REHABILITATION AND RECONSTRUCTION OF THE FISHING PORTS AND FISH-LANDING SITES IN ACEH PROVINCE AFTER THE TSUNAMI

INDONESIA

MISSION REPORT
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1. Executive Summary

The fisheries harbour expert visited the Tsunami-affected areas in Aceh Province in the period from 13 February to 13 March 2005, the fishing ports and fish-landing sites in the districts of Aceh Utara, Bireuen, Pidie, Aceh Besar, Aceh Barat and Aceh Barat Daya, and the towns of Lhokseumawe and Banda Aceh. The mission was a part of FAO Tsunami Response Team in Indonesia and in close cooperation with the Ministry of Marine Affairs and Fisheries (MMAF).

Fishing ports and fish-landing sites in Indonesia are officially classified into four categories, called Types A to D. Type D can be funded by the central government and run by local government, or both funded and run by local government. There are also smaller fish-landing sites that are community-, not government-organized. They are funded and run by district governments. These fish-landing sites will be called type E In this report. Types D and E are in line with FAO's target group, the small-scale artisanal fishers and processors.

Consultants for planning and designing the fishing ports and fish-landing sites are to be found in many districts. Consultants and contractors are classified in different categories according to the project size that they can handle. A reasonable number of contractors of all categories can be found in each district. All projects above Rp 50 million (about US$5 500) must be tendered for open bidding. There are usually a number of bids, with the lowest bid being about 80 to 85 percent of the cost estimate.

Cost estimates were made for a typical Type D and E facility, for the total reconstruction of river type site where no breakwater or dredging is needed. Included in the Type D facility, there are: a quay, a fuel facility, water supply, a well, an auction or market facility, a processing or handling facility, a packing and storing facility, an ice plant, ice storage facility, an office /laboratory for quality control for the government, a fishers meeting room, a WC and washroom, surface pavement of land area, drainage and a fence. Total cost infrastructure costs of a Type D facility including 10 percent for engineering and 10 percent for contingencies is Rp 3 650 million (US$ 400 000). Included in the Type E facility are: a quay, a fuel facility, water supply, an auction or market facility, an office /laboratory for quality control for government, a fishers meeting room, and WC and washroom. Total infrastructure cost for Type E facility, including 10 percent engineering and 10 percent for contingencies, is Rp 1 020 million (US$ 110 000).

This report identifies a number of sites where rehabilitation or reconstruction of the fishing ports and fish-landing sites is needed. This is a preliminary sum of activities as the assessment of infrastructure rehabilitation needs is ongoing and has not been finished. In one case, immediate actions for a short-term infrastructure programme were identified as having an estimated cost of US$50 000. As a medium-term programme for infrastructure 6 Type D and 19 Type E facilities were estimated at a total cost of US$7 490 000. This was not a complete list since the fisheries harbour expert did not get any information from three districts, Aceh Jaya, Nagan Raya and Simeulue. The need for ice plants was identified in two districts, for a total of five ice plants at an estimate of US$ 300 000. The need for consultants was established at 15 person/months for a national consultant for planning and structure, 8 person/months for a national coastal engineering consultant and 6 person/months for an International coastal engineering consultant.

Two projects are proposed that are not related to Tsunami damages on the fishing communities. Nonetheless, these projects fit in more with a long-term development programme are necessary for the development of the artisanal fishing communities and will help to create sustainable fishery. One of these projects is to establish a fishery school close to the new fishing port in Banda Aceh; the other is to establish public health centres that are

community-based clinics for the fishermen and workers in the fishing port. The clinics will help promote a clean and hygienic environment in the fishing industry.

During flights along the west coast of Aceh, from Banda Aceh to Meulaboh, it was clear that subsidence of land had occurred during the Tsunami. Lagoons appear inside the beach ridge parallel to the coastline, which evidently were not there before the Tsunami. In some places they are cut through by small rivers (see upper photo at the end of the report). Also, there are frequent breakthroughs in the beach ridge (see lower photo at the end of the report). These breakthroughs are not to be expected on stable sandy beaches. This can bee seen on photos at the end of this report.

2. FAO Tsunami Response Team in Indonesia

As a part of the FAO Tsunami Response Team in Indonesia and in close cooperation with the Ministry of Marine Affairs and Fisheries (MMAF) the fisheries harbour expert visited the Tsunami-affected areas in Aceh Province from 13 February to 13 March 2005. He visited fishing ports and fish-landing sites in the districts (*kabupaten*) of Aceh Utara, Bireuen, Pidie, Aceh Besar, Aceh Barat and Aceh Barat Daya, and the towns (*kota*) of Lhokseumawe and Banda Aceh.

3. Fishing ports in Indonesia

In Indonesia, fishing ports and fish-landing sites are officially classified in four categories, from Types A to D. There are few larger ports, Types A (PPS) and B (PPN), which can harbour larger fishing vessels, and are funded and run by the central government. Type C are medium-size coastal fishing ports for boats up to 30 GT, and funded and run by provincial or district governments. Type D is a smaller fishing port that can accommodate small boats usually up to 2 to 5 GT, but sometimes larger. Type D can be funded by the central government and run by local government (APBD), or funded and run by local government (APBD). If the port is in a district, then local government is the district government; if the port is in a provincial city (*kota*), then the local government is the provincial government.

Next, there are smaller fish-landing sites that are community-, not government-organized. They are funded and run by district governments. In this report, these fish-landing sites will be called Type E.

There is usually one district governmental employee at each Type D and E landing site, who collects data on fish landings. Fishing boats pay tax to local governments for landed fish. This tax depends on the type of fishing gear, the duration of the fishing trip, the size of boat and the price of fish.

Privately owned ports are called *tangkahan*. They can be medium to big fishing ports, and can accommodate 20 vessels larger than 100 GT on average.

The Type D ports and E landing sites are in line with FAO's target group, the small-scale artisanal fishers and processors.

4. Consultants and contractors

Consultants for planning and designing the fishing ports and fish-landing sites are found in many districts, including Aceh Utara, Banda Aceh and Aceh Barat Daya. They include architects and civil engineers with good structural backgrounds but lacking a coastal engineering background. Consultants are classified into three categories according to their project size:

Small consultancy firm, K	less than Rp 200 million
Medium-size consultancy firm, M	Rp 200 to 1 000 million
Large consultancy firm, B	Rp 1 000 million and over.

Contractors are classified into three categories according to their project size:

Small contractor	Rp 50 to 200 million
Medium-size contractor	Rp 200 to 1 000 million
Large contractor	Rp 1 000 million and over.

A reasonable number of contractors of all categories can be found in each district.

Government rules state that projects over Rp 50 million, or around US$5 500, must be tendered for open bidding. According to Mr Faisal, of CV. Q Design Consultant in Lhokseumawe, the lowest bid from a contractor is often around 85 percent of the cost estimate. According to Mr Susanto Sarijo of CV. Multi Cipta Consultant in Banda Aceh, there are often 40 bids for projects, sometimes up to 100. The lowest bid is usually around 80 percent of the cost estimate.

5. General recommendations for the fishing ports and fish-landing sites

Weighing facilities for registration of the catch should be included in the fishing ports. There are usually weighing facilities in the auction halls, but catch is only registered for trading.

It is important to include adequate facilities for collection of waste oil and all other kinds of waste in the fishing port.

The use of car tires as fenders and truck tires for larger boats was noted. It is recommended to cover the whole length of the quay with tires. If wave agitation at the quay is not high, car tires can be used for boats up to 5 or 10 GT, but it is recommended to use truck tires for larger boats. This system has been developed and used successfully in Iceland for many years.

The plans for the fishing ports should include facilities for hauling boats on land for repair and maintenance.

6. Cost estimate for reconstruction of typical Type D and E facility

Table 1. Type D, typical cost estimate for total reconstruction river type – no breakwater, no dredging

	In millions (Rp)
Quay	560
Fuel facility	200
Water supply facility	100
Well	120
Auction or market facility, *TPI*	270
Processing and handling facility	270
Packing and storing	144
Building for ice plant	180
Ice storage	230
Office for government / laboratory for quality control	200
Fishermen's meeting room	144
WC and washroom	58
Surface of land area	340
Drainage	84
Fence	150
Total contractor cost	3,050
Engineering, 10%	300
Contingencies, 10%	300
Total cost for infrastructure	**3,650**
Equivalent in **US$ 400,000**	

Table 2. Type E, typical cost estimate for total reconstruction river type – no breakwater, no dredging

Quay	300
Fuel facility	100
Water supply	100
Auction or market facility, TPI	150
Office for government / laboratory for quality control	100
Fishermen meeting room	80
WC and washroom	20
Total contractor costs	850
Engineering, 10%	85
Contingencies, 10%	85
Total infrastructure costs	**1,020**
Equivalent in US$110,000	

7. Description of possible FAO projects

Possible projects that FAO can implement or can facilitate to implement.

7.1 Aceh Utara

Fishing ports and fish-landing sites in Aceh Utara damaged by the Tsunami

In Aceh Utara, all three Type D (PPI) fishing ports or fish-landing sites and two out of four Type E have suffered total damage; and the other two Type E fishing ports were severely damaged. All four ice plants in the district with a capacity of 5 to 10 tonnes each are damaged.

Seunuddon. This is a Type D fishing port. Most facilities are reported destroyed. Apart from the Type D fishing port in Seunuddon, there is a Type E fish-landing site around 7 km away. It is reported completely damaged.

Tanah Pasir. Type D fish-landing site in Kuala Cangkoi (N 05° 10.738', E 97° 18.332') was completely destroyed by the Tsunami; neither buildings nor quays are left. The beach is reported to have been eroded by 50 to 200 m. A new landing site has been proposed further upstream in the river adjacent to a bridge that was damaged in the Tsunami (N 05° 10.148', E 97° 18.410').

Samudera. Type E fish-landing site is reported severely damaged.

Syamtalira Bayu. Type E fish-landing site is reported completely destroyed.

Muara Batu. Type D fish-landing site (N 05° 14.975', E 96° 35.170'). The quay is partly damaged but needs full reconstruction; all other facilities are completely destroyed. Around 70 boats were lost in the Tsunami. Estimated catch used to be around 20 t/day. The tidal difference is around 1.5 m.

Immediate actions or short-term programme

Immediate actions are needed to start up the fishing activities. Where this has not yet been done, it is recommended that a temporary quay facility be constructed adjacent to the planned reconstructed quay, including temporary fuel facility and water supply, and that damaged roads be repaired where this has not been done. The district and sub-district authorities who are the first to complete these actions would then be considered priority beneficiaries for the medium-term programme. ***It is not recommended that FAO support these immediate actions.***

Provision of turnkey mobile ice plants is also being considered.

Medium-term programme

A provisional cost estimate for reconstructing a Type D fishing port/fish-landing site totals US$ 400 000. This includes a quay, a fuel facility, a well and water supply facility, an auction and market facility (TPI), processing, handling, packing and storing facilities, an ice plant, an ice storage facility, an office for the government, a fishers meeting room and a WC and washroom, as well as surface coating, drainage and a fence. *This cost estimate is based on a river port with no sheltering structures or dredging.* The cost for reconstruction of a Type E fish-landing site is less than for the Type D and depends on the number of boats, the volume of catch and the required standard of the fish landing site. The initial estimate is a price range around US$ 110 000.

For the reconstruction of the three Type D fishing ports or fish-landing sites and one out of the three damaged Type E fish-landing sites, a total investment of approximately US$ 1 425 000 is needed. The beneficiaries of the proposed projects are the artisanal fishing communities.

Table 3. Reconstruction of fishing ports and fish-landing sites in Aceh Utara

Location	Type of facility	Cost (US$)
Seunuddon	Type D	400,000
Seunuddon	Type E	110,000
Tanah Pasir	Type D	400,000
Samudera	Type E	110,000
Syamtalira Bayu	Type E	110,000
Muara Batu	Type D	400,000
Total		1,530,000

It is recommended that the infrastructure projects be prepared and designed in detail by a national consultant applying local methods and standards, then tendered out for open bidding. Further, it is recommended that the fisheries administration (Dinas Kelautan dan Perikanan, or DKP) of the district be used to act as supervising authority for these projects, with follow up, supervision and backstopping from the funding organization.

Parallel to restoring fishing capacities, ice for conserving and handling catches must be available at economically viable prices for fish production. In Aceh Utara all four ice plants located at fish landing sites were destroyed by the Tsunami. The restoration of ice production capacities would enable remaining and production capacities to return to operating economically and sustainably, providing income and employment with comparatively little investment, and increasing food availability and diversity for local markets. Although the lost capacities vary, it is recommended to provide ice plants with a capacity of 5 tonnes/day. The rationale for this approach is to avoid creating parallel structures potentially competing with future private sector-based, market-led recovery of ice production. One option is that these plants will be operated by a fishermen's cooperative.

Unit costs will oscillate around US$ 45 000 to 50 000 excluding a generator, with additional capital outlay needs for a generator, cold storage, a deep well pump and initial operating capital per unit. The initial estimate of the total price is US$ 60 000. Procurement of ice plants can be done locally.

Table 4. Restoration of ice production in fishing ports and fish-landing sites in Aceh Utara

Location	Type of facility	Capacity	Cost (US$)
Seunuddon	Type D	5 tonnes/day	60,000
Tanah Pasir	Type D	5 tonnes/day	60,000
Syamtalira Bayu	Type E	5 tonnes/day	60,000
Muara Batu	Type D	5 tonnes/day	60,000
Total			240,000

Follow-up or detailed survey

It is proposed that FAO employ a qualified local architect as a national consultant in order to: conduct a detailed survey of the coast of the whole district of Aceh Utara; prepare a master plan for fish landings, auction facilities, ice plant and storage at the sub-district level; specify the requirements; and estimate the costs. FAO will then be able to offer technically sound reconstruction proposals to the international donor community.

7.2 Bireuen

Fishing ports and fish-landing sites in Pidie damaged by the Tsunami

A large Type D (PPI) fishing port is under construction in sub-district Peudada (N 05° 12.045', E 96° 35.170'). Only very limited damages occurred during the Tsunami. The contractor building the landing site is from Lhokseumawe, but the design came from a consulting company in Banda Aceh.

In Bireuen, four Type E fish-landing sites suffered damage – Jangka, Jeumpa, Jeunib and Samalanga, and all are located on rivers. All had quays with around 1 m water depth at low tide. All facilities were destroyed by the Tsunami in these fish-landing sites.

The tidal difference in Bireuen is 1.9 m and the yearly offshore wave height is around 3 m. There are two seasons, west and east season, each lasting around four months with 2 two-month periods between them.

Immediate actions or short-term programme

No immediate FAO actions are needed.

Medium-term programme

A provisional cost estimate for reconstructing a Type E fish-landing site totals US$ 110,000. This includes a quay, fuel facility, a well and water supply facility, an auction and market facility (TPI), a WC and washroom, and some dredging.

The beneficiaries of the proposed projects are the artisanal fishing communities and communities depending on aquaculture.

Table 5. Reconstruction of fishing ports and fish-landing sites in Bireuen

Location	Type of facility	Cost (US$)
Jangka	Type E	110,000
Jeumpa	Type E	110,000
Jeunib	Type E	110,000
Samalanga	Type E	110,000
Total		440,000

Contractors

In Bireuen there are five contractors registered for large construction work (>Rp 1 000 million), but none with experience in the construction of fishing ports or landing sites, and around 20 contractors registered for medium-size construction work (between Rp 200 million and Rp 1 000 million).

7.3 Pidie

Fishing ports and fish-landing sites in Pidie damaged by the Tsunami

In Pidie one Type D (PPI) fishing port and six Type E fish-landing sites have suffered total or near total damage. Both ice plants in Sigli – each with a capacity of 10 tonnes – are damaged.

Sigli is a Type D (PPI) fishing port, Meureudeu (Kuala Peukan Baro?), (N 05° 24.331', E 95° 56.148'). All fish-landing facilities were destroyed and 128 boats were lost in the Tsunami. When the Tsunami hit, a new quay structure was under construction, which was damaged as well. A local fisherman said that the navigational channel had moved east but there were still no navigational problems. Catch depends on season, but can be up to 100

tonnes/day. Some preliminary arrangements have already been carried out to enable the fishermen to land their catch.

The central government has plans to reconstruct the landing site and build a Type C, medium-size coastal fishing port at this location. The plan is to divert the river from the landing site with breakwaters and make a basin open to the sea. The immediate reply to this plan was that it would be better to have the landing site on the river because of the water quality and in order to prevent siltation. If there are valid reasons for making a closed basin, it might be necessary to make jetties on both sides of the opening of the harbour to the sea, instead of on one side only as in the plan. Since a Type C fishing port is not in line with FAO´s target group, FAO cannot be involved in its construction, but technical assistance from a coastal engineer might be useful.

In Sigli there are six Type E fish-landing sites and all suffered total or near-total damage – Pante Raja, Kembang Tanjong, Simpang Tiga, Pidie, Batee and Laweueng.

Immediate actions or short-term programme

No immediate FAO actions are needed.

Medium-term programme

It is recommended that FAO support the reconstruction of six Type E fish-landing sites in Sigli.

Table 6. Reconstruction of fishing ports and fish-landing sites in Pidie

Location	Type of facility	Cost (US$)
Pante Raja	Type E	110,000
Kembang Tanjong	Type E	110,000
Simpang Tiga	Type E	110,000
Pidie	Type E	110,000
Batee	Type E	110,000
Laweueng	Type E	110,000
Total		660,000

It is recommended that the infrastructure projects be prepared and designed in detail by a national consultant applying local methods and standards, then tendered out for open bidding. It is recommended that the fisheries administration of the district, DKP, act as supervising authority for these projects, with follow-up, supervision and backstopping from the funding organization.

The beneficiaries of the proposed projects will be the artisanal fishing communities.

Contractors

In Pidie, there are several contractors registered for large construction work (more than Rp 1 000 million), but none have experience in the construction of fishing ports or landing sites, and more than 20 contractors registered for medium-size construction work (between Rp 200 million and Rp 1 000 million).

7.4 Aceh Besar

Fishing ports and fish-landing sites in Aceh Besar damaged by the Tsunami

In Aceh Besar, there are five Type D (PPI) fishing ports and two Type E fishing fish-landing sites. The Type D ports are Leupung, Lhoknga, Peukan Bada, Pulo Aceh and Lambada Lhok, and the Type E facilities are Lhoong and Krueng Raya. Most facilities have suffered total or near total damage by the Tsunami, including ice plants.

Lambada Lhok is a Type D (PPI) fishing port site (N 5° 36.733', E 95° 23.463'). Prior to the Tsunami there were 125 boats, 90 of which were lost in the Tsunami, leaving 35 boats. All fish-landing facilities were totally damaged except for the quay and part of the concrete surface of the *PPI*. The Tsunami wave carried large volumes of sand and debris to the quay and navigational area. In some areas dredging of up to 2 m is necessary. An ice plant that was under construction no longer exists. A green belt is planned, extending from the quay out to the sea, around 200 m wide. Tidal difference is around 3 m. The Tsunami was described as coming from three sides with three waves of 15 minute periods and a reported height of 30 m.

The fisheries administration DKP in Aceh Besar has made a proposal for reconstructing the fish landing facility at Lambada Lhok. The work would be done by CV. Multi Cipta Consultant in Banda Aceh, an experienced national consultant. The proposal includes a plan for the facility and cost estimate. The cost estimate is divided into three parts:

- **Part 1** includes reconstruction of the quay, construction of an auction and market facility (TPI), a WC and washroom, a security post, fill material and concrete for land surface area. With 10 percent for consultancy and monitoring, Part 1 would total Rp 1 338 million.
- **Part 2** includes construction of an office, a boat repairing facility, buildings for packing, and an ice plant (20 tonnes), a fishermen community centre, a fuel facility, an office for the chief of port, a guest house, filling material, asphalt for roads, a fence, concrete for land surface area, a well, signage, a market facility and a lump sum for dredging (Rp 4 000 million). With ten percent for consultancy and monitoring, Part 2 would total Rp 8 841 million.
- **Part 3** includes construction of 229 houses for fishermen, Type 45. With 5 percent for consultancy and monitoring, Part 3 would total Rp 16 880 million.

Funding for Parts 1 and 3 have been secured from the district government in Aceh Besar, (Bupati office). **Funding for Part 2 is still needed – Rp 8 841 million or around US$1 million.** The main reason for the higher cost for reconstructing this Type D fishing port is that it includes considerable dredging.

According to DKP in Aceh Barat, it will take only around 10 days to finish detailed design of the project. There are usually five bids for projects of this type.

Krueng Raya is a Type E fish-landing site (N 5°35,603' E95°30.782'). Before the Tsunami there were 84 boats at this landing site, which were reduced to 60. There were also around 100 catamaran boats called *Palong* (Bagas), now reduced to around 50. The landing site is on a small river surrounded by reclaimed land and by a rubble mound breakwater structure. A three-tonne ice plant damaged by the Tsunami was being repaired at the time of the site visit.

All facilities at the landing site were destroyed. A reconstruction plan designed by CV. Multi Cipta Consultant in Banda Aceh includes a quay, an oil facility, a meeting room, protection of the riverbank and road construction. The cost of the plan is around US$ 52 000. The plan does not include dredging, which is needed, a WC, a washroom, or a water supply. With the addition of the above-mentioned facilities and contingencies, the recommended budget proposal is US$110 000.

No funding has been secured for the reconstruction of the fish-landing site.

Lhoknga is a Type D fish-landing site (N 5°28,356' E95°14.464') totally destroyed by the Tsunami. A reconstruction plan made by CV. Multi Cipta Consultant in Banda Aceh includes a quay, an oil facility, a meeting room, a packing facility, a market, a concrete platform and protection of the riverbank. The cost of the plan is around US$ 87 000. The plan does not include a well or water supply, an ice plant or ice storage building, an office for the government, a WC and washroom, drainage and a fence. With the addition of the above-mentioned facilities and contingencies, it is recommended that the budget proposal be US$ 300 000.

Immediate actions or short-term programme

For immediate actions, it is recommended to build a temporary quay facility, a temporary fuel facility and a water supply. It is also recommended that the district and sub-district authorities be requested to undertake these actions.

Provision of turnkey mobile ice plants is being considered.

Medium-term programme

It is recommended that FAO provide an international consultant in cooperation with a national coastal engineer and a national consultant for planning and detail design to review the plans for the reconstruction of the fishing ports and fish-landing sites in Aceh Besar.

Table 7. Provision of consultancies (in person/months) for the fishing ports and fish-landing sites in Aceh Besar

	National consultant Planning/structure	National consultant Coastal engineer	International consultant Coastal engineer
Aceh Besar	2 p/m	1 p/m	1 p/m
Total	2 p/m	1 p/m	1 p/m

It is recommended that FAO support the reconstruction of the Type D fishing port in Lambada Lhok. The district government of Aceh Besar has already offered funding for a part of the reconstruction. The remaining need for funding is around US$1 million, which would be supported by FAO.

Table 8. Reconstruction of fishing ports and fish-landing sites in Aceh Besar

Location	Type of facility	Cost (US$)
Lambada Lhok	Type D	1,000,000
Lhoknga	Type D	300,000
Krueng Raya	Type E	110,000
Lhoong	Type E	110,000
Total		1,520,000

It is recommended that the infrastructure projects be prepared and designed in detail by a national consultant applying local methods and standards, then tendered out for open bidding. It is recommended that the fisheries administration of the district, DKP, be used to act as the supervising authority for these projects, with follow up, supervision and backstopping from the funding organization.

In regard to ice production, the same implies as for Aceh Utara.

Table 9. Restoration of ice production in fishing ports and fish-landing sites in Aceh Besar

Location	Type of facility	Capacity	Cost (US$)

Lambada Lhok	Type D	5 tonnes/day	60,000
Total			60,000

The beneficiaries of the proposed projects will be the artisanal fishing communities.

7.5 Banda Aceh

Fishing ports and fish-landing sites in Banda Aceh damaged by the Tsunami

In Kota Banda Aceh, there are two fishing ports, Lampulo fishing port in the Krueng Aceh River (N 5°34,583' E95°19.373'), and Ulee Lheue located in deltas of the Krueng Lamteh River (N 5°33,411' E95°17.051'). Both are Type C medium-size coastal fishing ports. There are no Type D or E fishing ports or fish-landing sites in Kota Banda Aceh – both ports were destroyed by the Tsunami. Over the bridge at Ulee Lheue on a bar or reclaimed land, there is the Ulee Lheue commercial port. Large parts of the land in this area are now still under water according to DKP Banda Aceh, which is not due to land subsidence.

Before the Tsunami, there were plans to create a new fishing port in Banda Aceh, which would be upgraded to a Type B fishing harbour, and both locations were considered. The most likely location today is Lampulo Baru, a few hundred metres downstream from Lampulo. A report on the possible layout of the harbour has been made by IPB Bogor University, Marine Research Centre.

According to the plan, the harbour will be protected by two breakwaters with a wide entrance facing the main landing quay. The plan is provisional and needs revision by an experienced coastal engineer.

Near the harbour site there is the possibility of quarrying armour stone for breakwater construction and reasonably good road transport. It has been proven in many similar cases that rubble mound breakwaters of a berm type are the most economical structures (see all references below). Countries where berm-type structures have been used are Iceland, Norway, Iran and Brazil. It is recommended that the choice of breakwater type be based on a detailed cost estimate of various breakwater types including a berm breakwater.

Medium-term programme

It is recommended that FAO provide an international consultant in cooperation with a national coastal engineer to assist with the plans for the construction of the new fishing port in Lampulo Baru.

Table 10. Provision of consultancies for the fishing ports and fish-landing sites in Banda Aceh

	National consultant Planning/structure	National consultant Coastal engineer	International consultant Coastal engineer
Lampulo Baru	-	1 pm	1 pm
Total	-	1 pm	1 pm

Consultants and contractors

In Banda Aceh, there are over 50 consultant companies classified as small consultancy firms, around 25 medium-size and around 15 large. CV. Multi Cipta Consultant in Banda Aceh, the

firm that has made proposals for the fishing ports in Aceh Besar, is classified as a small consultancy firm with five civil engineers, two architects and one electrical engineer.

According to Mr Susanto Sarijo of CV. Multi Cipta Consultant, there are often 40 bids for projects, sometimes up to 100. The lowest bid is usually around 80 percent of the cost estimate.

7.6 Sabang

Fishing ports and fish-landing sites in Sabang damaged by the Tsunami

In Kota Sabang, there are two Type E fish-landing sites damaged by the Tsunami. The name of one of the sites is Krueng Raya. In both sites the landing facilities consist of an open pier. Both the pier and bridge to the land are constructed on piles.

Medium-term programme

It is recommended that FAO support the reconstruction of two Type E fish-landing sites in Sabang.

Table 11. Reconstruction of fishing ports and fish-landing sites in Sabang

Location	Type of facility	Cost (US$)
Krueng Raya	Type E	110,000
_____	Type E	110,000
Total		220,000

It is recommended that the infrastructure projects be prepared and designed in detail by a national consultant applying local methods and standards, then tendered out for open bidding. It is recommended that the fisheries administration, the DKP of the district, act as the supervising authority for these projects, with follow up, supervision and backstopping from the funding organization.

The beneficiaries of the proposed projects will be the artisanal fishing communities.

Before the Tsunami, the MMAF had plans to construct an international fishing harbour in Sabang. MMAF requested that FAO provide an international consultant in cooperation with a national coastal engineer and a national consultant for planning and design to review these plans and make a proposal for the layout of the harbour.

Table 12. Provision of consultancies for the fishing ports and fish-landing sites in Sabang

	National consultant Planning/structure	National consultant Coastal engineer	International consultant Coastal engineer
Sabang	1 p/m	1 p/m	1 p/m
Total	1 p/m	1 p/m	1 p/m

7.7 Aceh Jaya

Fishing ports and fish-landing sites in Aceh Jaya damaged by the Tsunami

In Aceh Jaya, the fishing port of Calang suffered total damage. According to Ir. Akmal Syukri, this fishing port was of a Type between D and E.

Other fishing ports in Aceh Jaya are in the sub-districts Sampoinit, Setia Bakti, Kota Calang, Panga, Teunom and Krueng Sabee. The fisheries harbour expert was not able to obtain information on the conditions of these fishing ports.

Medium-term programme

It is recommended that FAO provide an international consultant to cooperate with a national consultant coastal engineer and a national consultant for planning and design to assist with the planning of the reconstruction and rehabilitation of the fishing ports and fish-landing sites in Aceh Jaya.

Table 13. Provision of consultancies for the fishing ports and fish-landing sites in Aceh Jaya

	National consultant planning/structure	National consultant Coastal engineer	International consultant coastal engineer
Aceh Jaya	2 p/m	1 p/m	1 p/m
Total	2 p/m	1 p/m	1 p/m

7.8 Aceh Barat

Fishing ports and fish-landing sites in Aceh Barat damaged by the Tsunami

In Aceh Barat, one Type D (PPI) fishing port and one Type E fishing port have fish-landing sites that have suffered total or near total damage by the Tsunami. All ice plants with a capacity of up to 40 tonnes each were damaged.

In sub-district Johan Pahlawan **Meulaboh**, there is a Type D (PPI) fish-landing facility (N 4° 08.258', E 96° 07.852') located in a small river branch Kr. Cangkoei of the main river, Kr. Meureubo, with an outlet in the bay near the main headland. All facilities were destroyed.

Another fish-landing site was located near the fish market, a few hundred metres upstream in the river Pasar Ikan Meulaboh, (N 4° 08.476', E 96° 07.925'). A bridge over the river is an obstacle for boats to pass to the market upstream. Boats could still pass under the bridge at low tide. The landing site normally silted up twice a year, but deepened again naturally by the river. All facilities have been destroyed. A 40-tonne ice plant near this site is completely destroyed. Another ice plant of similar size located on the other side of the river was also destroyed. These plants supplied ice for the area between Blangpidie in the south and Calang in the north.

On the east side of the headland and near the tip is a quay for larger ships, probably a cargo quay (N 4° 08.041', E 96° 07.974'). No damages to this structure were immediately apparent.

The fishermen's village of **Meurebou** is one of the locations for a proposed fish-landing site (N 4° 08.850', E 96° 08.953'). It is located close to what used to be a small river branch to the main river, Kr. Meureubo, on the south bank. Due to subsidence, this river branch has now turned into a lagoon sheltered from the ocean by a wide barrier.

There is subsidence in this area of around 30 cm according to the Panglima Laot for the village, Mr B Husni. The barrier has lost more than 20 m of beach and the coastlines in the lagoon have also moved landward due to the subsidence. The navigational channel was 2 m

deep before the Tsunami and much narrower. The channel is now wider and shallower than before.

The fishermen would like the Type D facility (PPI) to be built in this site because it is very close to their homes.

A meeting was held with Mr Kaswaedi and Mr Amarulla, both of the *Dinas Kelautan dan Perikanan*, Aceh Barat office, Meulaboh. Over the last two or three years, two sites had been considered for the relocation of the fish landing site. First, it was agreed to construct it in the same river branch close to the existing site, **Site 1**. In 2004, this decision was revised and it was agreed to build a new fish-landing site in the main river, Kr. Meureubo, just upstream of the branch, **Site 2**. This decision has again been changed. A new master plan is being prepared.

The DKP office then considered a third location for the new fish-landing site, in the main river close to the river mouth and the fishing village of Meureubo, **Site 3**. The site offers several advantages: it has a relatively large area available for development, with space for fish processing facilities and related services. This is in contrast to the other two proposed sites, Sites 1 and 2, which are close to the town centre and have limited space. Site 3 has good road connections, is close to the main road south of Meulaboh and therefore provides a good connection to the airport. In contrast to a landing site in the small river branch, Site 1, which is narrow and shallow and limits the size of boats, a landing site in the main river would attract larger boats for landing their catch.

The fisheries harbour expert agrees with the fisheries administration DKP that Site 3 is an attractive and appropriate site to create a new fish-landing site, offering many opportunities for development. **It is therefore very important that this site be included in the master plan for Meulaboh**.

Since the river mouth of Kr. Meureubo is rather shallow, especially in the dry season, it is necessary to construct jetties on both sides to secure navigational water depth and to stabilize the river mouth. This project needs coastal engineering expertise. **The fisheries administration DKP requested that FAO field an international consultant to make plans for the channeling of the river mouth in cooperation with a national coastal engineer.**

Sama Tiga was a Type E fish-landing site on a river just downstream from a bridge; the landing site had few facilities and was not complete. The site is now completely damaged, as well as the bridge and the road south of the bridge. There is an alternative landing site, Kuala Bubon, used by some of the remaining fishermen in another river, but with many problems. After the government has made the master plan for this area, the DKP office can decide what to do. A military escort was needed to visit this site. Therefore, the site was not visited by the fishery harbour consultant and boat-building consultant. Information on the Sama Tiga fish-landing site was provided by Ir. Akmal Syukri, a national consultant stationed temporarily at the FAO office in Meulaboh.

Immediate actions or short-term programme

Immediate actions are needed to rehabilitate landing facilities in Meulaboh. It is recommended that FAO support the local authority to set up a temporary landing site. This includes clearance of debris and installation of a temporary quay structure, a temporary fuel facility and a water supply. The district and town authorities must decide on the location of the temporary landing site.

Table 14. Support to set up temporary landing sites in Aceh Barat

Location	Type of facility	Cost (US$)
Meulaboh	Type D	50,000
Total		50,000

Provision of turnkey mobile ice plants is being considered.

Medium-term programme

As a first step, it is recommended that FAO provide an international consultant to cooperate with the national coastal engineer and the national consultant for planning and detail design in order to make plans for the channeling of the river mouth.

This activity can be done in three steps: (ii) the planning phase, in close cooperation with the government; (ii) the pre-construction survey and design phase; and (iii) the construction phase, with investment either by international financial organizations such as the World Bank and the Asian Development Bank (ADB), or through an international banking institution.

Table 15. Provision of consultancies for the fishing ports and fish-landing sites in Aceh Barat

	National consultant For planning/structure	National consultant Coastal engineer	International consultant coastal engineer
Meulaboh	2 p/m	2 p/m	1 p/m
Total	2 p/m	2 p/m	1 p/m

It is recommended that the infrastructure projects be prepared and designed in detail by a national consultant applying local methods and standards, then tendered out for open bidding. It is recommended that the fisheries administration of the district, DKP, be used to act as supervising authority for these projects, with follow up, supervision and backstopping from the funding organization.

It is recommended that FAO support the reconstruction of a Type D fishing port in Meulaboh and a Type E fish-landing site in Sama Tiga. Table 16 sums up an initial estimate of the reconstruction cost for these fishing ports.

Table 16. Reconstruction of fishing ports and fish-landing sites in Aceh Besar

Location	**Type of facility**	**Cost (US$)**
Meulaboh	Type D	1,000,000
Sama Tiga	Type E	400,000
Total		1,400,000

7.9 Aceh Barat Daya

Fishing ports and fish-landing sites in Aceh Barat Daya damaged by the Tsunami

In Aceh Barat Daya, three Type E (PPI) fish-landing site suffered total or near total damage by the Tsunami – Susoh, Manggeng and Tangan Tangan.

Susoh is a Type E, small fish-landing facility (N 3° 43.083', E 96° 48.740'), located on the coast in a lee of a small promontory (*tombolo*), towards a coral reef. A small river runs to the sea on the northern part of the promontory. The landing site had a market/auction facility (TPI), which was destroyed by the Tsunami. There were four ice plants at the site, but now only two are producing ice.

Since the river was very small, it was not navigable for the larger boats and fish was first landed into small boats that were towed up to the shore. The total catch per day varied between 20 and 50 tonnes. Most of the boats were around 20 m long.

The tidal difference at the site is around 3 m. According to the Dinas representatives, the design wave height at the site is approximately 2 m, but a local fisherman said it was around 3 m. The fisheries harbour expert finds it likely that the design wave height outside the coral reef is higher than 4 m significant wave height. It was later confirmed by Mr Irwan Fakhry of MMAF in Jakarta that the yearly significant wave height was around 5 m.

Before the Tsunami, the Susoh landing site had been proposed to be upgraded to a Type D (PPI) fish-landing site with the construction of breakwaters and new land facilities. The planning of the harbour was done by a local consultant, Mr Salahuddin of CV. DEPCON in Blangpidie. The total cost to create the harbour is Rp 18 000 million, or around US$2 million, according to the plan.

The plan needs to be revised by an experienced coastal engineer because it underestimates the wave forces on the breakwater. The breakwater on the outer edge of the coral reef is exposed to unnecessarily high waves; the coral reef itself will be damaged by partly dredging the coral reef and partly making a landfilling on top of it. Further, the length of the breakwater is much too long for the required basin size. A more suitable solution would be to move the whole concept westward in the lee of the coral reef so that the outer breakwater is located on the inner side of the coral reef.

Representatives of the Dinas office requested that FAO field an international consultant to revise the plans for the fishing harbour.

Two other small landing sites in Aceh Barat Daya at **Manggeng** and **Tangan Tangan** were destroyed by the Tsunami. These landing sites had very few facilities. It was not possible to visit these landing sites. Still, there are no plans for reconstruction of these facilities. As an initial estimate it is assumed that the budget for the reconstruction is within the limits of US$ 110 000.

Immediate actions or short-term programme

No immediate actions are needed.

Medium-term programme

It is recommended that FAO support the reconstruction of three Type E fish-landing sites in Aceh Barat Daya. The initial cost estimate for the fishing port of Susoh is approximately US$1.5 million.

Table 17. Reconstruction of fishing ports and fish-landing sites in Aceh Barat Daya

Location	Type of facility	Cost (US$)
Susoh	Type E	1,500,000
Manggeng	Type E	110,000
Tangan Tangan	Type E	110,000
Total		1,720,000

As a first step, it is recommended that FAO provide an international consultant to cooperate with a national coastal engineer and a national consultant for planning and detail design in order to make plans for the channeling of the river mouth.

This activity can be done in three steps: (i) the planning phase, in close cooperation with the government; (ii) the pre-construction phase, survey and design; (iii) the construction phase, with investment either by international financial organization, such as World Bank or ADB, or an international banking institution.

Table 18. Provision of consultancies for the fishing ports and fish-landing sites in Aceh Barat Daya

	National consultant for planning/structure	National consultant Coastal engineer	International consultant Coastal engineer
Susoh	2 p/m	2 p/m	1 p/m
Total	2 p/m	2 p/m	1 p/m

7.10 Simeulue

Fishing ports and fish-landing sites in Simeulue damaged by the Tsunami

In Simeulue, there are fishing ports and fish-landing sites in the sub-districts Simeulue Timur, Salang, Simeulue Barat, Alfan, Teluk Dalam, Simeulue Tengah, Teupah Selatan and Teupah Barat. The fisheries harbour expert was not able to obtain information on the conditions of these ports.

7.11 A fishery school and a public health centre

It is recognized that the following two proposed projects are not a result of the Tsunami damage on the fishing communities in Sumatra. Nevertheless, these projects fit in more with a long-term development programme needed for developing the artisanal fishing communities and to help create a sustainable fishery.

It has been proposed to establish a vocational school in fisheries located close to the new fishing port in Banda Aceh. This school will act as a centre for development of the fishery.

The rationale of the fishery school is as follows:

- A new generation of fishermen would be prepared with more advanced skills in fishing, sailing, handling catch and machine driving than their parents.
- The school could be cheaper for fishermen or the community near fishing ports to send their children to school than that further, or in other provinces.

- Since education is expensive, most fishers are too poor to be able to send their children to colleges. This vocational school, which would be run by government, can help students improve their living standards after completing their education.

It has been proposed to establish a public health centre, or *Puskesmas*, which is a community-based clinic headed by a doctor. (*Puskesmas* stands for "*Pus at Kes ehatan Mas yarakat*", which means Centre for Public Health.). A *Puskesmas* is needed in an environment such as a fishing port. People who handle fish should be healthy and free from skin and other contagious diseases since fish is raw material for food that could affect human health. After arriving from the sea, sick or injured fishermen could be carried to the nearest polyclinic for cures or other treatment. All workers in the fishing port area and people who live nearby will also receive the benefits from the polyclinic. A clean and hygienic environment in the fishing port is important.

8. Summary of FAO activities

A review of rehabilitation needs for the small-scale fishing ports and fish-landing sites is presented in Tables 19 to 22. These can be used to define possible projects that FAO can assist in or fully implement. This is a preliminary sum of FAO activities because the assessment of infrastructure rehabilitation needs is still ongoing.

Table 19. Immediate actions short-term programme – infrastructure

Location	Type of facility	Cost (US$)
Aceh Barat	Temporary landing site	50,000
Total		50,000

Table 20. Medium-term programme – infrastructure

Location	Type of facility	Cost (US$)
Aceh Utara	3 Type D and 3 Type E	1,530,000
Bireuen	4 Type E	440,000
Pidie	6 Type E	660,000
Aceh Besar	2 Type D and 2 Type E	1,520,000
Sabang	2 Type E	220,000
Aceh Jaya	?	
Aceh Barat	1 Type D and 1 Type E	1,400,000
Nagan Raya	?	
Aceh Barat Daya	1 Type E	1,720,000
Simeulue	?	
Total		7,490,000

Table 21. Medium-term programme – ice plants

Location	Number of ice plants	Cost (US$)
Aceh Utara	4	240,000
Aceh Besar	1	60,000
Total		300,000

Table 22. Medium-term programme – consultancies

	National consultant planning/structure	**National consultant coastal engineer**	**International consultant coastal engineer**
Aceh Utara	2 p/m	-	-
Bireuen	2 p/m	-	-

Pidie	2 p/m	-	-
Aceh Besar	2 p/m	1 p/m	1 p/m
Banda Aceh	-	1 p/m	1 p/m
Sabang	1 p/m	1 p/m	1 p/m
Aceh Jaya	2 p/m	1 p/m	1 p/m
Aceh Barat	2 p/m	2 p/m	1 p/m
Nagan Raya	n.a.	n.a.	n.a.
Aceh Barat Daya	2 p/m	2 p/m	1 p/m
Simeulue	n.a.	n.a.	n.a.
Total	15 p/m + ?	8 p/m + ?	6 p/m + ?

9. Subsidence of the west coast of Sumatra

The flight between Banda Aceh and Meulaboh provided a good opportunity to view the coastline. Subsidence of land is evident, especially on the southern part of the coastline near Meulaboh. There are lagoons inside the beach ridge parallel to the coastline that evidently were not there before the Tsunami, and in some places are cut through by small rivers (see photos at the end of the report). Also, there are frequent breakthroughs in the beach ridge, second photo. These breakthroughs are not to be expected on stable sandy beaches. More photos can be seen on the separate compact disk (CD).

It should be noted that the subsidence of the land has the same effect as sea level rise on the land – sea interaction. According to the Bruun's rule, 1 cm of land subsidence will lead to a shoreline retreat of approximately 30 cm depending on several parameters. Since the sea waves, especially long ocean waves, are the most important force in forming the beach, it can take one or two windy seasons to form a stable beach.

Coastline north of Meulaboh
Note the lagoon parallel to the coastline is cut through by small rivers.

Coastline north of Meulaboh
The beach ridge is cut by breakthrough and the estuary does not seem to be stable.

10. References

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ANNEX A PHOTOS

Photos taken during the site visits to fishing ports and fish-landing sites in Aceh Province have been burned onto a CD and sent separately by post to FAO. The photos have been arranged separately in folders for each port and landing site. Table 23 lists the name of the picture folders. Requests to Sigurdur Sigurdarson for photos can be made by email to sigurdur@sigling.is.

Table 23. Photos taken during site visit of the fisheries harbours expert to Aceh Province from 13 February to 13 March 2005

Name of folder
Aceh Barat - Meulaboh - Cargo quay
Aceh Barat - Meulaboh - Johan Pahlawan
Aceh Barat - Meulaboh from the air
Aceh Barat - Meureubo fishing village
Aceh Barat Daya - River landing near Susoh
Aceh Barat Daya – Susoh
Aceh Besar – Krueng Raya
Aceh Besar - Lambada Lhok
Aceh Besar – Lhoknga
Aceh Jaya – Calang from the air
Aceh Utara - Meeting with Panglima Laot and DKP
Aceh Utara - Muara Batu
Aceh Utara - Tanah Pasir - Kuala Cangkoi
Air photos - between Meulaboh and Banda Aceh
Bada Aceh – Ulee Lheue
Banda Aceh
Banda Aceh – Lampulo
Bireuen – Peudada
Lhokseumawe - Fishing village
Lhokseumawe - Fish market, fish processing
Sigli - Sigli – Meureudeu

ANNEX B LIST OF USEFUL CONTACTS

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