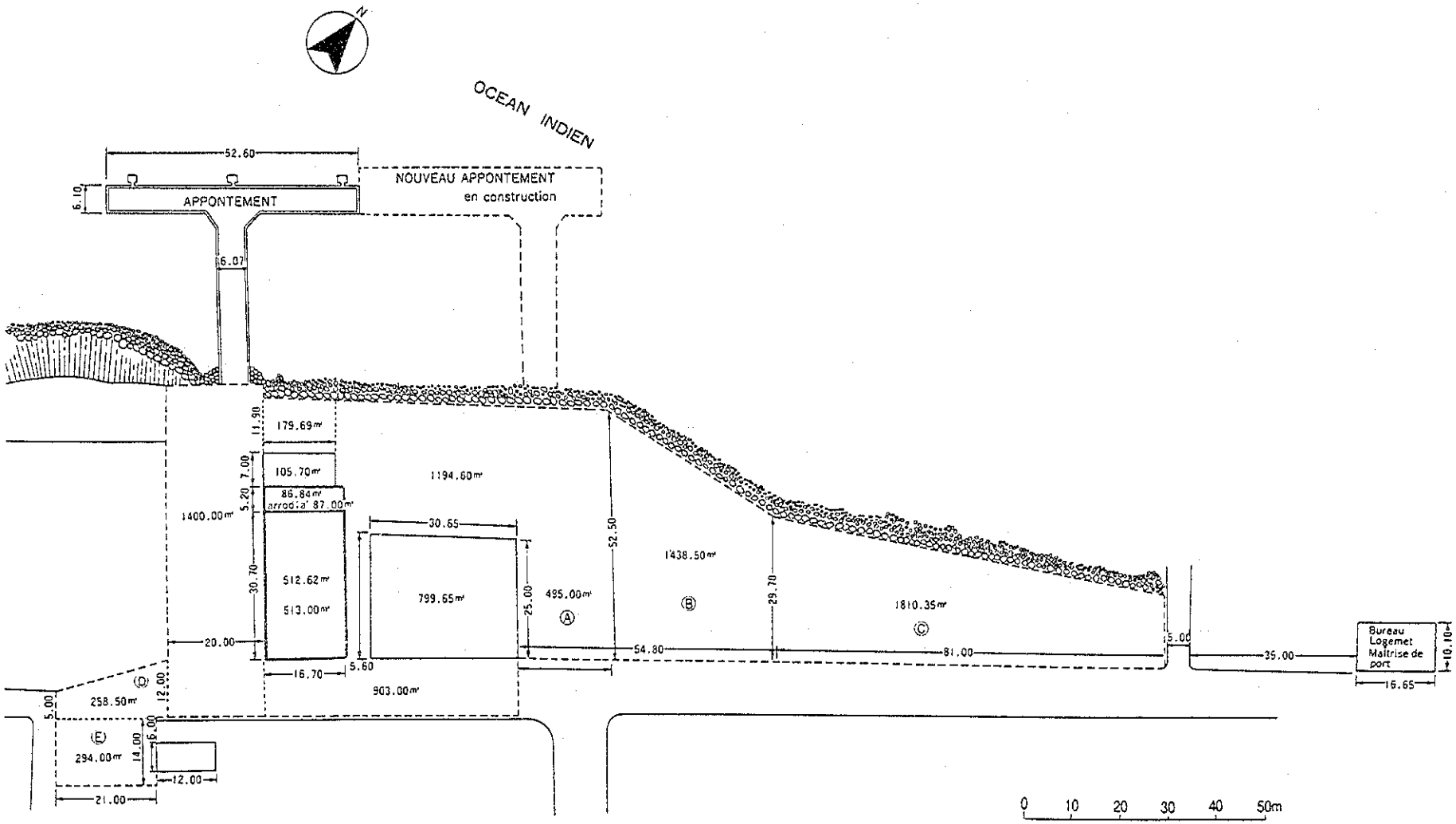


Figure A-2-2-5 Plan d'Implantation du Port de VOHEMAR

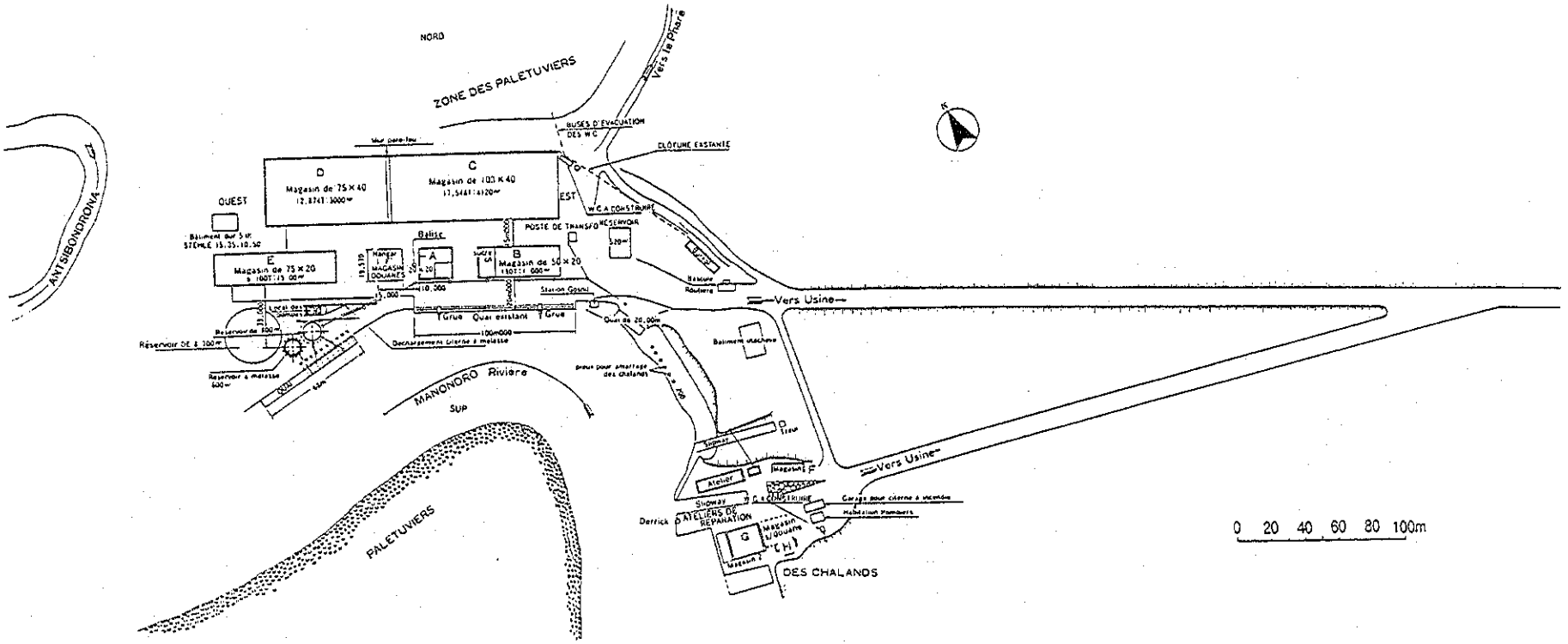


Figure A-2-2-6 Plan d'Implantation du Port SAINT LOUIS

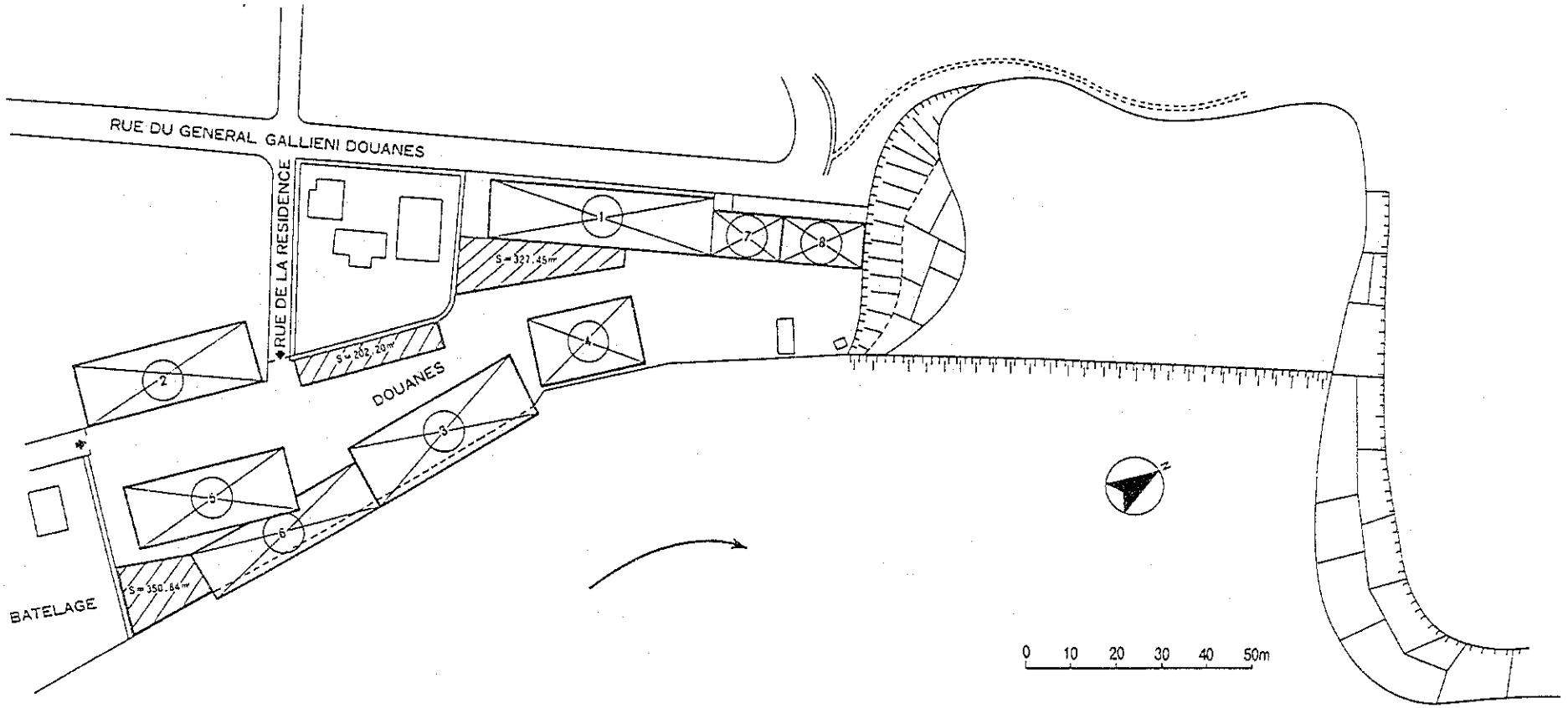


Figure A-2-2-7 Plan d'Implantation du Port de MANANJARY

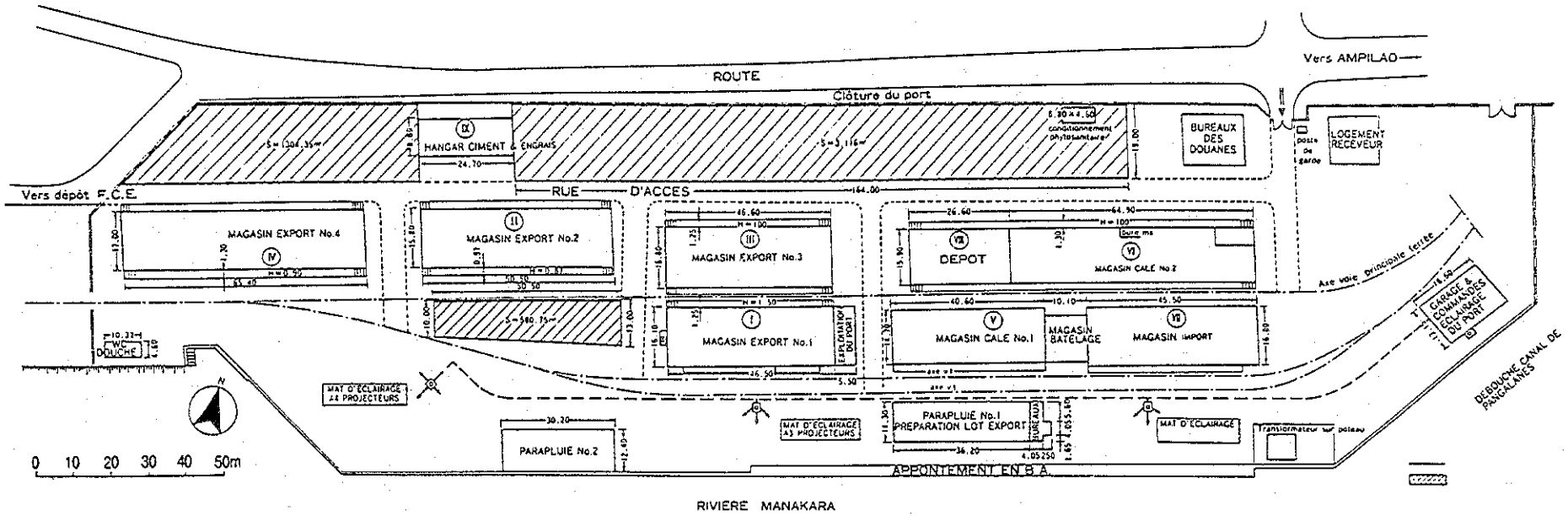


Figure A-2-2-8 Plan d'Implantation du Port de MANAKARA

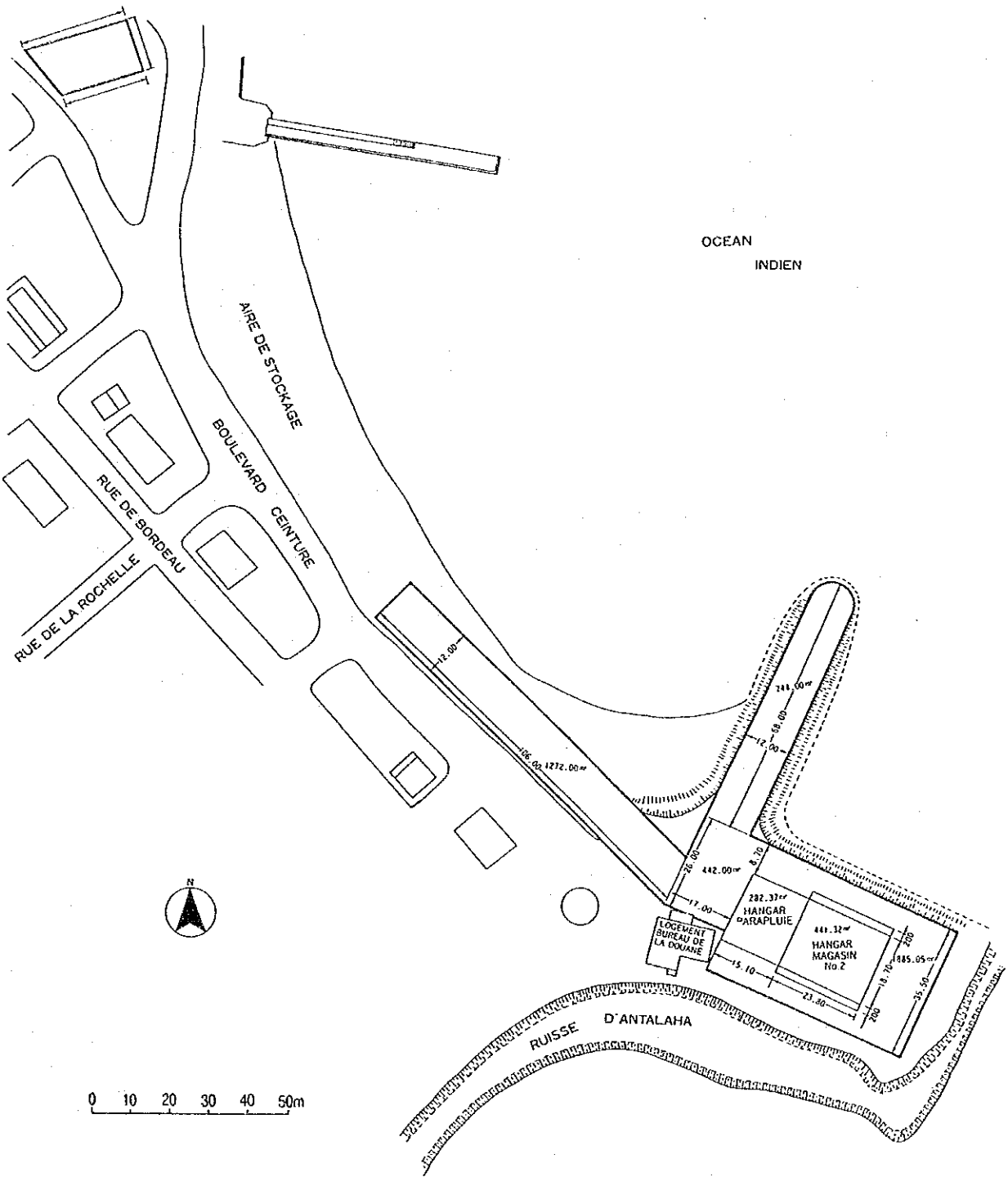


Figure A-2-2-9 Plan d'Implantation du Port d'ANTALAHA

A-3.2 Conditions naturelles

A-3.2.1 Calcul de vague

(1) Calcul de vague dans les conditions normales de vent de surface.

Les vagues atteignant le Port d'Antsiranana dans des conditions normales sont, pour la plupart, générées par des vents de surface à l'intérieur de la Baie de Diégo-Suarez. Et l'influence des vagues océaniques pénètrant par l'embouchure de la Baie est négligeablement faible, ce qui veut dire que l'élévation de vagues atteignant le Port d'Antsiranana s'affaiblit seulement de 5% par rapport à celle des vagues à l'embouchure, comme le paragraphe 3) de (2) suivant le prouve. Aussi, puisque la zone de vent (c'est ici la Baie) est relativement petite et la fetch (c'est la distance que parcourt le vent en soufflant) ne dépasse pas 10 km, il n'est pas nécessaire de considérer l'effet d'atténuation, dû au changement de la durée et de la direction des vents. C'est pourquoi les vagues atteignant le Port peuvent être directement calculées par la méthode S.M.B. en utilisant les données sur le vent dans le Tableau 3-2-2 présenté dans la section 3-2-2 précédente, pourvu que ces vitesses du vent soient multipliées par 1,5, si l'on opte pour ce mode de calcul des vagues d'après les raisons suivantes:

- les enregistrements du vent ont été effectués à l'Aéroport d'Antsiranana à 10 km du Port, et en général, le facteur de conversion de 1,2 à 1,5 est choisi pour ce cas,

- les enregistrements du vent ont été fais toutes les heures et on avait pris des moyennes de dix minutes et,

- au cas où la durée du vent qui souffle est brève, la vitesse réelle du vent sur mer dépasse probablement la moyenne.

Le fetch effectif requis pour appliquer la méthode SMB qui est la distance moyenne entre chaque fetch ,divisée tous les 5° de l'ordre de +45° à -45°, le centre étant à "0", peut être obtenu en utilisant la formule Saville suivante:

$$F_{eff} = \frac{\Sigma Fi \cdot COS^2 \theta i}{\Sigma COS\, \theta i}$$

où

Feff: Fetch effectif

F_i: Fetch de Composante de Direction

θ_i: Composante de Direction

Un exemple de calcul de fetch effectif pour le cas de Direction Est-Nord est illustré dans la Figure A-3-2-1.

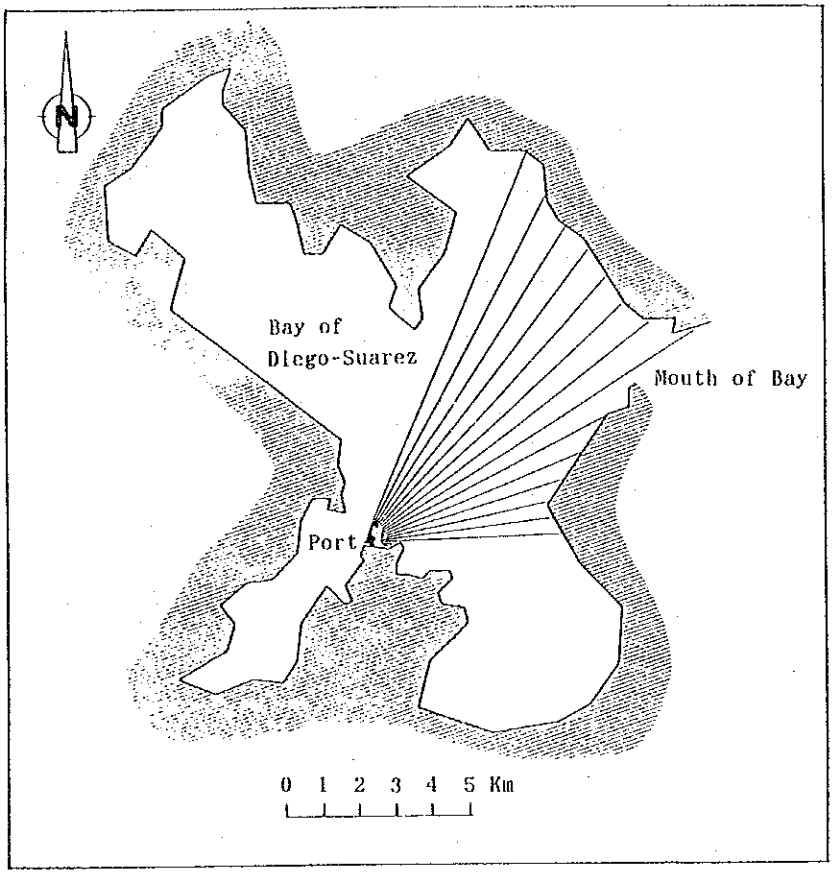


Figure A-3-2-1 Exemple Illustré de Calcul de Fetch (Direction ENE)

Le Tableau A-3-2-1 indique les fetchs effectifs de chaque direction.

Tableau A-3-2-1 Fetch Effectif (km)

Direction	N	NNE	NE	ENE	E	ESE	SE	SSE
Féff	5,8	7,5	7,6	5,9	3,3	1,4	0,3	0,2
Direction	S	SSO	SO	OSO	O	ONO	NO	NNO
Féff	0,7	1,7	2,5	2,6	2,2	1,5	2,1	3,5

Par conséquent, les fréquences d'occurrence des vagues dans des conditions normales de vent de surface sont obenues comme le Tableau 3-2-7 de la section 3-2-3 le présente.

(2) Calcul des vagues dans des conditions de vent extraordinaires

Les vagues dans des conditions de vent extraordinaires à Antsiranana sont apportées par des cyclones formés dans l'Océan Indien. Ici, seront obtenues les dimensions de vague, en évaluant de tels cyclones comme décrit dans le Plan suivant.

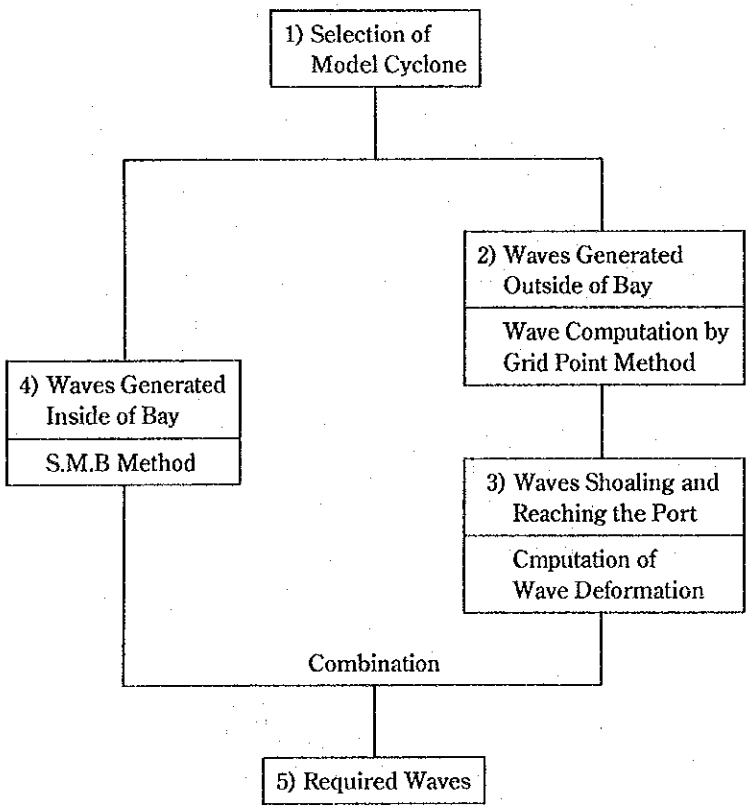


Figure A-3-2-2 Tableau de Calcul de Vagues

1) Sélection de Modèle de Cyclone

Le Tableau A-3-2-2 donne une liste des cyclones qui ont frappé Antsiranana de 1979 à 1990. Parmi ces cyclones, les trois cyclones de grande envergure, ayant une vitesse de vent maximum instantanée dépassant 250 km/h (70 m/s), à savoir, les cyclones "ANDRY", "KAMISY" et "BENEDICTE" seront exposés ici. Mais, étant donné que aucune donnée sur la pression centrale et le tracé de ces cyclones, on a fait des hypothèses sur ces données en ajustant les vitesses de vent simulées à celles qui ont été réellement enregistrés. D'après ces hypothèses, on avait constaté que deux cyclones, "ANDRY" et "KAMISY", avaient des caractères similaires, ainsi ces deux cyclones seront appelés "Cyclone de type B" et le cyclone "BENEDICTE", "Cyclone de type A", pour des raisons de commodité.

2) Calcul de vague par la méthode de Carte quadrillée à Points

La Figure A-3-2-3 présente la zone de calcul de vague, dans laquelle l'intervalle entre les points de la carte quadrillée est de 30 km. La Figure A-3-2-4 montre les variations de vents selon le type A, calculées toutes les heures à l'intérieur de la Baie. D'après cette Figure, on a constaté que la vitesse de vent maximum est de 25 m/s, ce qui est à peu près la même que celle qui est indiquée dans la carte météorologique (voir la Figure A-3-2-5). La Figure A-3-2-6 montre les variations de vagues calculées toutes les heures à l'embouchure de la Baie selon les types A et B, où l'on a constaté que la hauteur maximum de vague est de 5m dans le cas du type A, et de 4,3 pour le type B. Et les périodes et les directions des deux vagues ont à peu près la même valeur, qui est de 8 secondes en période et de direction Nord-Nord-Est. Pusiqu'on a trouvé que le type A est plus grand que le type B, d'après les résultats ci-dessus, le cyclone "BENEDICTE" (type A) sera retenu comme modèle final de cyclone. La Figure A-3-2-7 montre le plan de répartition des dimensions des vagues du type A, selon nos calculs.

3) Calcul de déformation des vagues

Les vagues calculées de type A ci-dessus pourront changer sous l'influence de réfraction et de diffraction des vagues à cause de la profondeur de l'eau, de la configuration du fond de la mer etc... Seront obtenues ici les dimensions des vagues atteignant le Port d'Antsiranana en appliquant le calcul de dimension de vague cité ci-dessus, à l'équation équilibre-énergie qui comporte l'effet d'irrégularité des vagues. Les conditions de calcul de vague sont présentées dans le Tableau A-3-2-3. S'agissant de la direction des vagues incidentelles, on présume que celle qui est la plus influente est la Direction Nord-Nord-Est, mais trois autres directions, le Nord-Est, l'Est-Nord-Est et l'Est seront aussi comprises dans cette étude, si l'on considère les conditions topographiques.

L'aboutissement des calculs est présenté dans les Figures de A-3-2-8 (1) à A-3-2-8 (3)

Tableau A-3-2-2 Listes des Cyclones Attaquant le Port d'Antsiranana (de 1979 à 1990)

Period	Name	Zone	Max. Wind Speed	Date of Passage
1979 - 1980	D.T BERENICE	ANTALAHA	19 km/h	16/12/79
1980 - 1981	D.T BETTINA	ANTSIRANANA	90 km/h	29/11/80
1981 - 1982	C.T BENEDICTE	ANTSIRANANA	252 km/h	19/12 to 20/12/81
		VOHEMAR	65 km/h	ditto
	D.T JUSTINE	VOHEMAR	104 km/h	18/03/82
		SAMBAVA	86 km/h	ditto
		ANTALAHA	76 km/h	ditto
		ANTSIRANANA	97 km/h	ditto
1982 - 1983	D.T ARILISY	ANTSIRANANA	79 km/h	01/11/82
		VOHEMAR	52 km/h	31/10/82
		ANTALAHA	40 km/h	ditto
	C.T BEMANY	ANTALAHA	54 km/h	03/12/82
1983 - 1984	C.T ANDRY	ANTSIRANANA	>250 km/h	10/12/83
	C.T KAMISY	ANTSIRANANA	>250 km/h	U.K
		SAMBAVA	U.K	U.K
		VOHEMAR	60 km/h	U.K
1984 - 1985	D.T ANETY	ANTSIRANANA	22 km/h	20/11/84
		VOHEMAR	43 km/h	ditto
		SAMBAVA	50 km/h	ditto
		ANTALAHA	50 km/h	ditto
1985 - 1986	C.T COSTA	ANTSIRANANA	54 km/h	07/01 to 12/01/86
		VOHEMAR	28 km/h	ditto
		SAMBAVA	36 km/h	ditto
		ANTALAHA	36 km/h	ditto
1987 - 1988	C.T CALIDERA	SAMBAVA	37 km/h	13/01/88
		VOHEMAR	32 km/h	ditto
	C.T FILAO	ANTSIRANANA	58 km/h	24/02/88
		SAMBAVA	U.K	ditto
		ANTALAHA	43 km/h	ditto
		ANDAPA	14 km/h	ditto
	D.T HELY	ANTSIRANANA	40 km/h	20/03/88
		SAMBAVA	U.K	ditto

Note: D.T: Tropical Depression (Wind Speed, 20 to 60 km/h)
C.T: Tropical Cyclone (Wind Speed, 119 to 168 km/h)
U.K: Unknown

Tableau A-3-2-3 Conditionsde Calcul des Vagues

Wave Direction	NNE, NE, ENE, E
Wave Period	8.0 seconds
Spreading Parameter	10

pour la direction de vague Nord-Nord-Est; dans les figures de A-3-2-9 (1) à A-3-2-9 (3) celle du Nord-Est, dans les Figures de A-3-2-10 (1) à A-3-2-10 (3), celle de Est-Nord-Est, et dans les Figures A-3-2-11 (1) à A-3-2-11 (3) pour la direction des vagues Est. Les Figures (1) de A-3-2-8 à A-3-2-11 représentent la répartition des hauteurs de vagues par rapport à la hauteur totale (100%) dus vagues formées par le cyclone à l'extérieur de la Baie, ce qui indique que l'élévation de la vague au port est de 5%. Les Figures (2) de A-3-2-8 à A-3-2-11 présentent la répartition du coefficient de réfraction des vagues par rapport à la réfraction totale des vagues formées par le cyclone hors de la Baie, ce qui démontre que leur coefficient au port est de 5%. Les Figures (3) du A-3-2-8 à A-3-2-11 présentent les répartitions de la direction de vague, ce qui indique que la direction de la vague au port est le Nord-Nord-Est, sans tenir compte de la direction des vagues incidentelles. En résumé, le taux d'élévation de vague au port décline de 5% par rapport à la hauteur de la vague hors de la Baie qui a été calculée dans le paragraphe 2) précédent sans tenir compte de la direction des vagues incidentelles. Probablement, c'est dû à l'étroitesse de l'embouchure par rapport à la largeur de l'intérieur de la Baie, que les vagues perdent rapidement de leur valeur à l'embouchure pour se développer ensuite de facon centrifuge.

D'après les résultats ci-dessus, l'élévation de vague au port peut être évaluée à 25 cm en multipliant 5 mètres de hauteur de vague à l'embouchure par 0,05 du taux d'élévation de vague calculée ci-dessus (c'est-à-dire: 5 mètres x 0,05 = 0,25 mètres).

4) Calcul des vagues formées dans la Baie

En utilisant la méthode SMB, le calcul de vagues formées dans la Baie pour le cas du type A est effectué dans les conditions suivantes:

- Vitesse maximum du vent: 25 m/s
- Fetch: 7,6 km (le plus long fetch Nord-Nord-Est)

Il en résulte que, les dimensions de la vague sont de 1,58 mètres de haut et 3,9 secondes en période.

5) Combinaison des vagues

Par conséquent, la vague en temps de vent extraordinaire peut être de 1,6 mètre de haut en combinant le calcul de deux vagues citées ci-dessus, auquel on applique la formule suivante:

$$H_t = \sqrt{H_1^2 + H_2^2}$$

où:

H_t: Hauteur des vagues combinées

H_1: Hauteur de vague atteignant le Port qui se fome hors de la Baie

H_2: Hauteur de vague formée dans la Baie

Puisque la période de vagues est influencée en grande partie par les vagues de vent formées à l'intérieur de la Baie et l'énergie des vagues formées à l'extérieur de la Baie a décru comme expliqué auparavant pour la période de vagues de vent formé à l'intérieur de la Baie, on optera la période de 3,9 secondes.

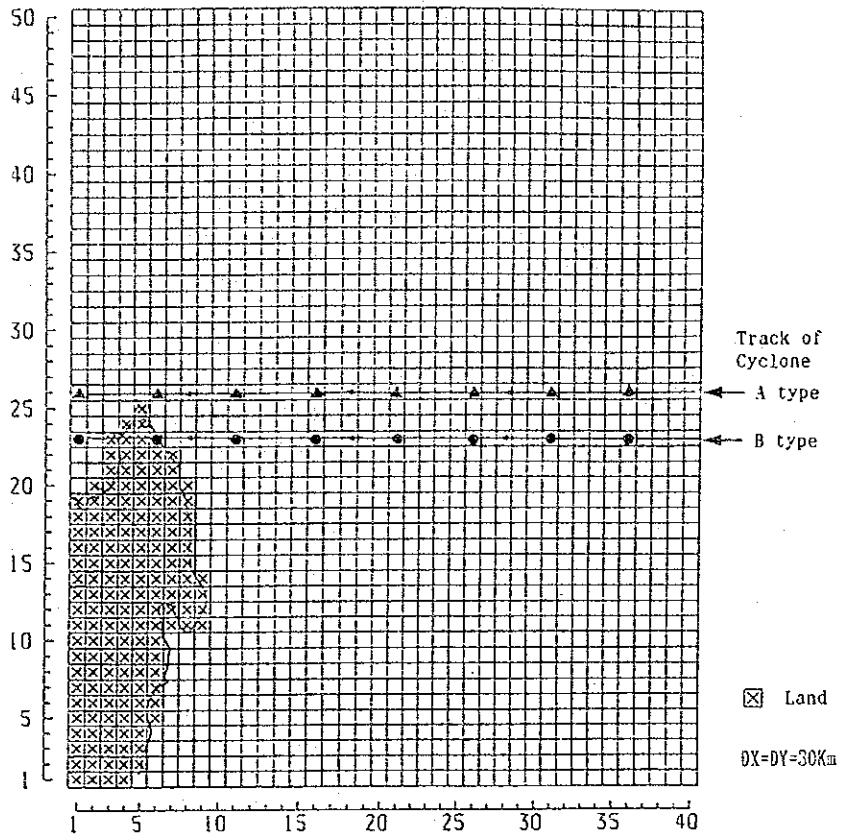


Figure A-3-2-3 Zone de Calcul de Vagues

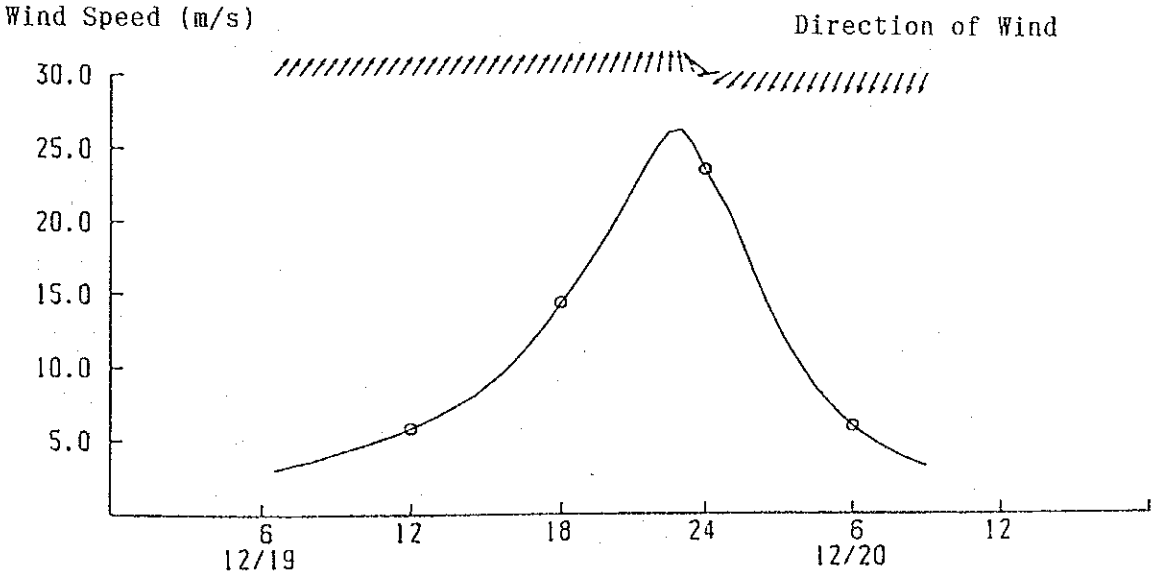


Figure A-3-2-4 Changements du vent toutes les heures
(TypeA: "BENEDICTE"

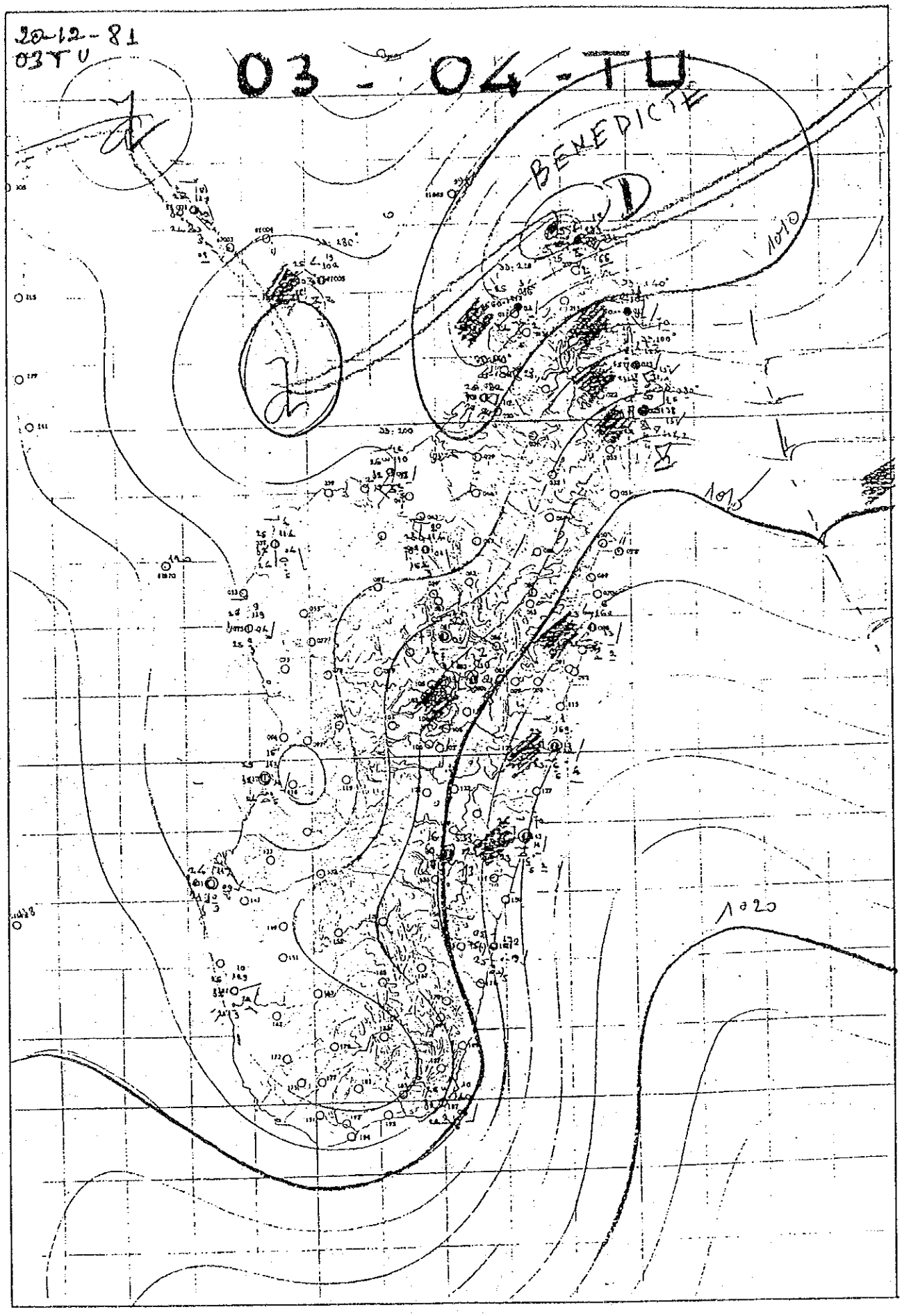
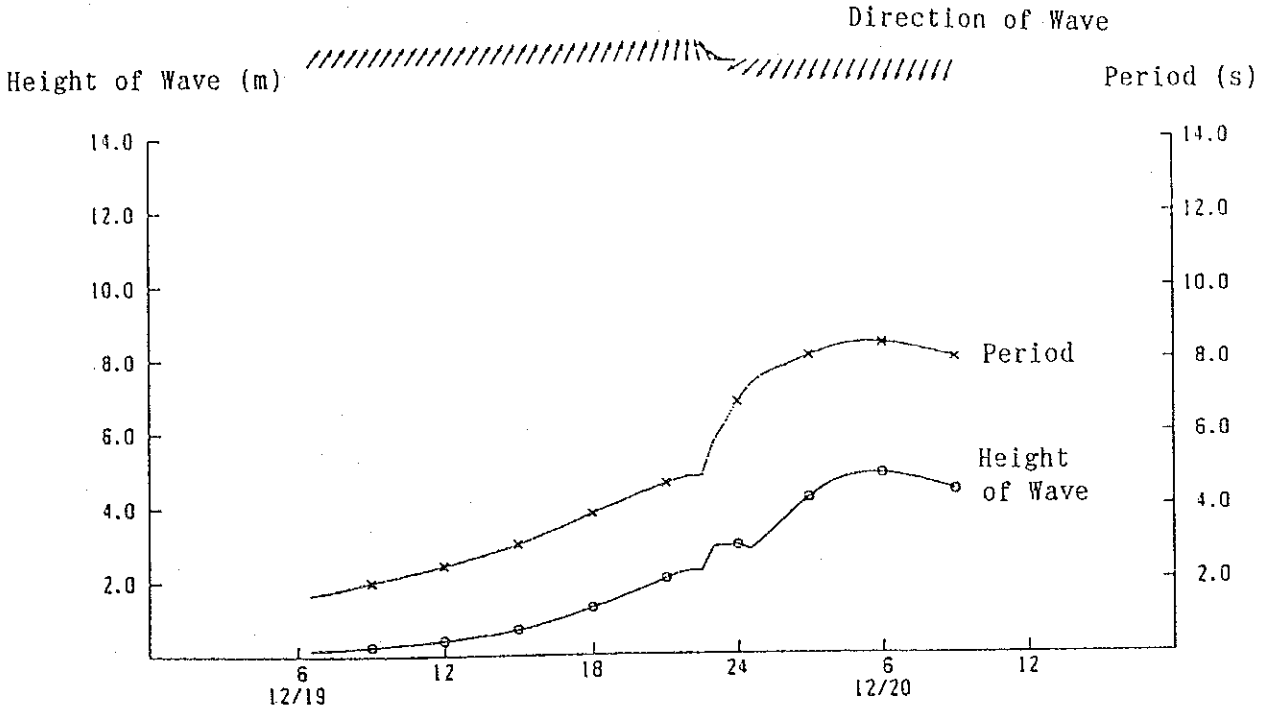
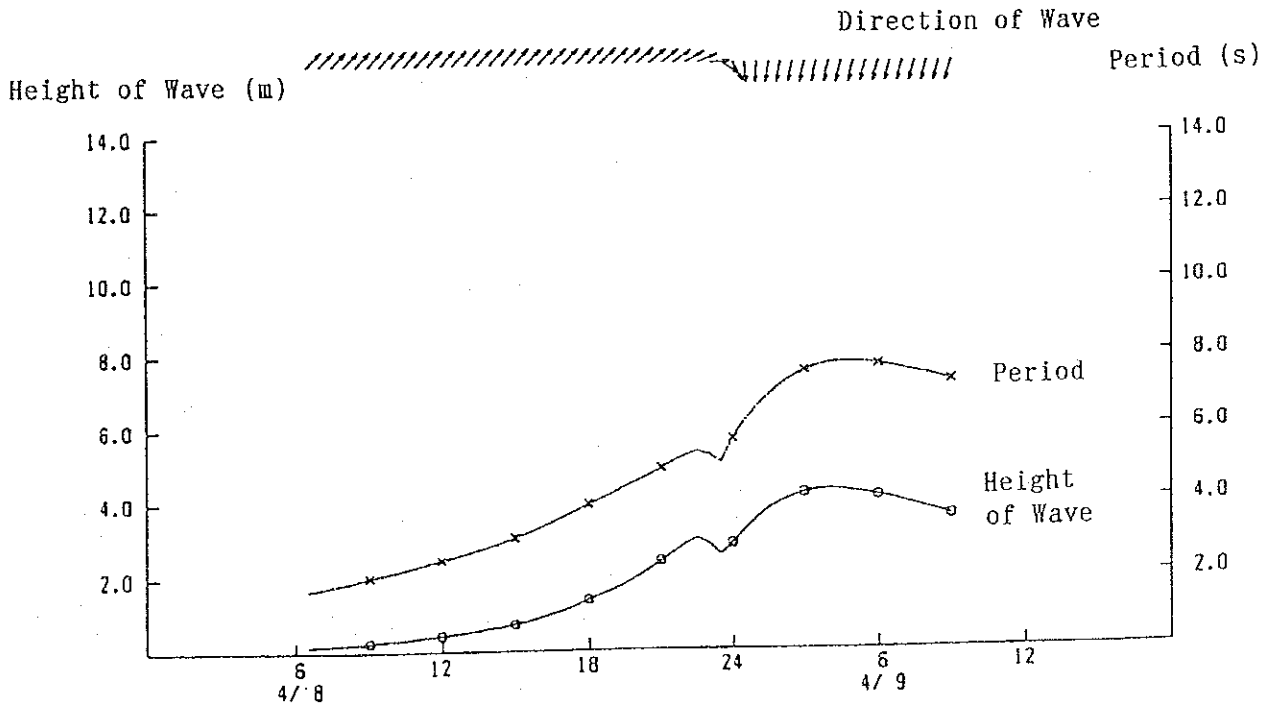


Figure A-3-2-5 Carte Météorologique (Cyclone BENEDICTE 20.12.1981)



(A type: BENEDICTE)



(B type: ANDRY, KAMISY)

Figure A-3-2-6 Changements des Vagues Toutes les Heures à l'Embouchure de la Baie

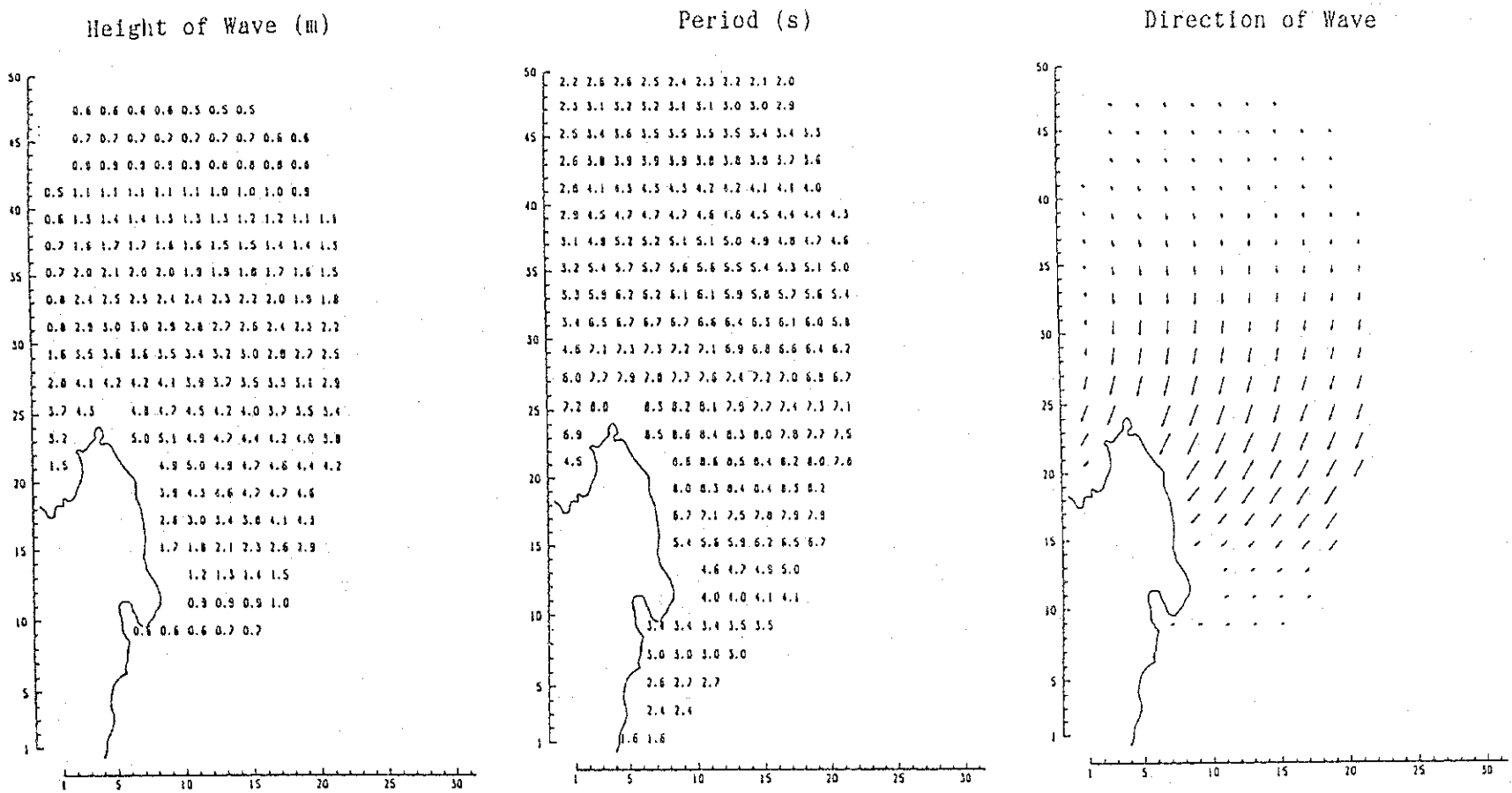


Figure A-3-2-7 Plan de Repartition des Dimensions des Vagues
(TypeA, BENEDICTE)

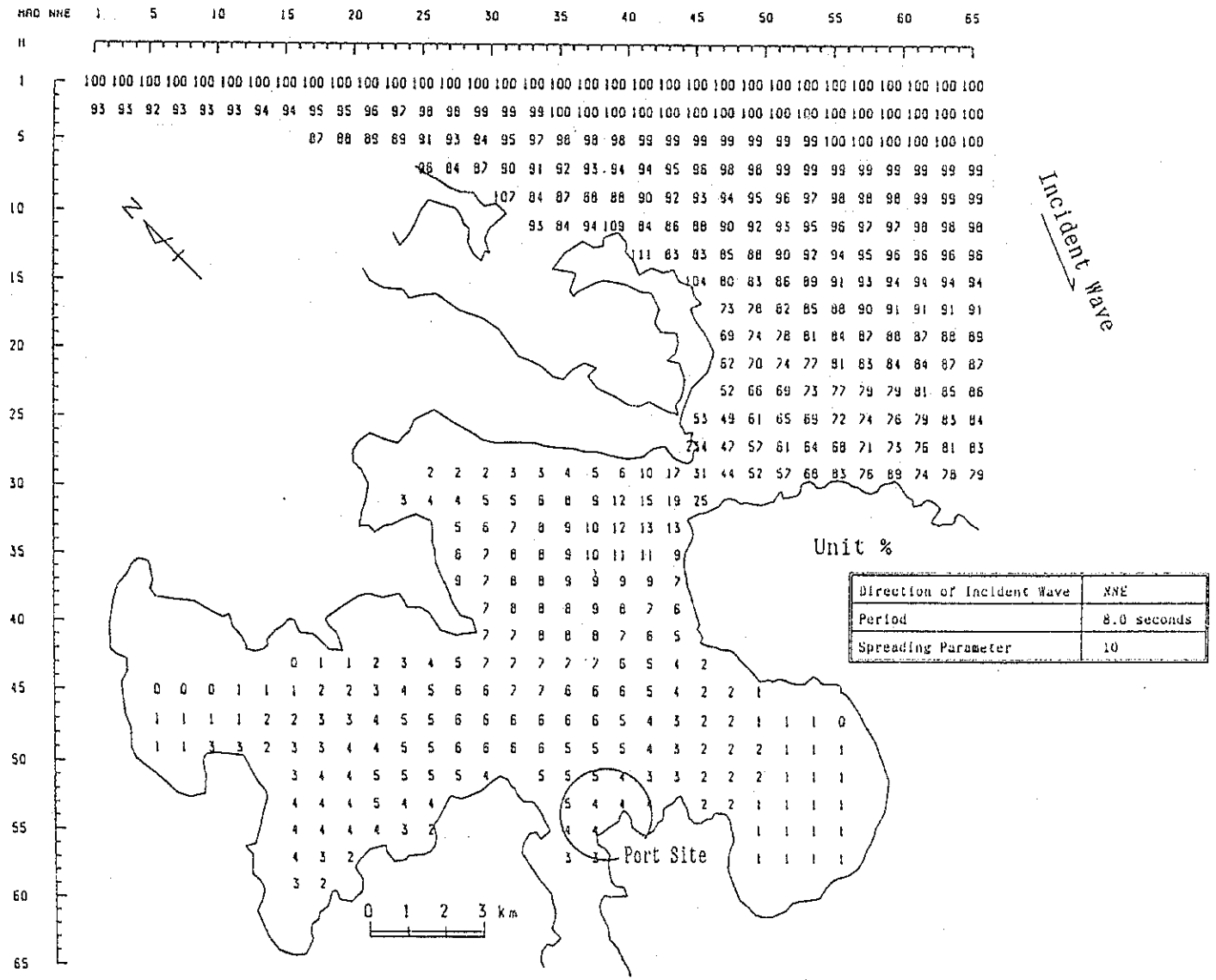


Figure A-3-2-8 (1) Plan de Repartition du Taux d'Elévation des Vagues
(Direction des vagues incidentes: NNE)

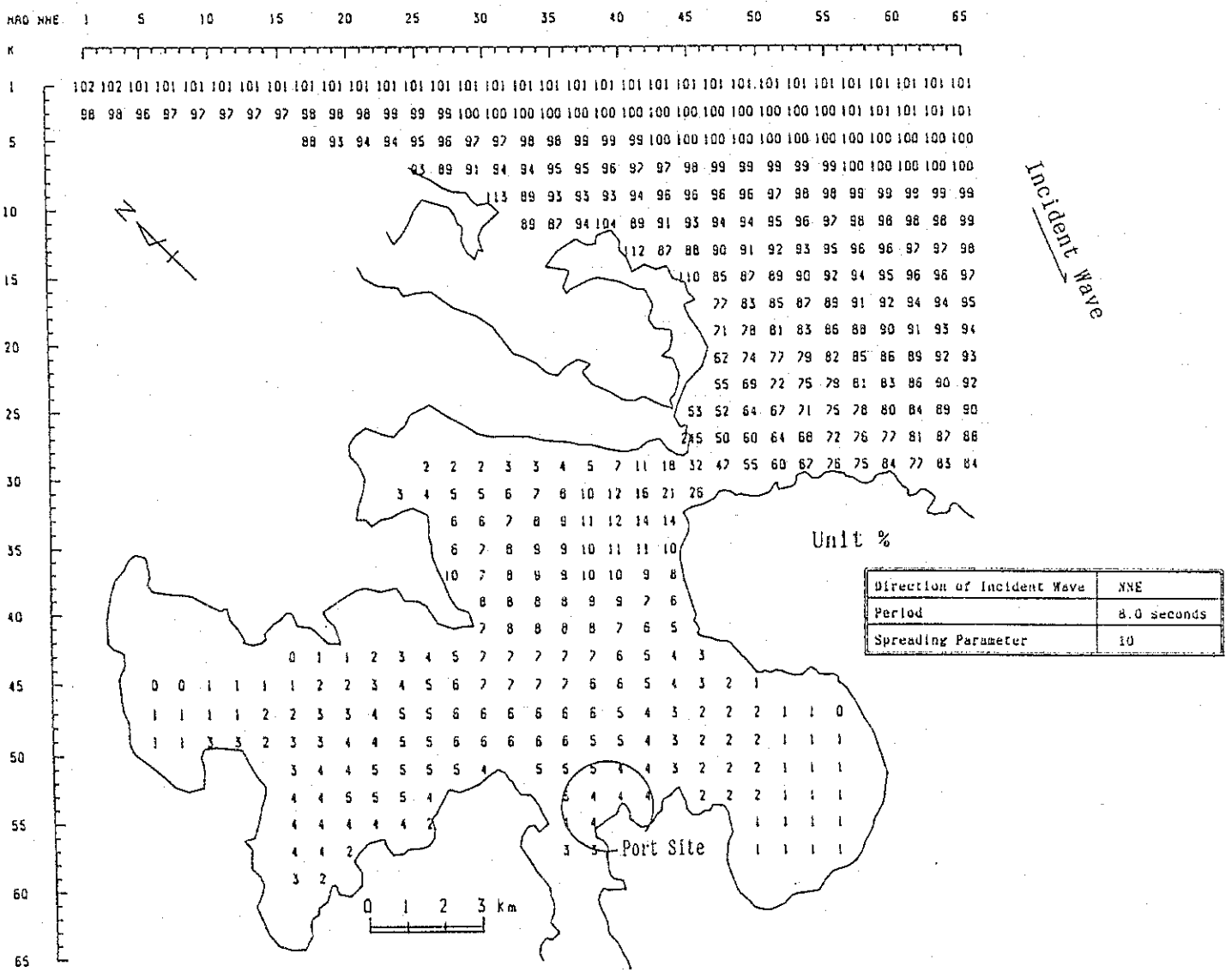


Figure A-3-2-8 (2) Plan de Répartition du Coefficient de Réfraction des Vagues
(Direction des vagues incidentes: NNE)

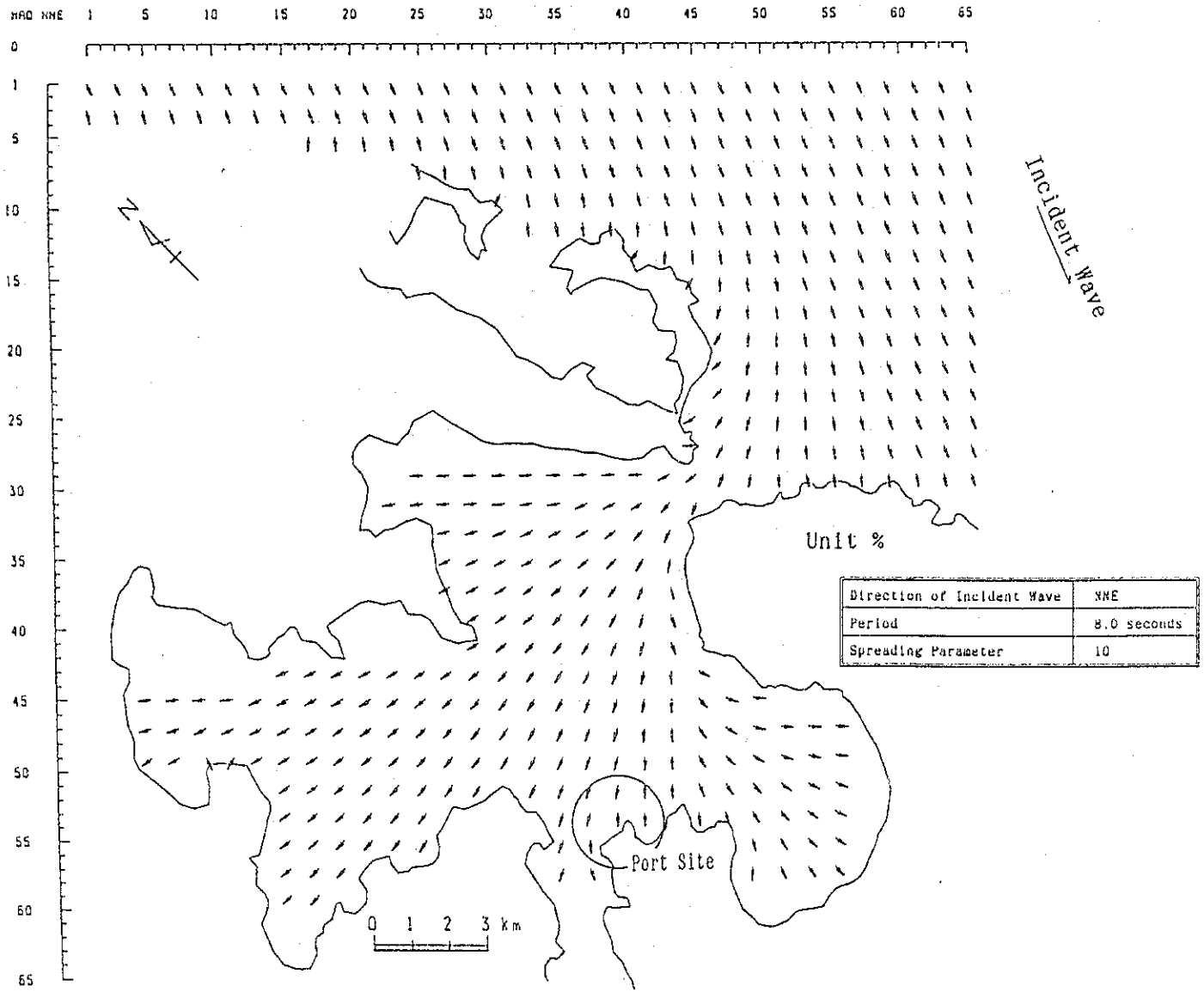


Figure A-3-2-8 (3) Plan de repartition de la direction des vagues (direction des vagues incidentes: NNE)

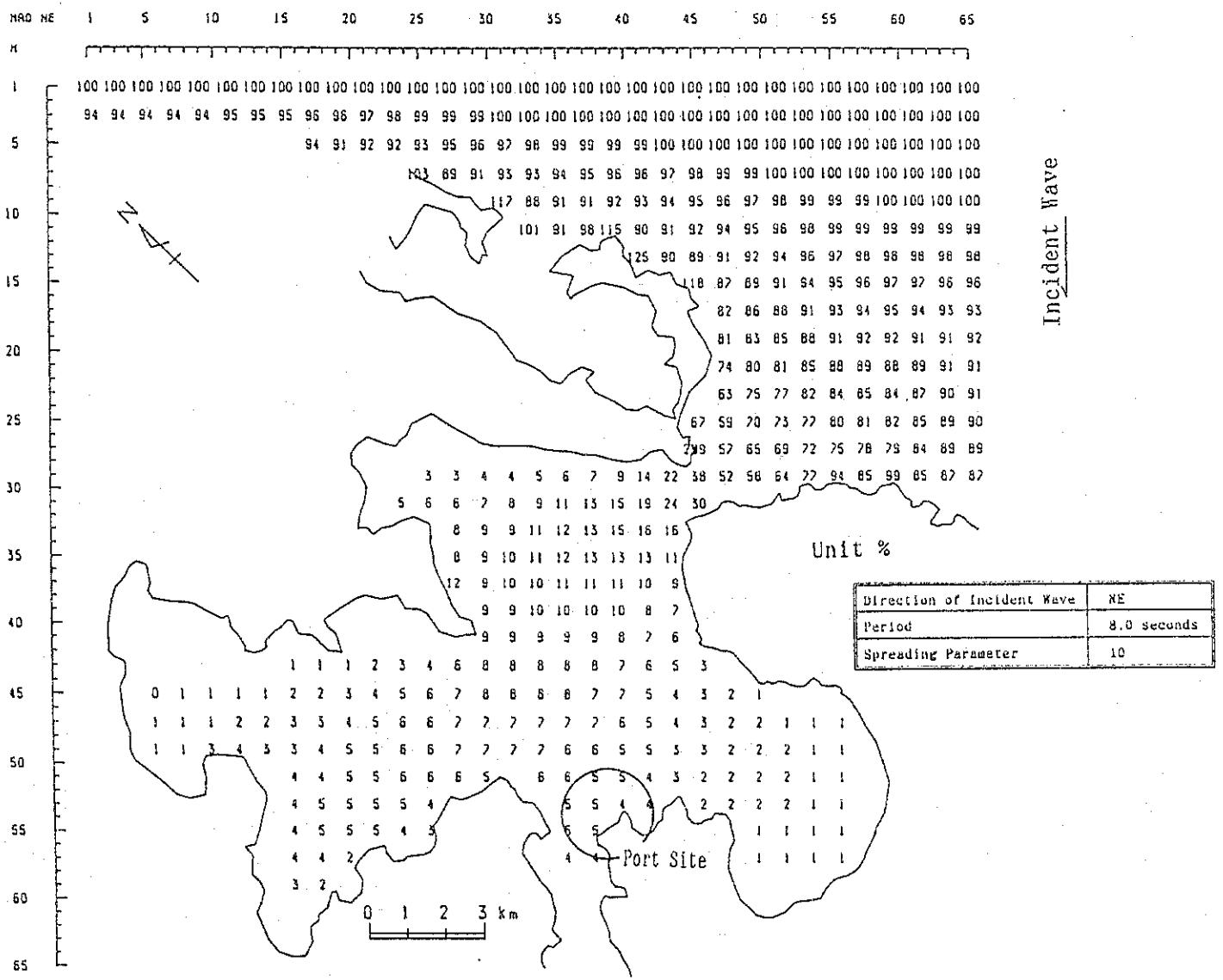


Figure A-3-2-9 (1) Plan de Répartition du Taux d'Elévation des Vagues (Direction des vagues incidentes: NE)

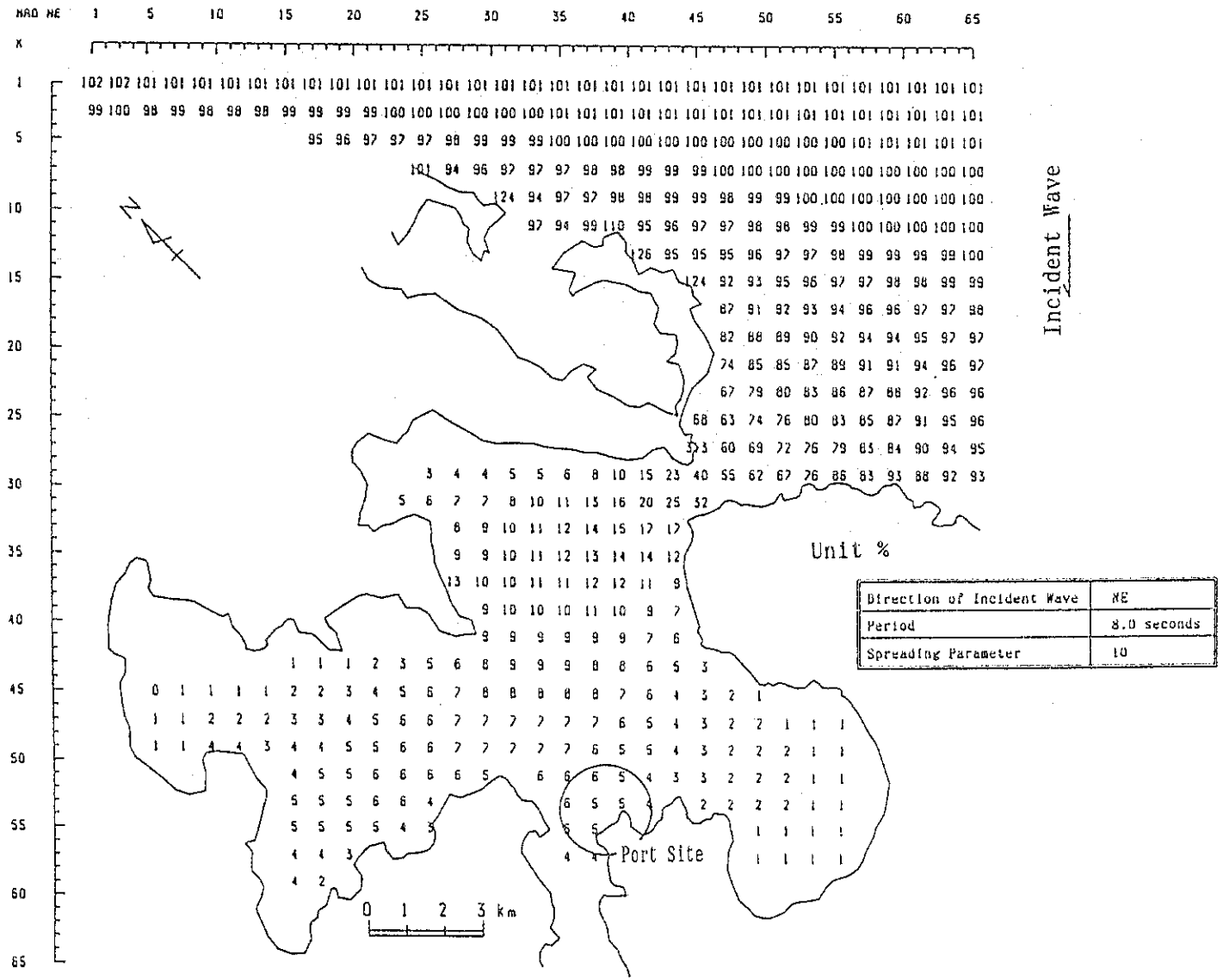


Figure A-3-2-9 (2) Plan de Répartition du Coefficient de Réefraction des Vagues (Direction des vagues incidentes: NE)

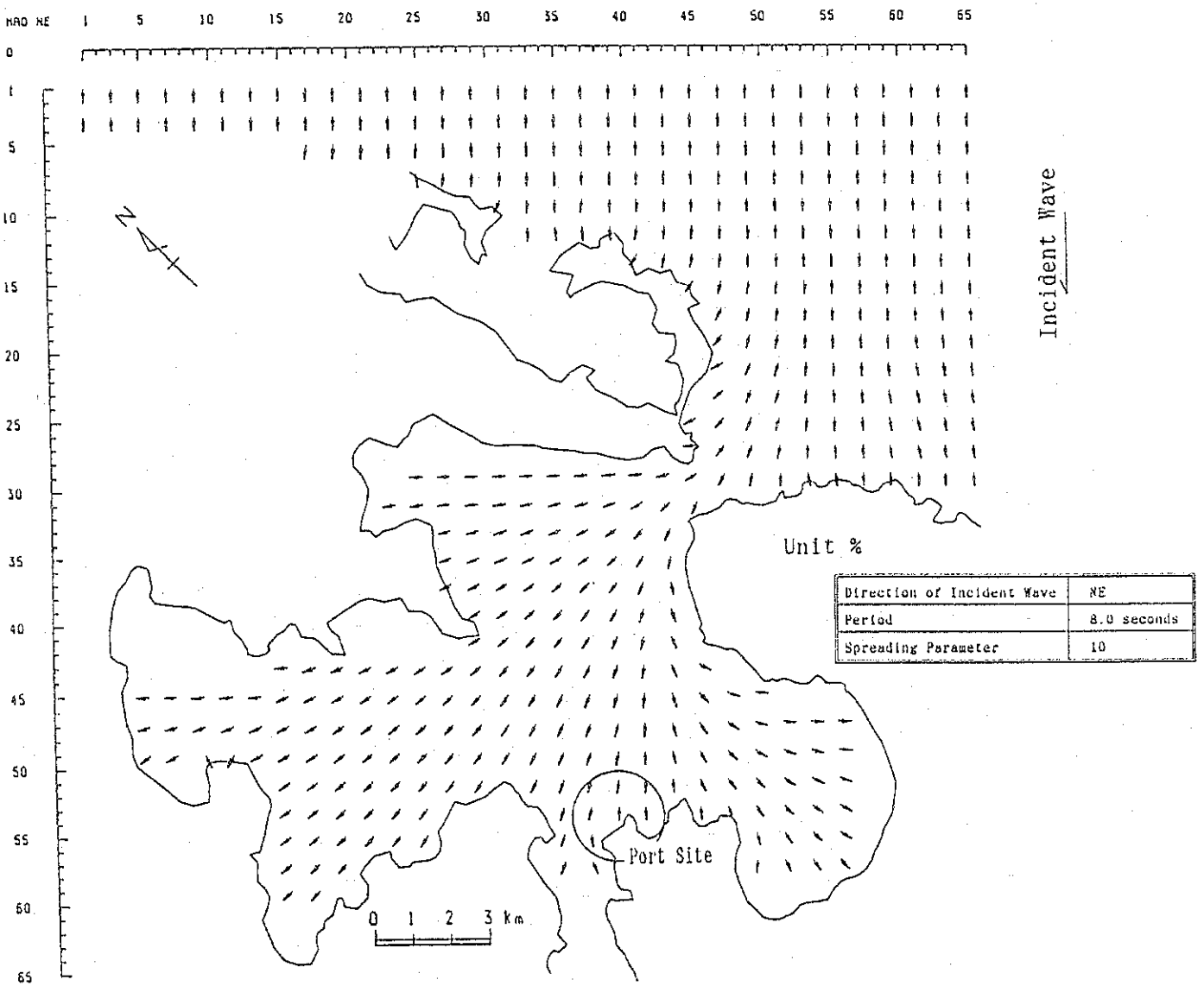


Figure A-3-2-9 (3) Plan de Répartition de la Direction des Vagues (direction des vagues incidentes: NE)

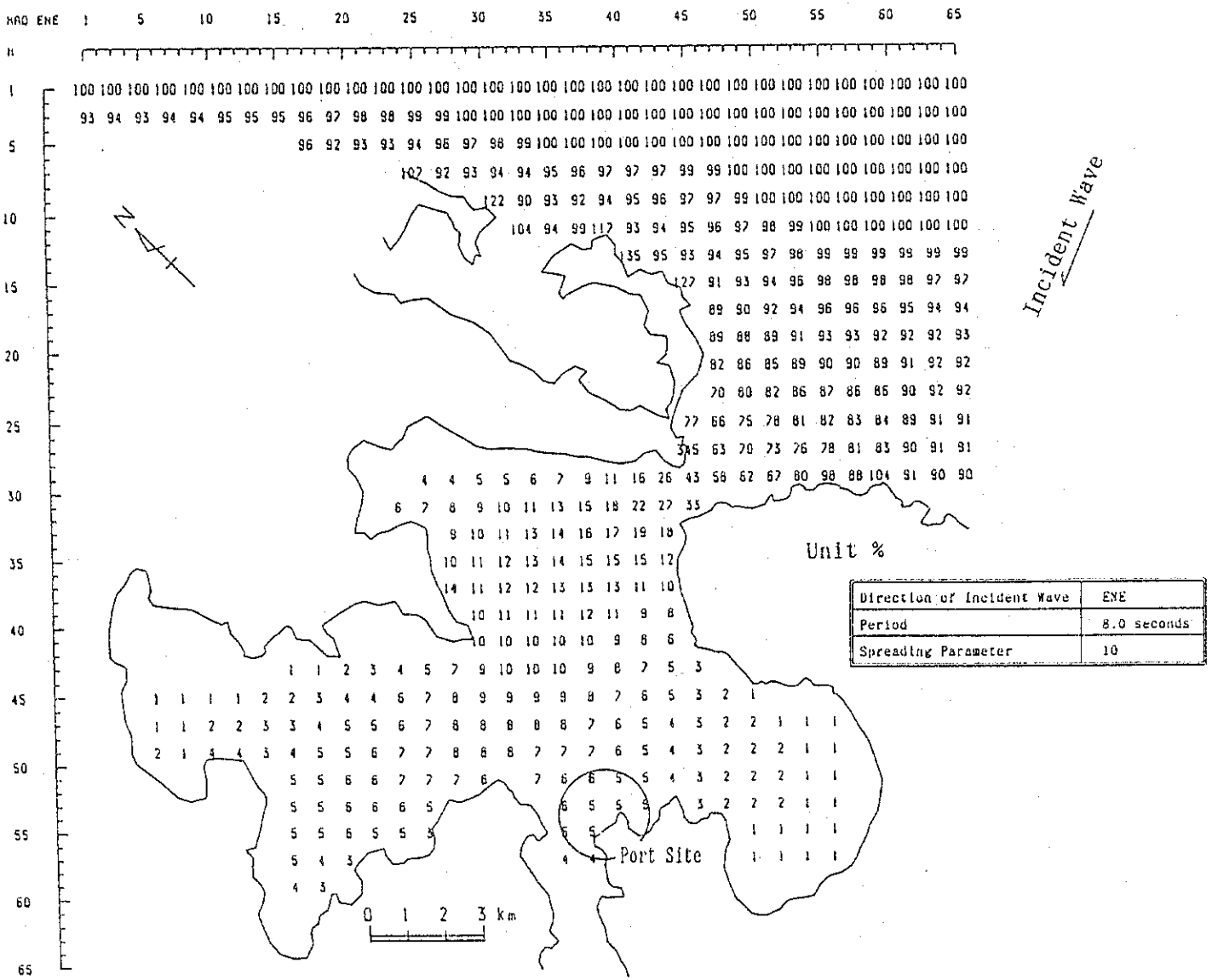


Figure A-3-2-10 (1) Plan de Répartition du Taux d'Elévation des Vagues (Direction des vagues incidentes: ENE)

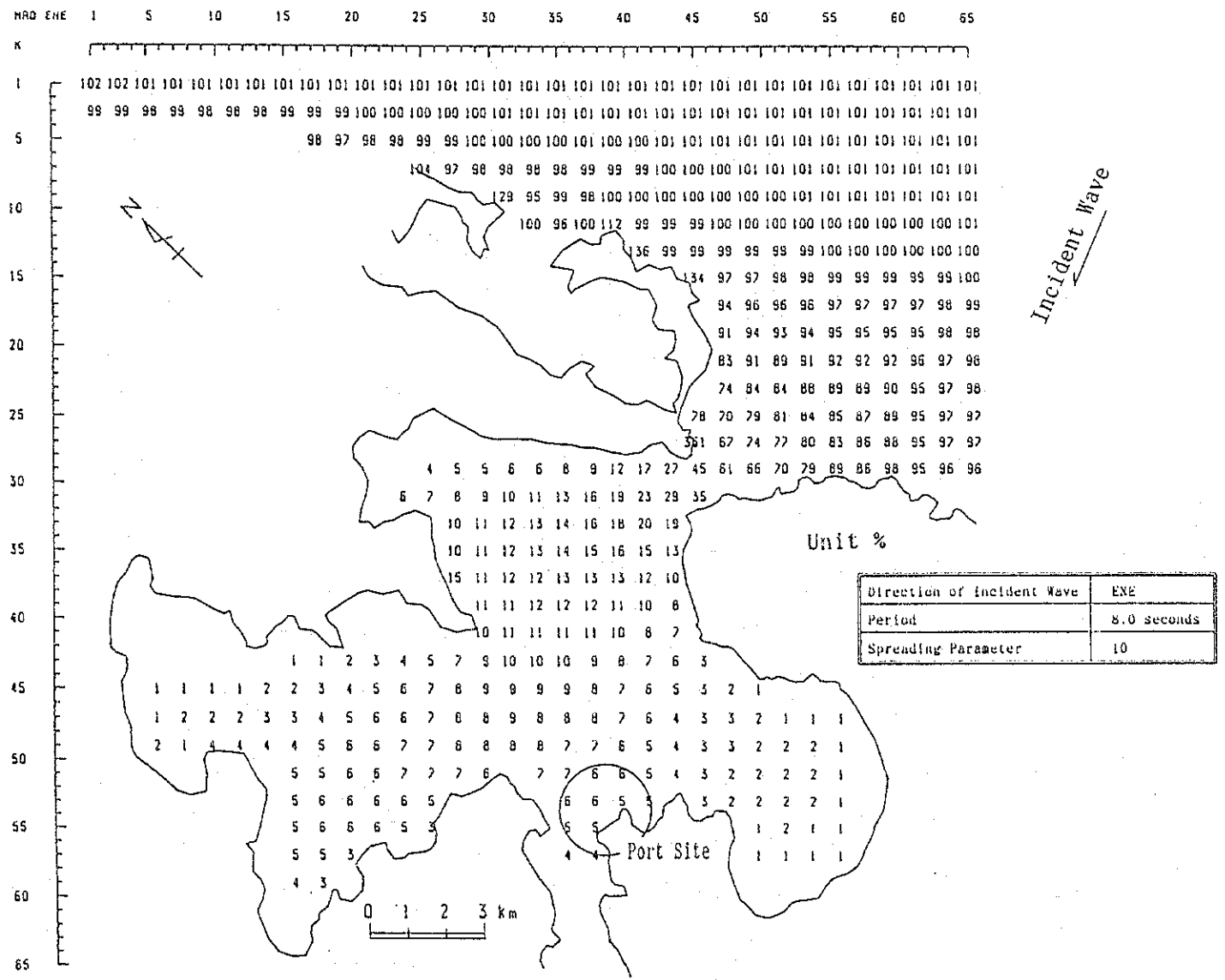


Figure A-3-2-10 (2) Plan de Répartition du Coefficient de Réfraction des Vagues (Direction des vagues incidentes: ENE)

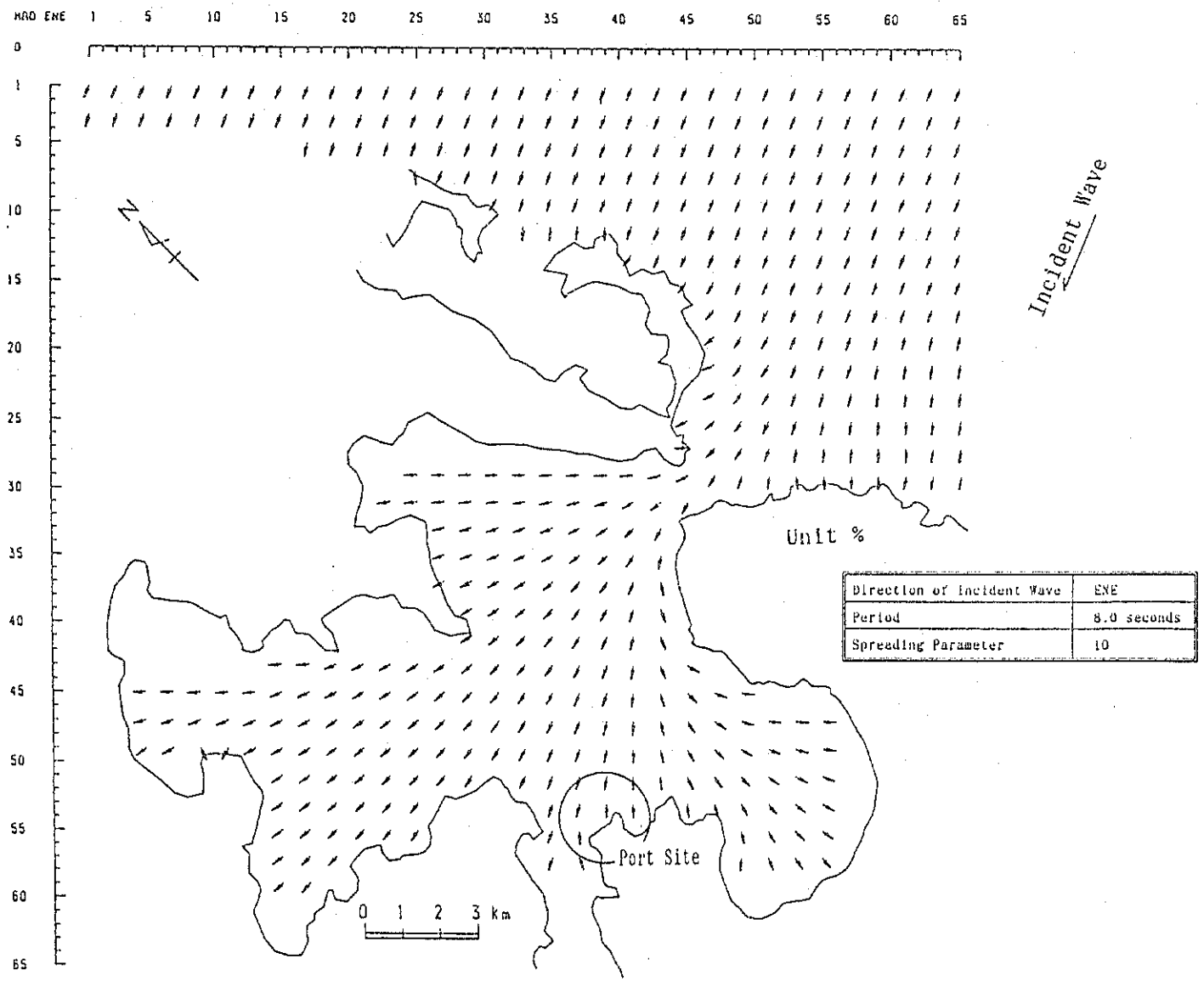


Figure A-3-2-10 (3) Plan de Répartition de la Direction des Vagues
(Direction des vagues incidentes: ENE)

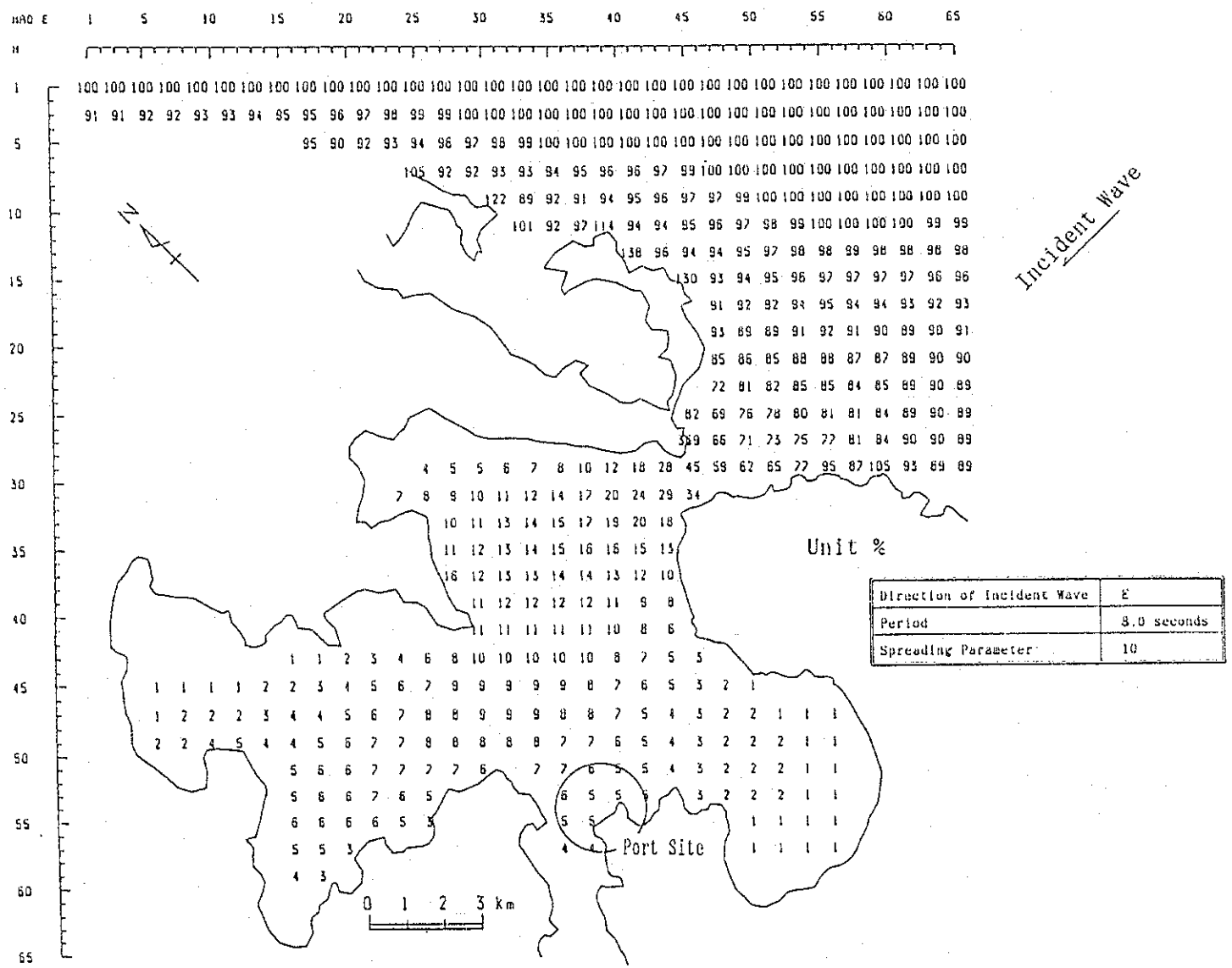


Figure A-3-2-11 (1) Plan de Répartition du Taux d'Elévation des Vagues
(Direction des vagues incidentes: E)

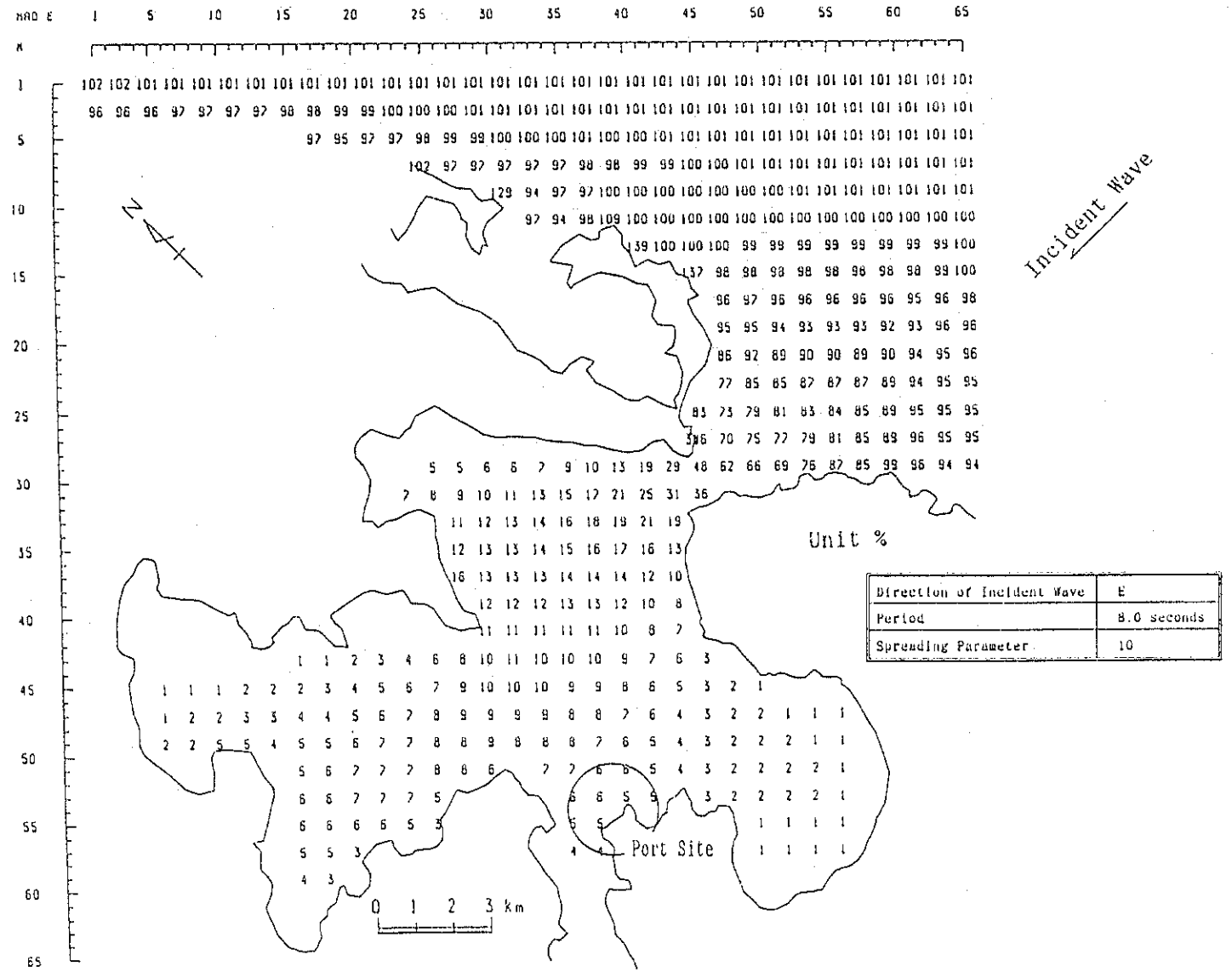


Figure A-3-2-11 (2) Plan de Répartition du Coefficient de Réfraction des Vagues
(Direction des vagues incidentes: E)

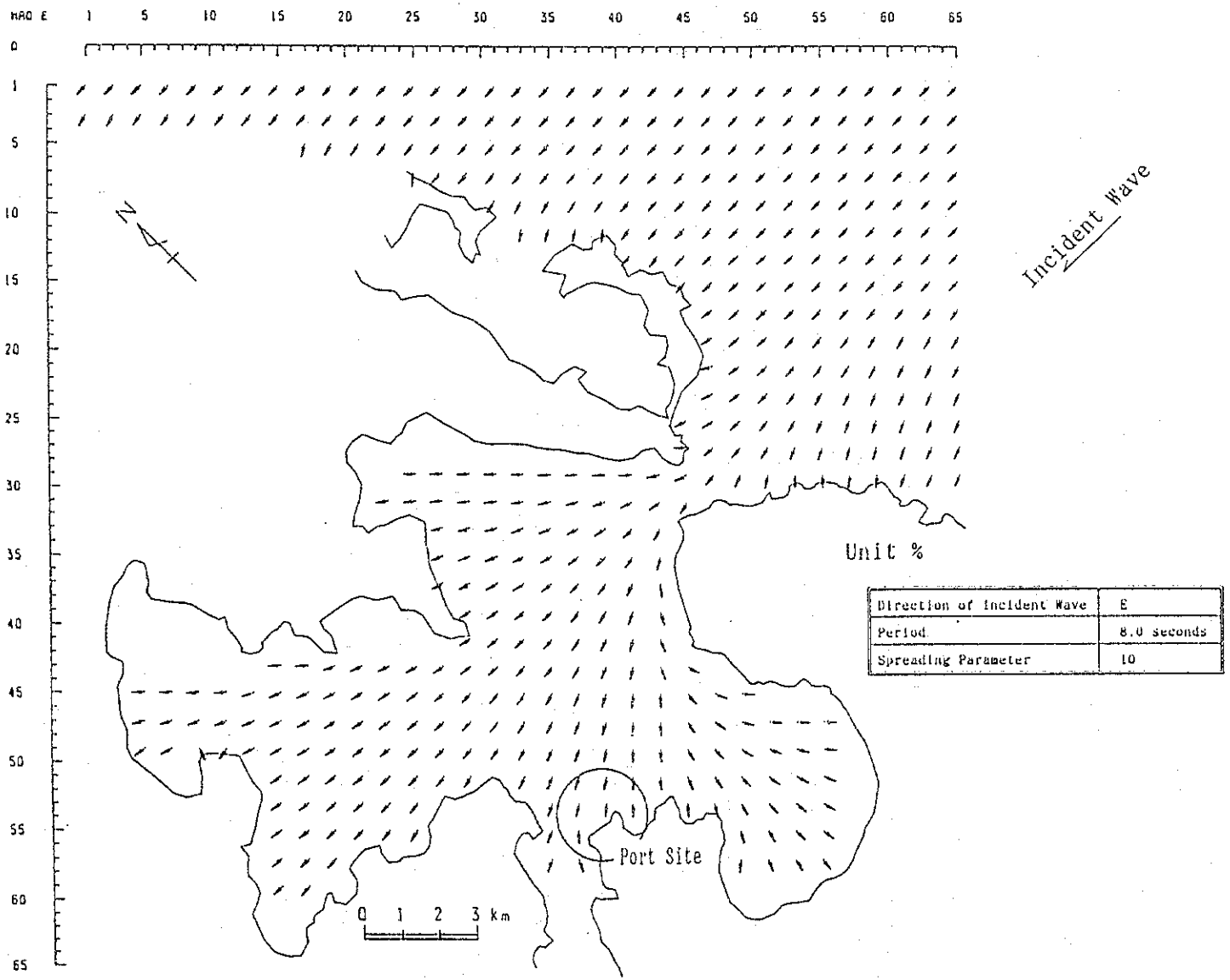


Figure A-3-2-11 (3) Plan de Répartition de la Direction des Vagues
(Direction des vagues incidentes: E)

A-3.2.2 Reconnaissance du Sol

Les profiles détaillés du sol et les résultats d'essais au laboratoire des échantillons prélevés sont présentés dans cette sous-section.

BACHY

SOCIETE MALGACHE DE
SONDAGES INJECTIONS FORAGES

LALANA RAVONINAHITRINIARIVO
ANTANANARIVO

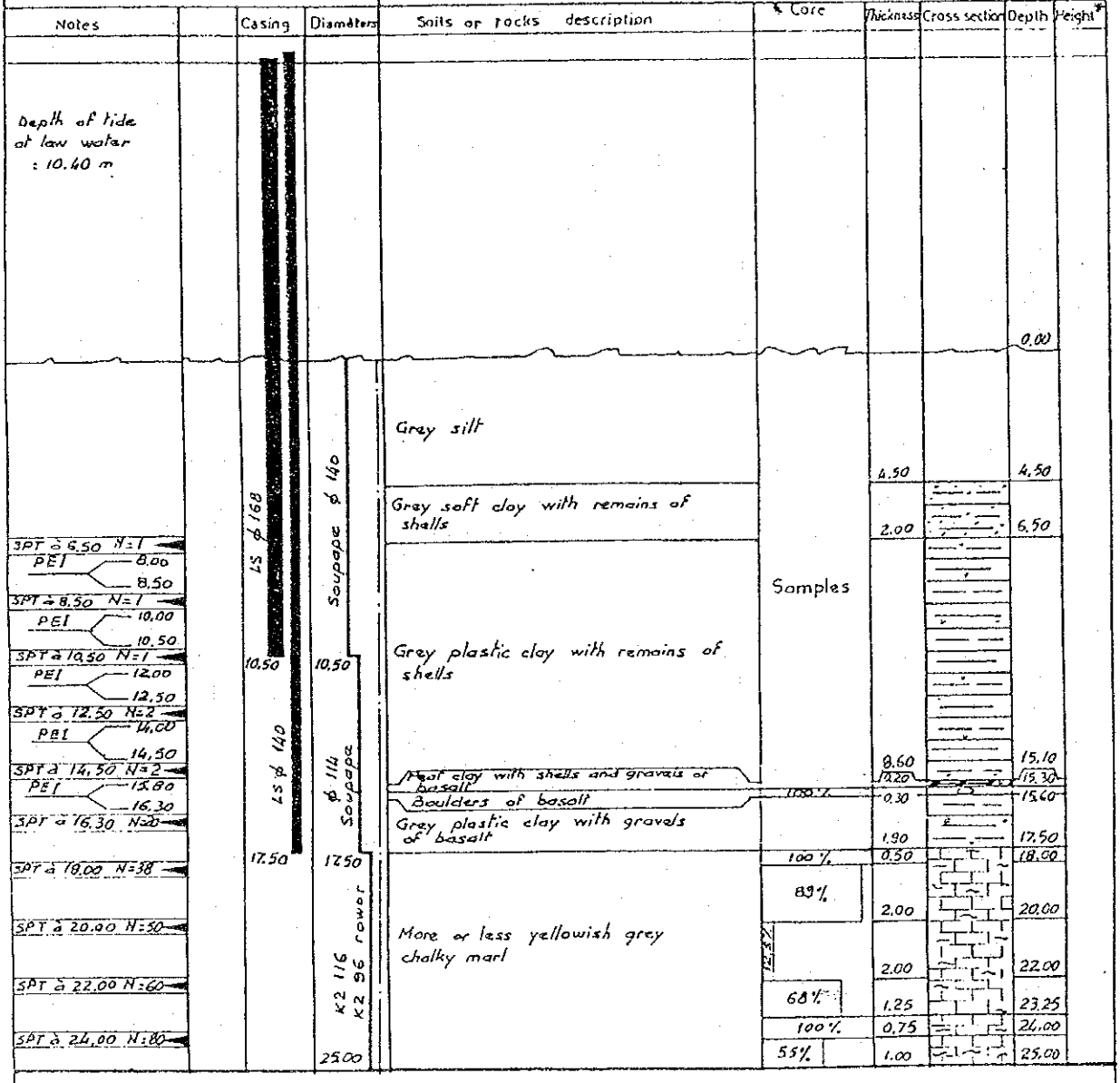
TELEPHONE 28 209.34
TELEX 22.307 . B.P. 186

Client : NIPPON TETRAPOD Co, LTD

MR : 719 ANTSIRANANA

Sondage n° S C 1

Beginning : 25-09-93 End : 30-09-93



* Height from NGM

BACHY

SOCIETE MALGACHE DE SONDAGES INJECTIONS FORAGES

LALANA RAVONINAHITRINIARIVO
ANTANANARIVO

TELEPHONE N° 208.34
TELEX 22.207 . BP 168

Client : NIPPON TETRAPOD Co, LTD

MR : 719 ANTSIRANANA

Sondage n° SC 2

Beginning : 01-10-93 End 04-10-93

Notes	Casing	Diameters	Soils or rocks description	% Core	Thickness	Cross section	Depth	Height *
Depth of tide at law water = 10,10 m							0.00	
PEI 2,50 / 3,00	ϕ 168	Sauaape ϕ 140	Blackish silt	Samples	2,20		2,20	
PEI 4,50 / 5,00			Grey soft clay		2,30		4,50	
SPT à 5,00 N=0								
PEI 6,50 / 7,00			Yellowish grey plastic clay with remains of shells and detritus		2,50		7,00	
SPT à 7,00 N=0								
PEI 8,00 / 8,45								
PEI 10,00 / 10,50					3,00		10,00	
SPT à 10,50 N=36	10,00	10,00 K2 46	Yellowish grey chalky marl, more or less soft	80%	2,00		12,00	
SPT à 12,00 N=43		12,00 K2 116	More or less yellowish grey chalky marl	80%	2,00		14,00	
SPT à 14,00 N=51				100%	0,85		14,85	
SPT à 16,00 N=125		14,85 K2 96	More or less compact grey chalky marl	100%	1,15		16,00	
SPT à 18,00 Refus				80%				
SPT à 20,00 Refus								
SPT à 22,00 Refus								
SPT à 24,00 Refus		25,00			9,00		25,00	

* Height from NGM

BACHY

SOCIETE MALGACHE DE SONDAGES INJECTIONS FORAGES

CALADA RAVONINAHITRINIARIVO
ANTANANARIVO

TELEPHONE BP 20034
TELEX 22307 . BP 1964

Client : NIPPON TETRAPOD Co, LTD

MR : 719 ANTSIRANANA

Sondage n° SC3

Beginning 12-10-93 End 14-10-93

Notes	Casing	Diameters	Soils or rocks description	% Core	Thickness	Cross section	Depth	Height*
Depth of tide at low water = 10.90 m							0.00	
			Silty sand and remains of shells and detritus		0.80		0.80	
PEI 3,50 / 4,00 — SPT à 4.00 N=3			Clayey sand and remains of shells and chalky marl		4.20		5.00	
PEI 5,50 / 6,00 — SPT à 6,00 N=2	LS ϕ 168	K2 146 Rowar		Samples				
PEI 8,00 / 8,50 — SPT à 8,50 N=4	LS ϕ 140		Sand with shells and detritus of chalky marl and cobbles		6.80		11.80	
PEI 9,50 / 10,00 — SPT à 10,00 N=16								
PEI 10,50 / 11,00	12,50		Boulders and gravels of basalt (5 - 10 cm)		1.60		13.40	
SPT à 12,80 N=41								
SPT à 15,80 N=46		15,80	Compact yellowish grey chalky marl	80%	6.40		19.80	
SPT à 17,80 N=76		K2 116 Rowar						
SPT à 19,80 N=*				90%				
SPT à 22,30 Refus					5.20		25.00	
SPT à 25,00 Refus		25,00						

* Height from NGM

SI/F BACHY

SOCIETE MALGACHE DE
SONDAGES INJECTIONS FORAGES

LALANA RAVONINAHITRINIARIVO
ANTANANARIVO

TELEPHONE ... 203-34
TELEX 22.307 B.P. 398

Client : NIPPON TETRAPOD Co, LTD

MR : 719 ANTSIRANANA

Sondage n° SC 4

Beginning 08-10-93 End 11-10-93

Depth of tide at low water = 10,10 m

Casing: LS ϕ 168 to 9.50; LS ϕ 140 to 13.50

Diamètres: Soupape ϕ 140 to 5.30; K2 146 Rotor 5.30 – 13.50; K2 116 Rotor 13.50 – 25.00

Notes	Soils or rocks description	Core	Thickness	Depth
				0.00
PEI 1.00 – 1.50	Grey plastic clay	Samples	1.20	1.20
PEI 2.00 – 2.50; PEI 3.00 – 3.50; SPT à 3.50 N:1	Grey sandy plastic clay	Samples	2.60	3.80
PEI 4.50 – 5.00	Fine grains clayey sand with gravels and boulders of basalt	Samples	1.40	5.20
	Gravels and boulders of basalt (10 - 20 cm)	Samples	2.30	7.50
SPT à 7.50 N:15; PEI 9.00 – 9.50	Yellowish grey chalky marl friable	45%	2.00	9.50
SPT à 9.50 N:16	Yellowish grey chalky marl very friable	30%	2.00	11.50
SPT à 11.50 N:34	Yellowish grey chalky marl friable	54%	1.30	12.80
	Grey chalky marl, more or less compact	100%	0.70	13.50
SPT à 13.50 N:36	Compact grey chalky marl	90%	2.00	15.50
SPT à 15.50 N:52	More or less compact chalky marl	90%	2.00	17.50
SPT à 17.50 N:62		85%	2.00	19.50
SPT à 19.50 N:72; SPT à 21.50 N:85; SPT à 23.50 Refus		80%	5.50	25.00

* Height From NGM

BACHY

SOCIETE MALGACHE DE SONDAGES INJECTIONS FORAGES

CALADA RAVONINAHITRINIARIVO
ANTANANARIVO

TELEPHONE N° 200.34
TELEX 22.207 . B.P. 166

Client : NIPPON TETRAPOD CO, LTD

MR : 719 ANTSIRANANA

Sondage n° SC5

Beginning : 18-10-93 End : 21-10-93

Notes	Casing	Diameters	Soils or rocks description	% Core	Thickness	Cross section	Depth	Height*
Depth of tide at low water = 8.90 m							0.00	
PEI 1.00 – 1.50		Soupape	Remains of shells and corals with soft clay	Samples	1.80		1.80	
PEI 2.20 – 2.70			Sandy soft clay		2.00		3.80	
SPT à 3.00 N=1								
PEI 4.80 – 5.30		3.80	Bluish grey soft chalky marl	100 %	1.00			
SPT à 5.30 N=18				40 %	2.00		7.20	
PEI 6.80 – 7.30				100 %	0.40			
SPT à 7.30 N=33								
SPT à 8.80 N=22			Decomposed sandy rock, with gravels of basalt	Samples	4.10		11.30	
SPT à 10.80 N=30								
SPT à 12.70 N=43			Gravels of basalt (5 - 8 cm)		1.40		12.70	
	12.70		More or less compact grey chalky marl	72 %	2.00		14.70	
SPT à 15.40 N=55			Gravels of basalt		0.70		15.40	
SPT à 17.40 N=68		15.70	More or less compact chalky marl	80 %	2.00			
SPT à 19.40 Refus				95 %	2.00			
SPT à 21.00 Refus				100 %	5.60		25.00	
	LS φ 168	K2 146 Rower						
		K2 116						
		25.00						

* Height from NGM

BACHY

SOCIETE MALGACHE DE SONDAGES INJECTIONS FORAGES

LALANA RAVONINAHITRINIARIVO
ANTANANARIVO

TELEPHONE No 300 24
TELEX 22.3 07 BP 1188

Client : NIPPON TETRAPOD CO, LTD

MR : 719 ANTSIRANANA

Sondage n° SC6

Beginning : 10-11-93 End : 12-11-93

Depth of tide at low water = 5,60 m

Notes	Casing	Diamètre	Soils or rocks description	% Core	Thickness	Cross section	Depth	Height*
							0,00	
PEI 0,75 – 1,25		soupape ø 114	Sand with remains of corals and shells	Samples	1,80		1,80	
PEI 1,80 – 2,30	4,5 ø 140	1,80	Gravels of basalt (5 - 10 cm)		1,75		3,55	
PEI 3,00 – 3,50				100%	0,45		4,00	
SPT à 4,00 N = 39	4,00		Yellowish grey chalky marl, more or less compact	95%	2,00		6,00	
PEI 4,50 – 5,00				80%	2,00		8,00	
SPT à 6,00 N = 76			More or less compact chalky marl	73%	1,30		9,30	
SPT à 8,00 N = 30			Compact chalky marl	100%	0,70		10,00	
SPT à 10,00 Refus			More or less compact chalky marl	82%	1,40		11,40	
SPT à 14,00 Refus			Compact grey chalky marl	100%	0,60		12,00	
SPT à 14,00 Refus		C D K2 116 Rowor	More or less compact chalky marl	87%	2,00		14,00	
SPT à 16,00 Refus								
SPT à 18,00 Refus			Compact grey chalky marl	100%	11,00		25,00	
SPT à 20,00 Refus								
SPT à 22,00 Refus		25,00						

* Height from NGM

BACHY

SOCIETE MALGACHE DE SONDAGES INJECTIONS FORAGES

LALANA RAVONINAHITRINIARIVO
ANTANANARIVO

TELEPHONE BP 209.34
TELEX 22.307 . B.P. 194

Client : NIPPON TETRAPOD Co, LTD

MR : 719 ANTSIRANANA

Sondage n° SC7

Beginning 13-11-93 End 16-11-93

Notes	Casing	Diamètres	Soils or rocks description	% Core	Thickness	Cross section	Depth	Height
Depth of tide at low water = 7.30 m							0,00	
PBI 1,00 – 1,50		Soupape ø 114	Sand with remains of corals and shells	Samples	3,80		3,80	
PBI 2,60 – 3,10			Gray clay with remains of shells		0,85		4,65	
PBI 3,80 – 4,30			Blackish scoria sand with gravels		2,65		7,30	
SPT à 4,30 N=22								
PBI 7,30 – 7,80			Soft yellowish grey chalky marl	67 %	0,75		8,05	
SPT à 7,80 N=79			Compact grey chalky marl	100 %	0,95		9,00	
SPT à 9,00 N=95			Compact grey chalky marl with soft layer	82 %	2,00		11,00	
SPT à 11,00 Refus			More or less compact grey chalky marl	80 %	2,00		13,00	
SPT à 13,00 Refus				90 %	2,00		15,00	
SPT à 15,00 Refus			Compact grey chalky marl	100 %				
SPT à 16,50 Refus								
SPT à 18,00 Refus								
SPT à 20,00 Refus								
SPT à 22,00 Refus								
	15 ø 140 / 8,00	C.D K2 116 Rowor / 25,00					25,00	

* Height from NGM

BACHY

SOCIETE MALGACHE DE SONDAGES INJECTIONS FORAGES

Client : NIPPON TETRAPOD Co, LTD

MR : 719 ANTSIRANANA

Sondage n° SC 8

Beginning 18-11-93 End 20-11-93

Notes	Casing	Diameters	Soils or rocks description	Core	Thickness	Gross section	Depth	Height*
Depth of tide at low water = 7,30 m							0,00	
PBI 1,10 – 1,60 PBI 2,80 – 3,30 PBI 4,00 – 4,50 SPT à 4,50 N=1	LS ϕ 140	Soupape ϕ 114	Sand with remains of corals and shells	Samples	4,00		4,00	
SPT à 6,00 N=1 PBI 7,50 – 8,00 SPT à 8,00 N=63	8,00	4,00	Grey clay with remains of shells		2,40		6,40	
			Gray peaty clay		0,70		7,10	
			Soft yellowish gray chalky marl		0,40		7,50	
SPT à 9,50 N=72			Soft to compact yellowish gray chalky marl	47%	2,00		9,50	
SPT à 11,50 Refus		C.D K2 116 Rowor	More or less compact yellowish grey chalky marl	85%	2,00		11,50	
SPT à 13,50 Refus				82%	2,00		13,50	
SPT à 15,50 Refus				93%	2,00		15,50	
SPT à 17,50 N=58			More or less compact chalky marl with soft layers	80%	2,00		17,50	
SPT à 20,00 Refus				82%	2,00		19,50	
SPT à 23,00 Refus			Compact grey chalky marl	100%	5,50		25,00	
		25,00						

* Height from NGM

LRPG MADAGASCAR

TABLEAU DE RESULTATS DES ESSAIS DE LABORATOIRE

ETUDE GEOTECHNIQUE
CHANTIER : ANTSIRANANA – NORD MR 719

Dossier n° 93.96.46
Annexe n° I
Tableau n° 01

N° SONDAGE			SC1 B	SC1 M	SC1 H	SC1 B	SC1 M	SC1 H	* SC1 B	SC2 B
PROFONDEURS (m)			8.00 / 8.50	8.00 / 8.30	8.00 / 8.50	12.00 / 12.50	12.00 / 12.50	12.00 / 12.50	15.80 / 16.30	8.00 / 8.30
NATURE APPARENTE DES SOLS ECHANTILLONNES			Argile molle grise + coquilles	Argile molle grise + coquilles	Argile molle grise	Argile molle grise + g. g. coquilles	Argile molle grise + g. g. coquilles	Argile molle grise + g. g. coquilles	Argile grise avec cailloux	Argile molle grise
CARACT. D'ETAT	γ (kN/m3)		16,3	16,0	16,0	18,0	18,0	18,1	20.3	16.8
	W (%)		64,7	68,2	66.6	44,0	45.0	45.3	33,5	57,1
	γd (kN/m3)		9,9	9,5	9,6	12,5	12,4	12,4	15.2	10,7
	Sr (%)		100	99	99	100	100	100	100	100
	γs (kN/m3)		27.3	27.3	27.3	27.4	27.4	27.4	27.4	27.3
IDENTIFICATION	Granulo-Sédimento % de passant à	2 mm	99			99			95	100
		0,40 mm	99			99			91	100
		80 µ	93			92			84	83
		20 µ	71			64			61	61
		2 µ	39			38			40	40
	Ld'Atterberg	WL (%)	73			51			53	60
		Wp (%)	36			25			27	30
		IP (%)	37			26			26	30
CLASSIFICAT° LPC			Lt			At			At	At
COMPRESSIBILITE	G'c (kPa)		50	46		34 ± Remanié	50		*	38 ± Remanié
	Cc		0.570	0.595		0.342	0,372		*	0.414
	Cg								*	
CISAILLEMENT BOITE TRIAXIAL	R.C (kPa)		18,8	19.7	13,6	32,1	35,3	26.1	*	11,8
	φuu (°)									
	C' (kPa)									
	φ' (°)									
AUTRE										

LABO GEOTECHNIQUE MADAGASCAR

TABLEAU DE RESULTATS DES ESSAIS DE LABORATOIRE

ETUDE GEOTECHNIQUE

CHANTIER : ANTSIRANANA - NORD MR 719

Dossier n° 93546

Annexe n° I

Tableau n° 02

N° SONDAGE			Sc2 M.	Sc2 H	Sc2 B	Sc2 M	Sc2 H	Sc3 B	Sc3 M	Sc3 H
PROFONDEURS (m)			8.00 / 8.50	8.00 / 8.50	10.00 / 10.50	10.00 / 10.50	10.00 / 10.50	3.50 / 4.00	3.50 / 4.00	3.50 / 4.00
NATURE APPARENTE DES SOLS ECHANTILLONNES			Argile molle grise	Argile molle grise	Marne argileuse grise	Marne argileuse grise	Marne argileuse grise	Sable argileux non verdâtre + Nodules	Sable argileux non verdâtre + Nod.	Sable argileux non verdâtre + Nodules
CARACT. D'ETAT	γ (kN/m3)		16,9	16,8	19.7	*	20,3	20,2	20,6	21,0
	W (%)		57,1	57,7	27.0	*	26,8	23.3	21.5	20,4
	γd(kN/m3)		10,7	10,6	15,5	*	16,0	16.4	16,9	17.4
	Sr (%)		100	100	100		100	94	94	96
	γs(kN/m3)		27.3	27.3	26.6		26.6	27.6	27.6	27.6
IDENTIFICATION	Granulo-Sédimento % de passant à	2 mm			100			33		
		0,40 mm			98			57		
		80 µ			99			24		
		20 µ			81			11		
		2 µ			52			5		
	L.d'Atterberg	WL (%)			59			31		
		Wp (%)			30			22		
		IP (%)			29			9		
CLASSIFICAT° LPC					At			SA		
COMPRESSIBILITE	G'c(kPa)				160	*		40		
	Cc				0,095	*		0,117		
	Cg					*				
CISAILLEMENT BOITE TRIAXIAL	R.C (kPa)		15,2	8.9	371,5	*	217,6	26.6	20.3	18,3
	φuu (°)									
	C' (kPa)									
	φ'(°)									
AUTRE					[illegible]	* essai [illegible]				

LNTPB MADAGASCAR

TABLEAU DE RESULTATS DES ESSAIS DE LABORATOIRE

ETUDE GEOTECHNIQUE
CHANTIER : ANTSIRANANA - NORD PR719

Dossier n° 93S446
Annexe n° I
Tableau n° 03

N° SONDAGE			SC3 B	SC3 M	SC3 H	SC4 B	SC4 M	SC4 H	SC5 B	SC5 M
PROFONDEURS (m)			8.00 / 8.50	8.00 / 8.50	8.00 / 8.50	3.00 / 3.50	3.00 / 3.50	3.00 / 3.50	4,80 / 5.30	4,80 / 5,30
NATURE APPARENTE DES SOLS ECHANTILLONNES			Sable argileux mou verdâtre + Nodules	Sable argileux mou verdâtre + Nodules	Sable argileux mou verdâtre + Nodules	Sable argileux verdâtre	Sable argileux verdâtre	Sable argileux verdâtre	Argile marneuse grise	Argile marneuse grise
CARACT. D'ETAT	γ (kN/m3)		20.0	19.9	19.9	20,3	20,6	19.6	18.9	19.0
	W (%)		25.6	26.4	26.0	33,2	30.3	29.8	33,7	32,9
	γd (kN/m3)		15.9	15.7	15.8	15.2	15.8	15.1	14,1	14,3
	Sr (%)		96	94	96	100	100	100	99	100
	γs (kN/m3)		27.5	27.5	27.5	27,3	27,3	27,3	27.0	27.0
IDENTIFICATION	Granulo-Sédimento % de passant à	2 mm	94			100			99	
		0,40 mm	74			85			98	
		80 µ	49			42			96	
		20 µ	41			30			87	
		2 µ	27			20			70	
	L. d'Atterberg	WL (%)	34			33			59	
		Wp (%)	22			23			31	
		IP (%)	12			10			28	
CLASSIFICAT° LPC			SA			SA			LE	
COMPRESSIBILITE	G'c (kPa)		50	46		56	60			
	Cc		0,112	0,106		0.132	0,114			
	Cg									
CISAILLEMENT BOITE TRIAXIAL	R.C (kPa)		28.1	19.9	14.6	25.4	24.7	23.7	87,5	77,2
	φuu (°)									
	C' (kPa)									
	φ' (°)									
AUTRE										

LABEX MADAGASCAR

TABLEAU DE RESULTATS DES ESSAIS DE LABORATOIRE

ETUDE GEOTECHNIQUE

CHANTIER : ANTSIRANANA - NORD MR 719

Dossier n° 93.SL.46

Annexe n° I

Tableau n° 04

N° SONDAGE			Sc5 H	Sc5 B	Sc5 M	Sc5 H				
PROFONDEURS (m)			4.80 / 5.30	6.80 / 7.30	6.80 / 7.30	6.80 / 7.30	—	—	—	—
NATURE APPARENTE DES SOLS ECHANTILLONNES			Argile marneuse grise	Argile marneuse grise	Argile marneuse grise	Argile marneuse grise				
CARACT. D'ETAT	γ (kN/m3)		18.9	17.5	18,1	18,0				
	W (%)		35,6	45,2	44.0	47,0				
	γd (kN/m3)		13,9	12,0	12,5	12,2				
	Sr (%)		100	96.	100	100				
	γs (kN/m3)		27,0	27,4	27,4	27,4				
IDENTIFICATION	Granulo-Sédimento % de passant à	2 mm		100						
		0,40 mm		99						
		80 µ		98						
		20 µ		90						
		2 µ		75						
	L.d'Atterberg	WL (%)		80						
		Wp (%)		39						
		IP (%)		41						
CLASSIFICAT° LPC				Lt						
COMPRESSIBILITE	G'c (kPa)									
	Cc									
	Cg									
CISAILLEMENT BOITE TRIAXIAL	R.C (kPa)		66,7	70,7	65,9	57,3				
	φuu (°)									
	C' (kPa)									
	φ' (°)									
AUTRE										

TABLEAU DE RESULTATS DES ESSAIS DE LABORATOIRE

Dossier n°.....
Annexe n°.....
Tableau n° 01

ETUDE GEOTECHNIQUE
CHANTIER : MR 719 ANTSIRANANA - NORD

			N° SONDAGE	SC7 B	SC7 M	SC7 H	SC7 B	SC7 M	SC7 H	SC8 B	SC8 M
			PROFONDEURS (m)	3.80 / 4.30	3.80 / 4.30	3.80 / 4.30	7.30 / 7.80	7.30 / 7.80	7.30 / 7.80	1.00 / 1.50	1.00 / 1.50
			NATURE APPARENTE DES SOLS ECHANTILLONNES	Argile molle grise + Coques	Argile molle grise + Coques	Argile molle grise + Coques	Argile molle grise	Argile molle grise	Argile molle grise	Argile plastique grise	Argile plastique grise
CARACT. D'ETAT			γ (kN/m3)	19.7	19.9	19,6	18.8	18.6	18,3	17,7	17,8
			W (%)	31,1	32,0	29,3	36,4	36.4	36,0	46,9	45,9
			γd(kN/m3)	15,0	15,1	15,1	13,8	13,6	13,8	12,0	12,2
			Sr (%)	100			100			100	
			γs(kN/m3)	27.9			27,0			27,0	
IDENTIFICATION	Granulo-Sédimento % de passant à	2 mm		93			92			100	
		0,40 mm		76			83			99	
		80 µ		40			71			98	
		20 µ		24			57			88	
		2 µ		11			38			54	
	L.d'Atterberg	WL (%)		43			69			50	
		Wp (%)		22			34			26	
		IP (%)		21			35			24	
CLASSIFICAT° LPC				SA			Lt			Ap/At	
COMPRESSIBILITE			G'c(kPa)	28			140			34	
			Cc	0,218			0,210			0,374	
			Cg	à remanié							
CISAILLEMENT BOITE TRIAXIAL			Cuu(kPa)								
			φuu (°)								
			R.C(kPa)	24,0	22,9	21,8	66,3	57,1	41,2	14,4	13,9
AUTRE											

TABLEAU DE RESULTATS DES ESSAIS DE LABORATOIRE

Dossier n°.....
Annexe n°.....
Tableau n° 02

ETUDE GEOTECHNIQUE
CHANTIER : M719 ANTSIRANANA - NORD

N° SONDAGE		SC8 H	SC8 B	SC8 M	SC8 H				
PROFONDEURS (m)		1.00 / 1.50	7.50 / 8.00	7.50 / 8.00	7.50 / 8.00	—	—	—	—
NATURE APPARENTE DES SOLS ECHANTILLONNES		Argile plastique grise	argile marneuse grise	Argile marneuse grise	Argile marneuse grise				
CARACT. D'ETAT	γ (kN/m3)	17,5	21,1	21,7	20,7				
	W (%)	47,4	16,0	15,2	17,1				
	γd(kN/m3)	11,9	18,2	18,8	17,7				
	Sr (%)		88						
	γs(kN/m3)		27,2						
IDENTIFICATION Granulo-Sédimento % de passant à	2 mm		100						
	0,40 mm		99						
	80 µ		98						
	20 µ		87						
	2 µ		54						
L.d'Atterberg	WL (%)		43						
	Wp (%)		22						
	IP (%)		21						
CLASSIFICAT° LPC			Ap						
COMPRESSIBILITE	G'c(kPa)			100					
	Cc			0,103					
	Cg								
CISAILLEMENT BOITE TRIAXIAL	Cuu(kPa)								
	φuu (°)								
	R-C(kPa)	13,4	122,0	124,2	107,5				
AUTRE									

A-3.3 Installations Portuaires

A-3.3.1 Critère de Jugement de Détérioration

Tableau A-3-3-1 Critère de Jugement du Degré de Détérioration des Installations

Item	Corrosion of the reinforcing bar	Cracking of the concrete	Spalling of the cover concrete
Degree	Visual inspection		
0	Not observed	Not observed	Not observed
1	A few dotted rusts are observed on the concrete surface	A few cracks are observed on the concrete surface	Not observed
2	A few rust strains are observed on the concrete surface	Some cracks are observed on the concrete surface	A few swellings (expansions) are observed on the concrete surface
3	Many rust strains are observed on the concrete surface	Many cracks are observed on the concrete surface	A few spallings are observed on the concrete surface
4		Many wide cracks (more than 2mm in width) are observed on the concrete surface	Many spallings are observed on the concrete surface
5			Heavy spallings are observed on the concrete surface

Tableau A-3-3-2 Critère de Jugement du Degré de Détérioration

Degree	Visual inspection.
0	Steel is not corroded.
1	Only the surface of the steel is corroded partially.
2	Only the surface of the steel is corroded generally, or some deficits are observed on the steel.
3	Many deficits are observed on the steel.
4	Heavy deficits are observed on the steel.
5	

Tableau A-3-3-3 Jugement pour Nécessité de Réparation

Degree of Deterioration	0	1	2	3	4	5
Necessity of Repair	Not necessary			Need to repair		
			(execute repair depends on situation)			(execute reinforcement depends on situation)

A-3.3.2 Essai de Compression des Carottes en Béton

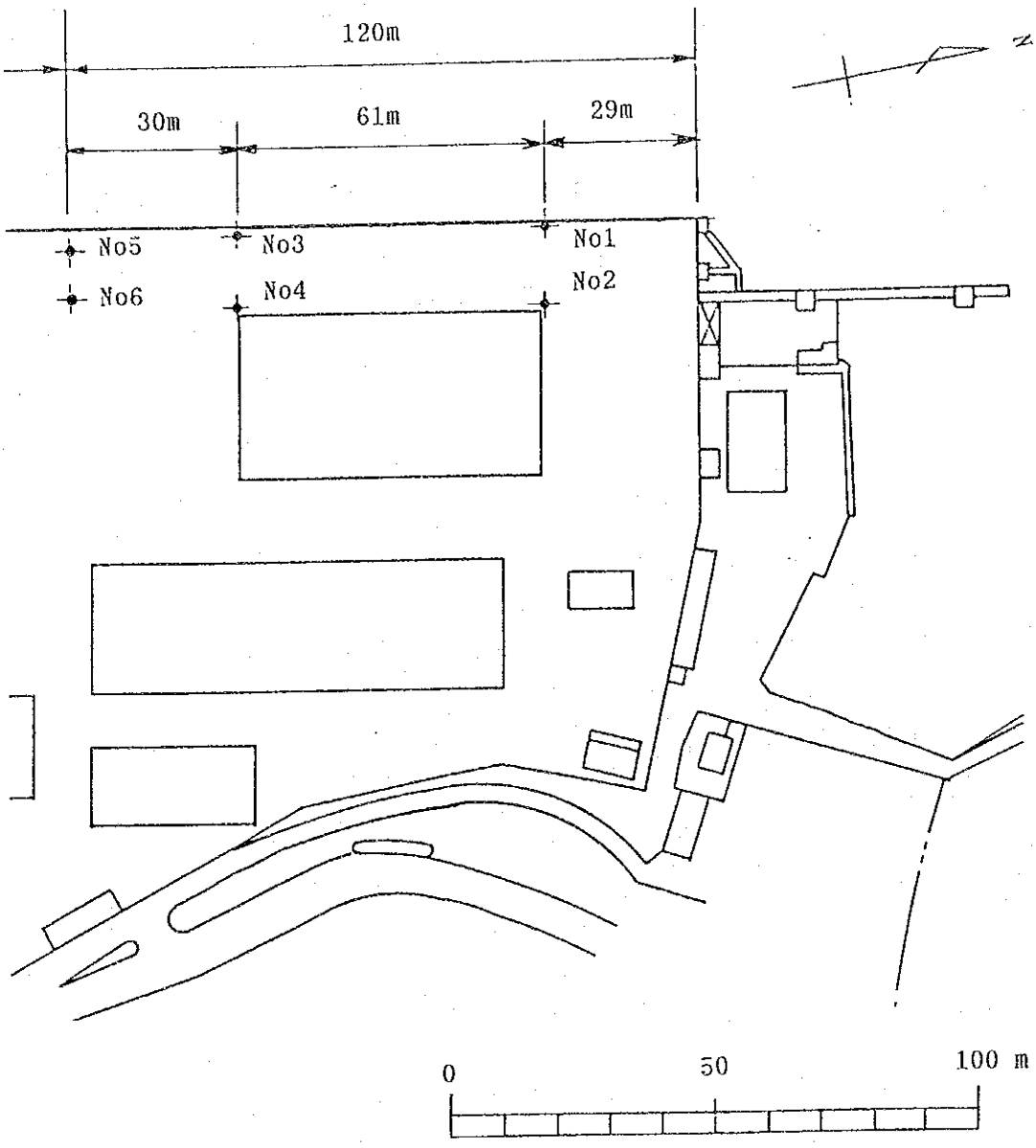


Figure A-3-3-1 Emplacement du Noyau Prélevé

Tableau A-3-3-4 Resultats du Test Simple de Compression

Location No	Sample	Dimension (cm)		Unit Weight (tf/m^3)	Compressive Strength (kgf/cm^2)
		Diameter	Height		
No 1	1	11.5	11.8	2.43	324*
	2	11.5	11.3	2.53	304*
	3	11.5	11.6	2.66	265*
No 2	1	11.5	11.4	2.31	265*
	2	11.5	11.7	2.26	225
No 3	1	11.5	11.6	2.66	320*
	2	11.5	11.6	2.65	312
No 4	1	11.5	11.5	2.31	278
	2	11.5	11.5	2.30	320
	3	11.5	11.6	2.27	285
No 5	1	11.5	11.7	2.62	280*
No 6	1	11.5	11.6	2.22	246
	2	11.5	11.6	2.30	285

Note : L'astérisque (*) signifie la présence de fer à béton.

A-3.6 Navires en Escale

Quelques extraits du registre de la capitainerie relatifs aux navirs en escale sont montrés ci-dessous. Les données non-fiables ou non-disponibles sont accompagnées d'une barre.

Tableau A-3-6-1 Données sur les Navires En escale d'après le Service Portuaire

MOIS D'AVRIL 1990

NUMERO	CONSIGNATAIRE	ARRIVEE	PROVENANCE	DEPART	DESTINATION	J.BRUTE (Tx)	L.H.TOUT (m)	NOMS NAVIRES
90/70	AUXIMAD	01/4/90 10h30	SECREN	10/4/90 17h15	Vohimar	587.01	52.40	VATSY 2
90/71	SCAC	01/4/90 13h05	Toamasina	02/4/90 08h25	Arabia Golf	18,211.00	176.06	LIA
90/72	AUXIMAD	01/4/90 13h35	Toamasina	01/4/90 19h30	Mahajanga	1,103.10	77.02	VATSY 4
90/73	SAMA	02/4/90 06h30	Mahajanga	04/4/90 03h00	Mahajanga	175.31	25.02	ASGARI
90/74	TM. VALLY MA	02/4/90 12h15	Nosy Be	04/4/90 03h10	Mahajanga	[illegible]	27.97	SAINT LOUIS
90/75	AUXIMAD	04/4/90 07h40	Nosy Be	04/4/90 18h15	Toamasina	11,530.00	158.00	TOAMASINA
90/76	AUXIMAD	04/4/90 07h40	Nosy Be	08/4/90 10h00	SECREN	171.12	33.00	JACQUES ORSINI
90/77	SOLIMA	04/4/90 12h00	Toamasina	06/4/90 05h00	Nosy Be	4,205.00	108.00	TSIMIRORO
90/78	AUXIMAD	06/4/90 08h20	Mayotte	10/4/90 7h30	Haute Mer	760.49	58.20	GOMBESSA
90/79	AUXIMAD	08/4/90 10h00	SECREN	10/4/90 20h30	Vohimar	429.00	47.99	KINGA
90/80	AUXIMAD	10/4/90 7h00	Seychelles	21/4/90 16h30	Haute Mer	1,475.00	77.30	ALBACORA 14
90/81	AUXIMAD	10/4/90 10h45	Haute Mer	21/4/90 16h30	Haute Mer	1,344.88	76.75	ALBACORA 6
90/82	AUXIMAD	10/4/90 14h15	Haute Mer	23/4/90 05h30	Haute Mer	1,498.98	77.30	ALBACORA ONCE
90/83	AUXIMAD	11/4/90 10h30	Singapore	18/4/90 07h30	Bangkok	1,782.38	83.13	TANYO 1
90/84	AUXIMAD	11/4/90 15h00	SECREN	01/5/90 [illegible]	Mahajanga	171.12	33.00	JACQUES ORSINI
90/85	AUXIMAD	12/4/90 10h15	Haute Mer	24/4/90 05h00	Haute Mer	1,475.00	77.30	ALBACORA 12
90/86	AUXIMAD	12/4/90 20h10	Haute Mer	24/4/90 06h00	Haute Mer	760.49	58.20	GOMBESSA
90/87	AUXIMAD	13/4/90 08h45	Djeddah	02/5/90 17h10	Bangkok	4,731.00	11.50	VICTORIA REEFER
90/88	AUXIMAD	14/4/90 07h45	Haute Mer	15/4/90 16h00	Haute Mer	131.12	23.00	MARO DE FATIMA
90/89	AUXIMAD	14/4/90 22h10	Seychelles	23/4/90 06h10	Haute Mer	1,385.11	76.75	EUZKADI ALAI
90/90	AUXIMAD	14/4/90 22h15	Seychelles	20/4/90 17h30	Haute Mer	988.15	52.00	ATERPE ALAI
90/91	AUXIMAD	15/4/90 06h30	Seychelles	24/4/90 17h30	Porto Rico	1,479.77	96.05	PACIFIC QUEEN
90/92	AUXIMAD	15/4/90 07h30	Haute Mer	18/4/90 16h30	Haute Mer	833.90	63.30	TXORI EDER
90/93	AUXIMAD	16/4/90 06h30	Haute Mer	27/4/90 18h30	Haute Mer	1,351.69	68.00	MONTE FRISA 7
90/94	AUXIMAD	16/4/90 16h30	Antalaha	19/4/90 15h30	AntsoNihy	429.00	47.99	KINGA
90/95	AUXIMAD	17/4/90 06h00	Haute Mer	25/4/90 6h00	Haute Mer	1,300.00	72.20	KAI ALAI
90/96	AUXIMAD	14/4/90 18h15	Victoria	23/4/90 16h15	Italie	87.84	68.00	FADH
90/97	TRANS 7	18/4/90 23h12	La Réunion	18/4/90 19h15	Nosy Be	3,704.40	110.00	BARBARA D
90/98	AUXIMAD	19/4/90 07h20	Haute Mer	27/4/90 17h00	Haute Mer	2,107.00	97.97	JUAN RAMON E.
90/99	ALY MAMAD	19/4/90 23h30	Mitsamudu	23/4/90 23h00	Vohimar	317.48	50.45	SOALALA
90/100	AUXIMAD	20/4/90 07h00	Mitsamudu	20/4/90 09h00	SECREN	458.34	51.00	YLANG YLANG
90/101	AUXIMAD	19/4/90 13h00	Mahi	27/4/90 18h30	Bangkok	1,658.16	81.88	DELPHINUS
90/102	SOLIMA	21/4/90 08h45	Toamasina	21/4/90 02h00	Nosy Be	4,205.00	108.00	TSIMIRORO
90/103	AUXIMAD	21/4/90 09h10	Haute Mer	21/4/90 14h30	Haute Mer	1,132.73	71.50	BAYOTA
90/104	AUXIMAD	21/4/90 11h06	Hodeidah (Yimen)	14/5/90 17h00	Espagne	1,949.40	89.76	PRASLIN REEFER
90/105	SOLIMA	22/4/90 17h15	Las Palmas	04/5/90 05h10	Haute Mer	557.68	733.00	INTERTUNA UNO
90/106	AUXIMAD	24/4/90 07h00	Espagne	12/5/90 14h00	Espagne	1,220.06	87.75	ILARGIA
90/107	AUXIMAD	24/4/90 08h00	Haute Mer	02/5/90 17h20	Haute Mer	851.19	68.00	LA BOUGAINVILLE
90/108	AUXIMAD	25/4/90 05h30	Haute Mer	03/5/90 06h30	Haute Mer	1,475.36	68.00	ALBACORA 16
90/109	AUXIMAD	25/4/90 08h00	Seychelles	26/5/90 06h30	SECREN	1,200.26	70.50	READRUG
90/110	AUXIMAD	25/4/90 10h18	Djeddah	25/4/90 14h48	SECREN	2,058.00	95.50	
90/111	AUXIMAD	28/4/90 06h30	Haute Mer	04/5/90 05h10	Haute Mer	1,475.36	68.00	

MOIS DE MAI 1990

NUMERO	CONSIGNATAIRE	ARRIVEE	PROVENANCE	DEPART	DESTINATION	J.BRUTE (Tx)	L.H.TOUT (m)	NOMS NAVIRES
90/120	AUXIMAD	01/5/90 06h30	Haute Mer	06/5/90 20h15	Haute Mer	855.00	83.00	CHRISTOPHE
90/121	AUXIMAD	01/5/90 09h30	Haute Mer	10/5/90 11h45	Haute Mer	851.19	59.06	P.JOINVILLE
90/122	AUXIMAD	01/5/90 10h45	Ceuta (Esp.)	05/6/90 14h00	Victoria (Sey.)	1,386.80	92.00	ALBACORA FRISA
90/123	AUXIMAD	01/5/90 07h00	Haute Mer	10/5/90 09h30	Haute Mer	607.93	51.00	GEVREDO
90/124	AUXIMAD	02/5/90 07h00	Haute Mer	08/5/90 12h30	Haute Mer	833.90	63.30	TXORI-URD
90/125	AUXIMAD	02/5/90 03h30	Haute Mer	08/5/90 14h00	Haute Mer	1,308.49	73.80	ALMADABRA
90/126	SOLIMA	03/5/90 15h00	SECREN	05/5/90 10h20	SECREN	2,734.00	100.00	BEMOLANGA
90/127	ALI MAMADE	04/5/90 20h00	Mahajanga	10/5/90 23h00	Vohimar	317.98	50.45	SOALALA
90/128	SOLIMA	06/5/90 08h30	SECREN	08/5/90 00h00	Toamasina	2,734.00	100.00	BEMOLANGA
90/129	AUXIMAD	06/5/90 09h00	Haute Mer	15/5/90 10h04	SECREN	1,332.91	69.48	TXORI-ZURI
90/130	AUXIMAD	06/5/90 14h34	Singapore	07/5/90 17h30	Zone Ice. Pche	424.00	42.88	YAH YOW 8
90/131	AUXIMAD	06/5/90 15h00	Haute Mer	14/5/90 14h00	Haute Mer	1,146.50	69.00	TREVIGNON II
90/132	AUXIMAD	07/5/90 04h30	Mahajanga	11/5/90 23h10	Mahajanga	182.00	35.00	WUBBINA
90/133	AUXIMAD	07/5/90 06h30	Haute Mer	10/5/90 05h30	Haute Mer	1,475.00	77.30	ALBACORA 14
90/134	AUXIMAD	07/5/90 07h30	Haute Mer	08/5/90 14h30	SECREN	988.15	52.00	ATERPE ALAI
90/135	AUXIMAD	07/5/90 07h30	Haute Mer	14/5/90 07h30	Haute Mer	773.00	55.00	ARMEN
90/136	MSC	07/5/90 10h00	La Réunion	08/5/90 18h00	Durban	9,192.14	155.73	ROSA S
90/137	AUXIMAD	07/5/90 13h10	Haute Mer	10/5/90 17h30	SECREN	1,146.50	70.50	H. DE KERNANDEC
90/138	AUXIMAD	07/5/90 15h10	Haute Mer	16/5/90 12h10	Haute Mer	1,146.50	70.50	TRESCAO
90/139	AUXIMAD	09/5/90 07h00	Haute Mer	17/5/90 05h15	Mahi (Sey.)	760.49	58.20	GOMBESSA
90/140	AUXIMAD	09/5/90 07h00	Haute Mer	13/5/90 06h00	Haute Mer	1,365.11	76.75	EUZKADI ALAI
90/141	SOLIMA	10/5/90 06h00	Toamasina	11/5/90 06h30	Nosy Be	4,205.00	[illegible]	TSIMIRORO
90/142	AUXIMAD	08/5/90 11h20	Mahajanga	10/5/90 17h15	Moroni (Comores)	433.48	47.00	V. DE NIOUMACHO
90/143	AUXIMAD	10/5/90 17h45	SECREN	11/5/90 12h30	Haute Mer	1,146.50	69.00	ROSPICO
90/144	AUXIMAD	10/5/90 20h10	Marcantseba	[illegible]	[illegible]	[illegible]	58.00	HASIKIN 18
90/145	AUXIMAD	12/5/90 14h45	Mayotte	19/5/90 05h10	Vohimar	429.00	47.99	KINGA
90/146	AUXIMAD	12/5/90 19h10	Haute Mer	21/5/90 13h15	Haute Mer	1,809.50	67.50	IZARO
90/147	AUXIMAD	13/5/90 06h00	Port Victoria	31/5/90 06h30	Porto-Rico	2,689.00	96.95	PACIFIC MARCHION
90/148	AUXIMAD	13/5/90 06h00	SECREN	15/5/90 10h10	Moroni (Comores)	458.34	51.00	YLANG YLANG
90/149	SOLIMA	14/5/90 10h45	Maurice	15/5/90 18h40	Toamasina	2,734.00	100.00	BEMOLANGA
90/150	AUXIMAD	14/5/90 15h10	Toamasina	21/5/90 10h30	Vohimar	1,438.80	72.54	VATSY
90/151	AUXIMAD	16/5/90 07h30	Mahajanga	18/5/90 06h00	Toamasina	3,297.48	97.52	ONIBE
90/152	AUXIMAD	16/5/90 08h30	Toamasina	21/5/90 05h30	Port St. Louis	139.63	73.37	V. DE MANAKARA
90/153	AUXIMAD	16/5/90 13h30	Haute Mer	21/5/90 06h00	SECREN	1,132.73	71.50	BAYOTA
90/154	SCAC	16/5/90 08h45	Fort Dauphin	08/6/90 06h15	Fort Dauphin	491.59	72.05	ILDERIM 6
90/155	AUXIMAD	19/5/90 10h45	Haute Mer	22/5/90 06h30	Vohimar	429.00	47.99	KINGA
90/156	AUXIMAD	18/5/90 13h00	SECREN	19/5/90 16h00	Haute Mer	1,146.50	70.50	H.NERLANDERS
90/157	AUXIMAD	05/5/90 09h00	Toamasina	08/5/90 06h30	Port St Louis	1,103.10	77.02	VATSY 4
90/158	AUXIMAD	19/5/90 15h00	SECREN	23/5/90 06h00	Haute Mer	988.15	52.00	ATERPE ALAI
90/159	AUXIMAD	20/5/90 19h30	Haute Mer	23/5/90 06h00	Haute Mer	1,682.00	84.21	MONTELAPE
90/160	HASIKIN	21/5/90 12h15	Taowan	24/5/90 11h00	Haute Mer	413.24	[illegible]	YUH YOW 2
90/161	SCAC	22/5/90 16h00	Moroni	24/5/90 06h00	Toamasina	98.68	[illegible]	ISLE FERRY

A-4.4 Prévision de la Demande

Les résultats de prévision de la demande en cas de basse croissance économique sont indiqués dans les tableaux et les figures ci-dessous.

Tableau A-4-4-1 Résultat de Prévision du PIB au Prix de 1990

(UNIT:BILLION FMG,%)

YEAR		AGRICULT		INDUSTRY		SERVICE		TOTAL	
		PRICE	SHARE	PRICE	SHARE	PRICE	SHARE	PRICE	SHARE
1992	Price	1383	33.6	577	14.0	2155	52.4	4115	100
2010	Case 1								
	Price	2581	28.0	1833	19.9	4793	52.1	9207	100
	Ave growth rate	3.5		6.6		4.5		4.6	
	Case 2								
	Price	2234	31.9	1103	15.7	3669	52.4	7006	100
	Ave growth rate	2.7		3.7		3.0		3.0	

Tableau A-4-4-2 Résultats de Prévision du Volume de Marchandises (1)

(UNIT:TON)

YEAR		Case1(A)	Case2(B)	(A)-(B)
FOREIGN	EXPORT	89100	78600	10500
	IMPORT	86800	70700	16100
	TOTAL	175900	149300	26600
DOMESTIC	LOAD	60000	54700	5300
	UNLOAD	87300	78900	8400
	TOTAL	147300	133600	13700
TRANSHIP		164000	148300	15700
TOTAL	LOAD	149100	133300	15800
	UNLOAD	174100	149600	24500
	TRANSHIP	164000	148300	15700
	TOTAL	487200	431200	56000

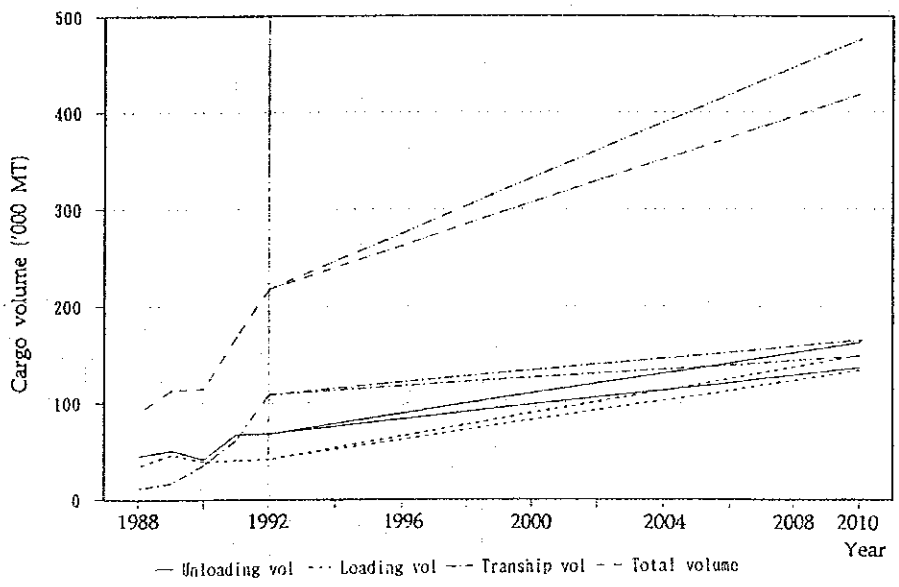


Figure A-4-4-1 Résultats de Prévision du Volume des Navires (1)

Tableau A-4-4-3 Résultats dePrévision du Volume des Marchandises (2)

(UNIT:TON)

YEAR		Case1(A)	Case2(B)	(A)-(B)
LOAD	FOREIGN	89100	78600	10500
	TUNA-related	15200	15200	0
	SALTS	25600	25600	0
	PETROLEUM	0	0	0
	OTHERS	48300	37800	10500
	DOMESTIC	60000	54700	5300
	TUNA-related	0	0	0
	SALTS	29900	29900	0
	PETROLEUM	12200	10400	1800
	OTHERS	17900	14400	3500
	TOTAL	149100	133300	15800
	TUNA-related	15200	15200	0
	SALTS	55500	55500	0
	PETROLEUM	12200	10400	1800
	OTHERS	66200	52200	14000
UNLOAD	FOREIGN	86800	70700	16100
	TUNA-related	8000	8000	0
	SALTS	0	0	0
	PETROLEUM	48700	41600	7100
	OTHERS	30100	21100	9000
	DOMESTIC	87300	78900	8400
	TUNA-related	37000	37000	0
	SALTS	0	0	0
	PETROLEUM	19100	15900	3200
	OTHERS	31200	26000	5200
	TOTAL	174100	149600	24500
	TUNA-related	45000	45000	0
	SALTS	0	0	0
	PETROLEUM	67800	57500	10300
	OTHERS	61300	47100	14200
TRANSHIP	TOTAL	164000	148300	15700
	TUNA	52000	52000	0
	PETROLEUM	112000	96300	15700
TOTAL	FOREIGN	175900	149300	26600
	TUNA-related	23200	23200	0
	SALTS	25600	25600	0
	PETROLEUM	48700	41600	7100
	OTHERS	78400	58900	19500
	DOMESTIC	147300	133600	13700
	TUNA-related	37000	37000	0
	SALTS	29900	29900	0
	PETROLEUM	31300	26300	5000
	OTHERS	49100	40400	8700
	TRANSHIP	164000	148300	15700
	TUNA	52000	52000	0
	PETROLEUM	112000	96300	15700
	TOTAL	487200	431200	56000
	TUNA-related	112200	112200	0
	SALTS	55500	55500	0
	PETROLEUM	192000	164200	27800
	OTHERS	127500	99300	28200

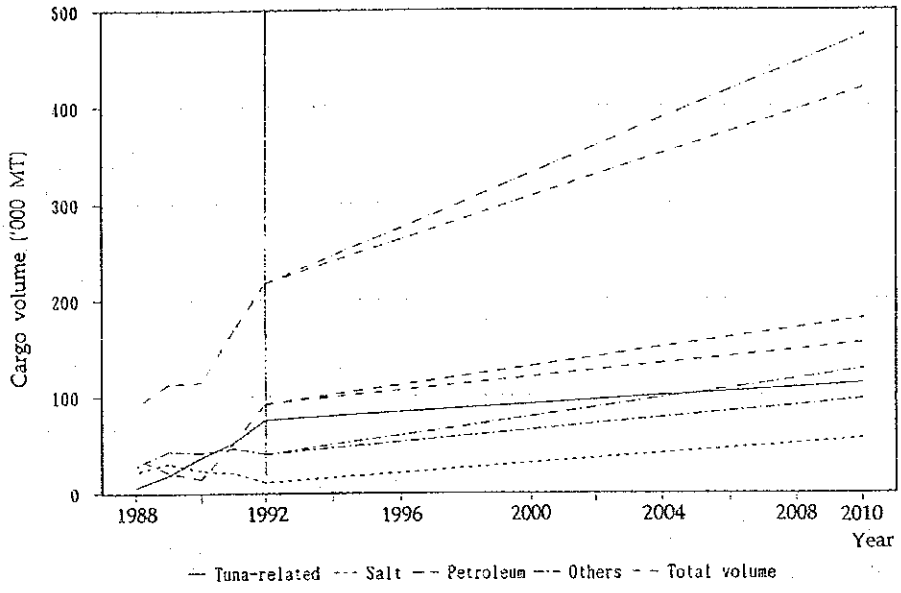


Figure A-4-4-2 Resultats de Prévision du Volume des Marchandises (2)

Tableau A-4-4-4 Résultats de Prévision des MarchandisesGénérales Chargées

(Unit:ton)

	Case1(A)	Case2(B)	(A)-(B)
Foreign cargo	141,100	130,600	10,500
Tuna(tranship)	52,000	52,000	0
Salts	25,600	25,600	0
Rice	0	0	0
Flour	0	0	0
Cement	0	0	0
Fertilizer	0	0	0
Canned food	15,200	15,200	0
Others	48,300	37,800	10,500
Domestic cargo	47,800	44,300	3,500
Tuna(tranship)	0	0	0
Salts	29,900	29,900	0
Rice	1,500	1,500	0
Flour	2,200	2,200	0
Cement	400	300	100
Fertilizer	1,700	1,000	700
Canned food	0	0	0
Others	12,100	9,400	2,700
Total	188,900	174,900	14,000
tuna(tranship)	52,000	52,000	0
Salts	55,500	55,500	0
Rice	1,500	1,500	0
Flour	2,200	2,200	0
Cement	400	300	100
Fertilizer	1,700	1,000	700
Canned food	15,200	15,200	0
Others	60,400	47,200	13,200

Tableau A-4-4-5 Résultats de Prévision des Marchandises Générales Déchargées

(Unit:ton)

	Case1(A)	Case2(B)	(A)-(B)
Foreign cargo	38,100	29,100	9,000
Rice	0	0	0
Flour	0	0	0
Tuna-related	8,000	8,000	0
Cement	6,200	4,600	1,600
Coffee	0	0	0
Fertilizer	1,900	1,200	700
Animal & Vegetable oil	1,100	700	400
Metal products	1,100	1,100	0
Others	19,800	13,500	6,300
Domestic cargo	120,200	115,000	5,200
Rice	4,600	4,600	0
Flour	7,200	7,200	0
Tuna-related	89,000	89,000	0
Cement	4,100	3,000	1,100
Coffee	1,600	1,600	0
Fertilizer	0	0	0
Animal & Vegetable oil	200	200	0
Metal products	300	300	0
Others	13,200	9,100	4,100
Total	158,300	144,100	14,200
(TRANSHIP)	52000	52000	0
Rice	4,600	4,600	0
Flour	7,200	7,200	0
Tuna-related	97,000	97,000	0
(TRANSHIP)	52000	52000	0
Cement	10,300	7,600	2,700
Coffee	1,600	1,600	0
Fertilizer	1,900	1,200	700
Animal & Vegetable oil	1,300	900	400
Metal products	1,400	1,400	0
Others	33,000	22,600	10,400

A-5.5 Etude Structurelle

A-5.5.1 Travaux de Reconstruction du Vieux Quai (1972)

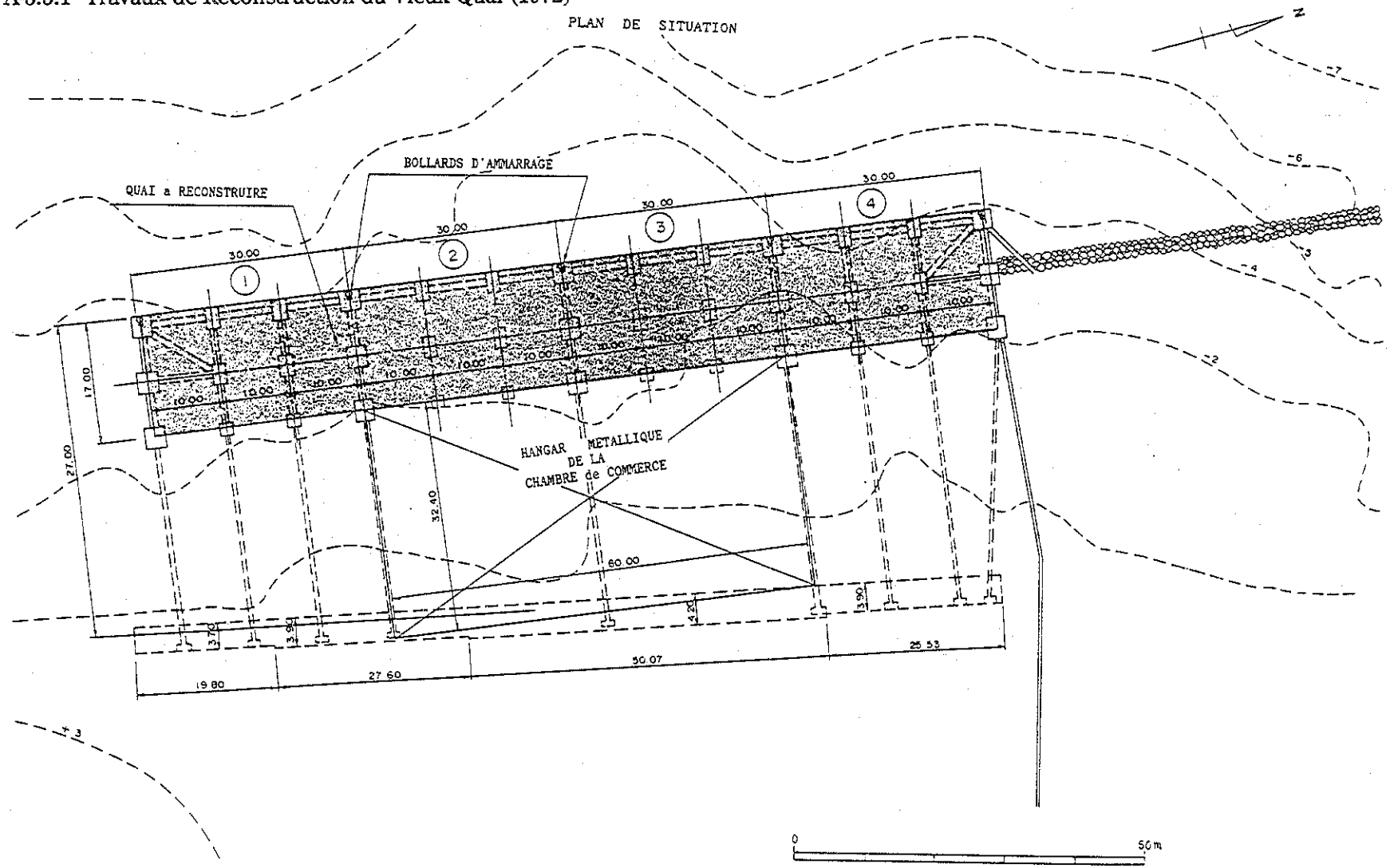


Figure A-5-5-1 Plan de Situation

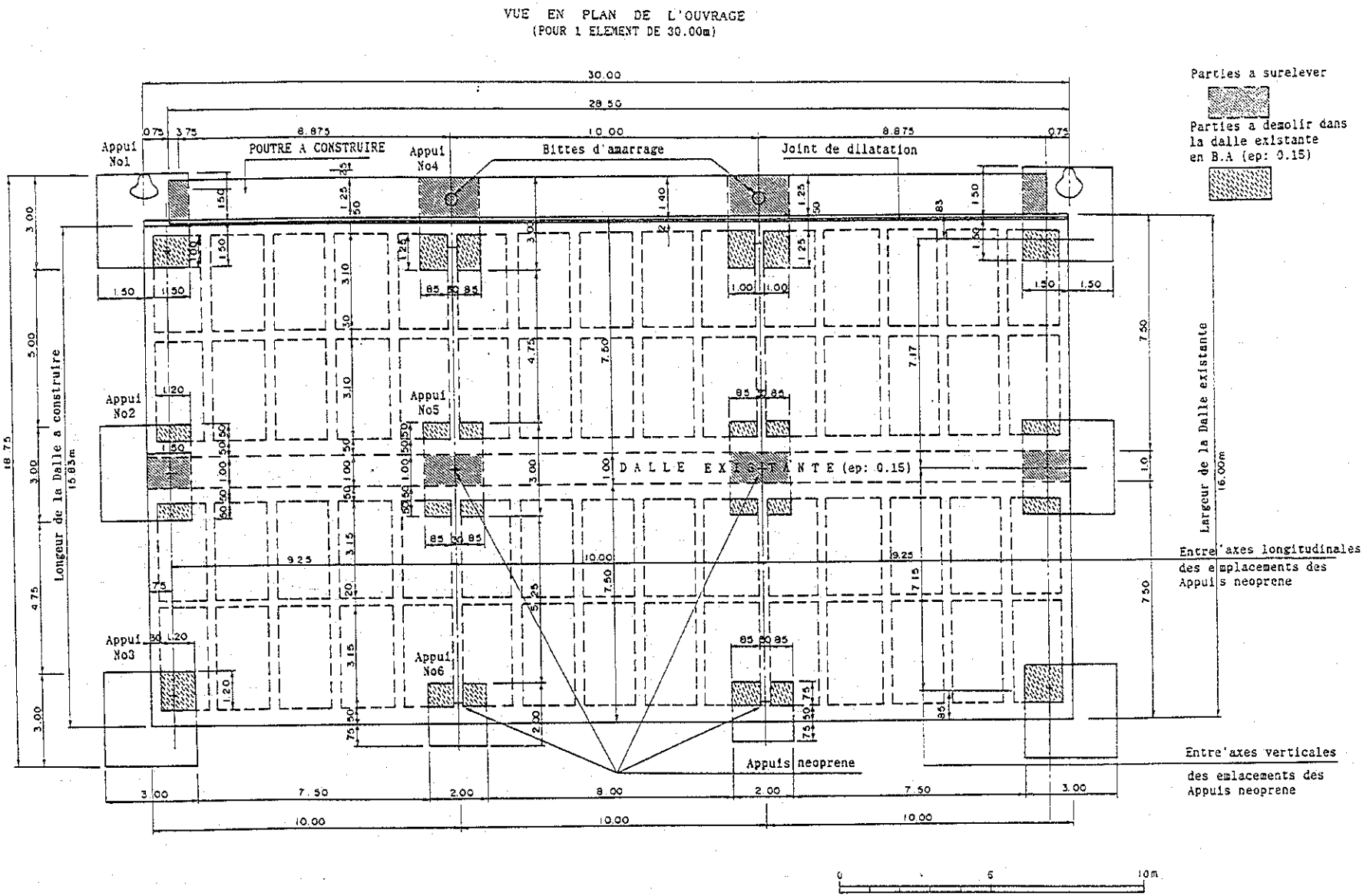


Figure A-5-5-2 Vue Structurelle

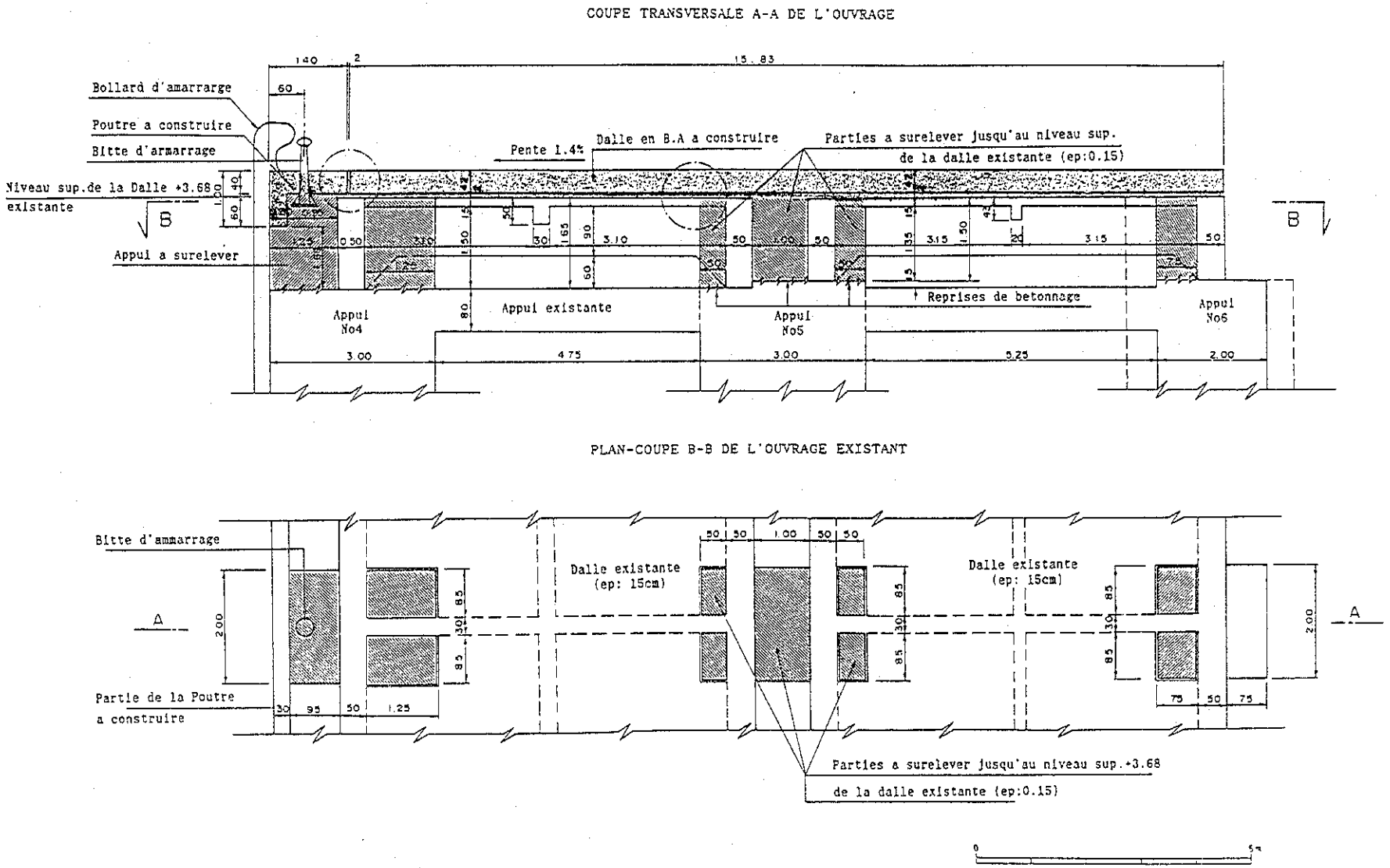


Figure A-5-5-3 Dalle et Paroi Frontale

JICA