PIANC 125th Anniversary Celebration in ASIA, Nagoya JAPAN
12-14 September 2010

Dredging and environment : MARCOM contributions

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Dredging and environment : MARCOM contributions

1- Former MARCOM reports dealing with dredging

2- Ongoing MARCOM reports

3- Recent presentations from PIANC in Liverpool

4- MARCOM networking about port dredging

5- Concluding remarks

1- Former MARCOM reports

WG 3-A Navigation in muddy areas

WG 6 Classification of soils and rocks to be dredged (to be updated by WG 144)

WG 10 Disposal of dredged materials into sea

WG 14 Economical channel maintenance

WG 19 Beneficial use of dredged materials

WG 23 Site investigations for dredging works

WG 3A Navigation in muddy areas : introduction of nautical depth

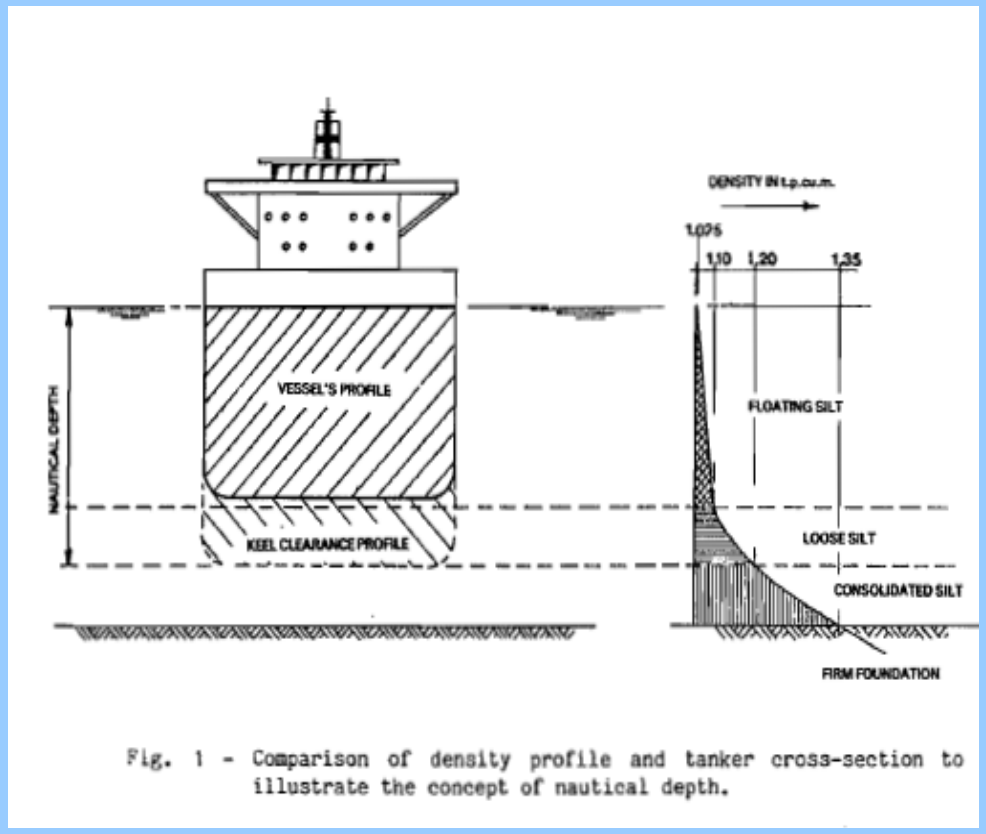

Fig. 1 - Comparison of density profile and tanker cross-section to illustrate the concept of nautical depth.

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WG 6 Classification of soils and rocks to be dredged (*1984 supp Bullet 46 to be updated by WG 144*)

First introduced in 1968 as International Study Commission together with IADC and ISSMFE , completed in 1972 and revisited and published in 1982

Attempt to classify soils and rocks And to recall tests and sampling techniques

Geoffro

TABLE 1 : GENERAL BASIS FOR IDENTIFICATION AND CLASSIFICATION OF SOILS FOR DREDGING PURPOSES

Main Soil Type	Particle size identification Range of size (mm)	Identification	Particle nature and plasticity	Strength and Structural Characteristics
Boulders Cobbles	Larger than 200 mm Between 200 - 60 mm	Visual examination and measurement (3)	Particle shape : Rounded Irregular Angular Flaky Elongated Flaky and elongated Texture : Rough Smooth Polished	N.A.
Gravels	Coarse 60 - 20 Medium 20 - 6 Fine 6 - 2 mm	Easily identifiable by visual examination		Possible to find cemented beds of gravel which resemble weak conglomerate rock. Hard-packed gravels may exist intermixed with sand.
Sands (4)	Coarse 2 - 0.6 Medium 0.6 - 0.2 Fine 0.2 - 0.06 mm	All particles visible to the naked eye. Very little cohesion when dry.		Deposits will vary in strength (packing) between loose, dense and cemented. Structure may be homogeneous or stratified. Intermixture with silt or clay may produce hard-packed sands.
Silts (4)	Coarse 0.06 - 0.02 Medium 0.02 - 0.006 Fine 0.006- 0.002 mm	Generally particles are invisible and only grains of a coarse silt may just be seen with the naked eye. Best determination is to test for dilatancy (1). Material may have some plasticity, but silt can easily be dusted off fingers after drying and dry lumps powdered by finger pressure.	Non-plastic or low plasticity	Essentially non-plastic but characteristics may be similar to sands if predominantly coarse or sandy in nature. If fine will approximate to clay with plastic character. Very often intermixed or interleaved with fine sands or clays. May be homogeneous or stratified. The consistency may vary from fluid silt through stiff silt into "siltstone".
Clays	Below 0.002 mm. Distinction between silt and clay should not be based on particle size alone since the more important physical properties of silt and clay are only related indirectly to particle size.	Clay exhibits strong cohesion and plasticity, without dilatancy. Moist sample sticks to fingers, and has a smooth, greasy touch. Dry lumps do not powder, shrinking and cracking during drying process with high dry strength.	Intermediate plasticity (Lean clay) High plasticity (Fat clay)	Strength — Shear Strength (2) V. Soft — May be squeezed easily between fingers. — Less 20 kN/m² Soft — Easily moulded by fingers. — 20-40 " Firm — Requires strong pressure to mould by fingers. — 40-75 " Stiff — Cannot be moulded by fingers, indented by thumb. — 75-150 " Hard — Tough, indented with difficulty by thumb nail. — Above 150 " Structure may be fissured, intact, homogeneous, stratified or weathered.
Peats and Organic soils	Varies	Generally identified by black or brown colour, often with strong organic smell, presence of fibrous or woody material.		May be firm or spongy in nature. Strength and structure may vary considerably in horizontal and vertical directions. Presence of gas should be noted.

WG 10 Disposal of dredged materials into sea(*1986 supp Bullet 52*)

Introduced by US section in Monaco 1982 in order to consider sea disposal as alternative solutions based on scientific evidence

Three basic solutions

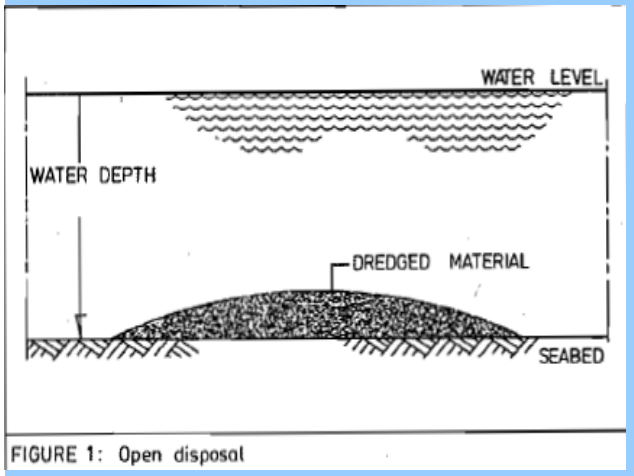


FIGURE 1: Open disposal

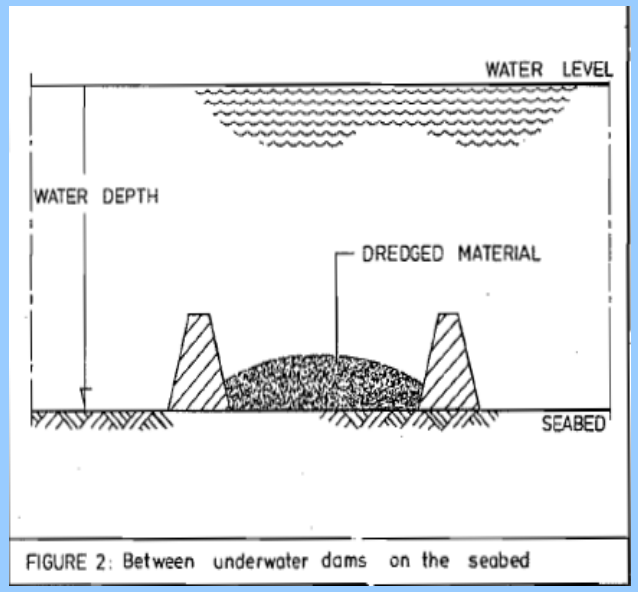


FIGURE 2: Between underwater dams on the seabed

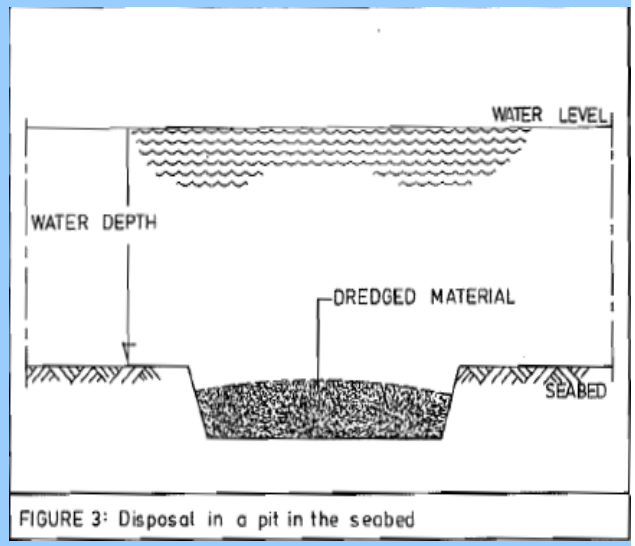


FIGURE 3: Disposal in a pit in the seabed

A fourth case with artificial island

And cases where the dredged material is capped due to contaminants within* sediments

Appendix 1 :
effects of disposal scientific data

Appendix 2: Convention on the Prevention of maritime Pollution (MARPOL)by dumping Of wastes and other matter

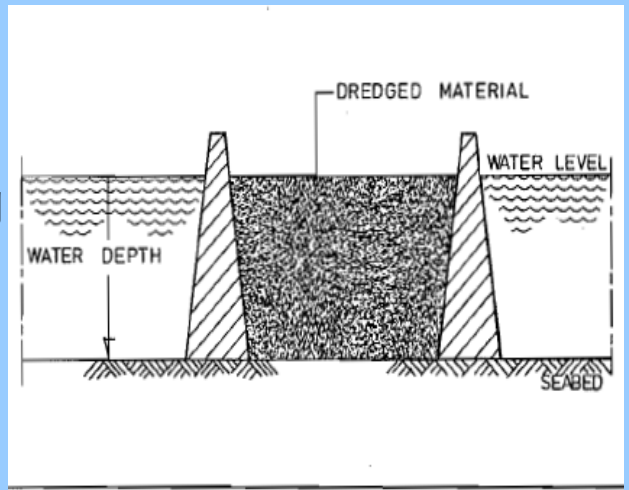


FIGURE 4: Disposal in an artificial island at sea

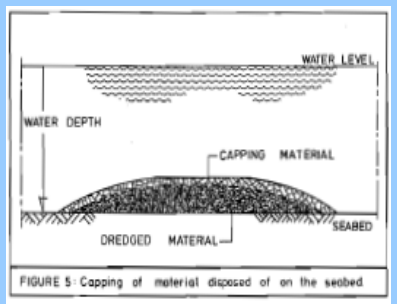


FIGURE 5: Capping of material disposed of on the seabed

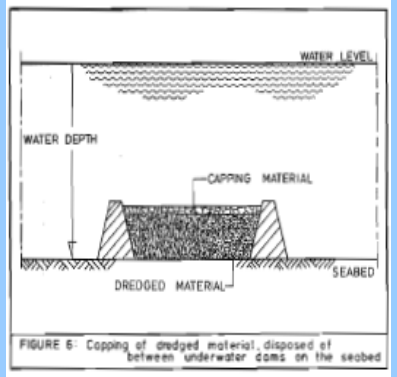


FIGURE 6: Capping of dredged material, disposed of between underwater dams on the seabed

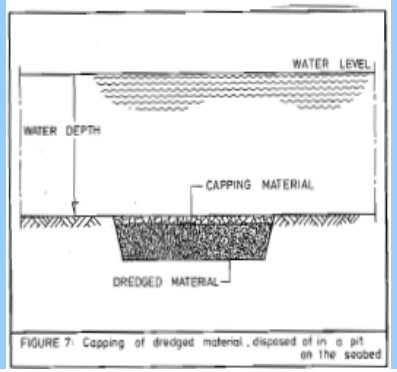


FIGURE 7: Capping of dredged material, disposed of in a pit on the seabed

WG 14 Economical channel maintenance ‘1989 supp Bullet 67)

Mainly derived by dredging managers working in dredging companies or port authorities with practical solutions for contracts

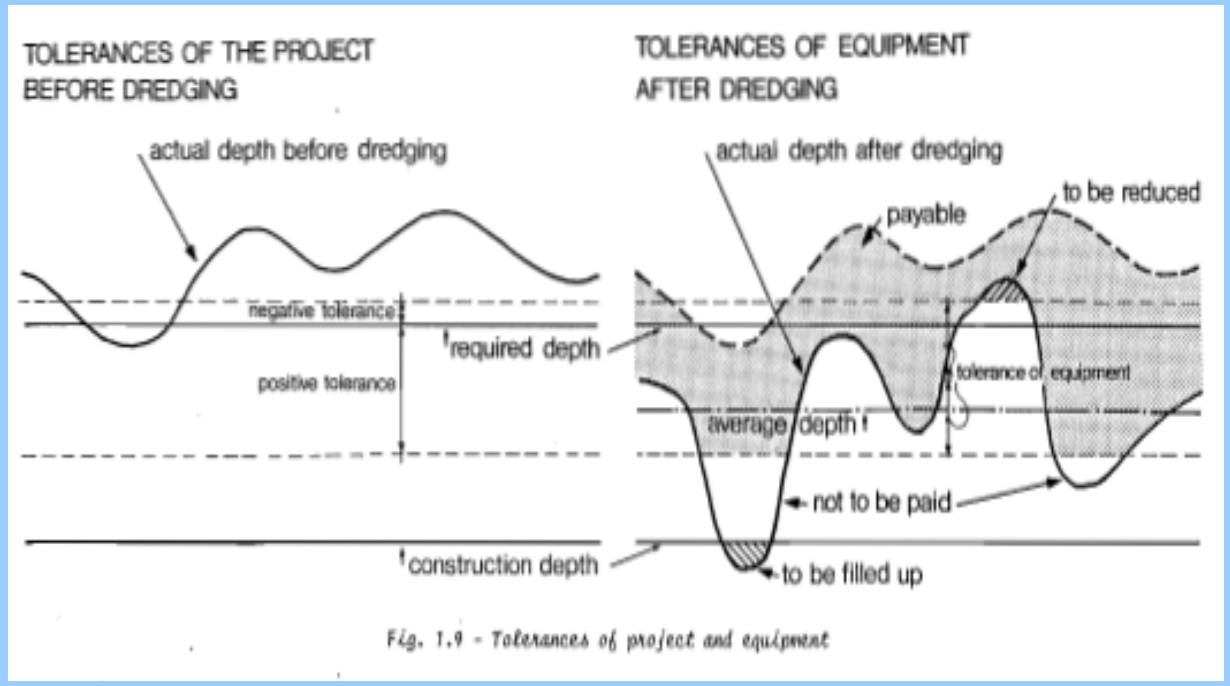


Fig. 1.9 - Tolerances of project and equipment

WG 14 Economical channel maintenance ‘1989 supp Bullet 67)

Describing also land disposal facilities

Fig. 5.14 : The "Parrot's Beak" is being filled with heavily polluted material. The jetty at the bottom of the photograph is for self-unloading hopper dredgers. (With kind permission of the Port of Rotterdam)

Fig. 5.3 : Construction of the Hart-Miller Island disposal area in the U.S.A. The dike was protected with layers of rock of increasing sizes. (With kind permission of Great Lakes Dredge & Dock Company).

WG 19 Beneficial use of dredged materials (PIANC 1992) : a practical guide

Many examples :

Football soccer field in Rouen

Golf course in the Netherlands

WG 19 Beneficial use of dredged materials (PIANC 1992) : a practical guide

Other examples :

Beach nourishment in Belgium

Dredged material containment
Area used for aquaculture(USA)

WG 23 Site investigations requirements for dredging works – *2000 Supp Bullet 103*

The report summarizes different in situ and laboratory investigations and considers also the contract for those tests through FIDIC (IFCE) standards

Table 6.5: In SITU tests appropriate for dredging ground investigations

TEST	MATERIAL TYPE	MEASURED PROPERTIES OR CHARACTERISTICS	REMARKS
Field shear vane	Soft to firm clay, clayey silts	Undrained shear strength, remoulded shear strength	Carried out in boreholes
Quasi-static cone penetration test	Most soils except coarse gravels, cobbles and boulders	Relative density of granular soils, shear strength of cohesive soils	
Standard penetration test	Most soils except cobbles and boulders, weak rocks	Relative density of granular soils, indicative shear strength of cohesive soils, indicative strength of weak rock	Carried out in boreholes
Dynamic cone penetration test	Sands and gravels	Qualitative evaluation of compactness/relative density, qualitative evaluation of sub-soil stratification	
Permeability test	Granular soils	Mass permeability	Carried out in boreholes
Trial dredging	Soils and rocks	Dredgeability	

2- ongoing or recent MARCOM

MARCOM 43 Minimizing harbour siltation

MARCOM 51 Water injection dredging

MARCOM 144 Classification of soils and rocks for the maritime dredging process (updating of WG 6

WG 43 Minimising harbour siltation (2008)

Describes three alternative techniques to cope with sedimentation :

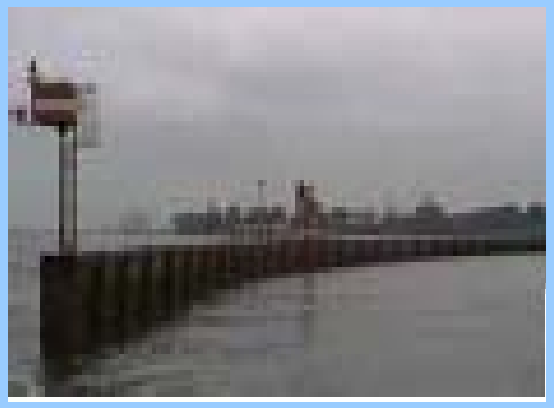
KSO: keep sediment out of the port

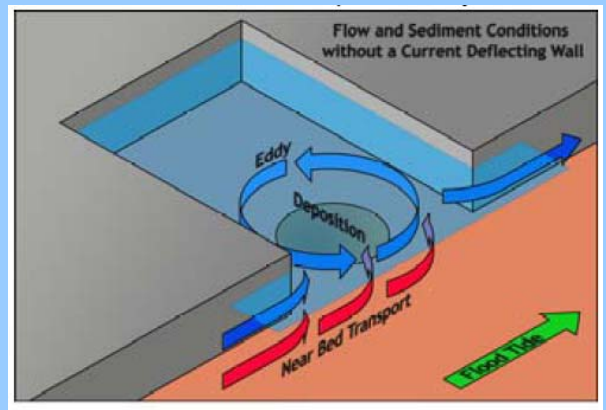
KSM: keep sediment moving (raising flow velocities in quiescent areas)

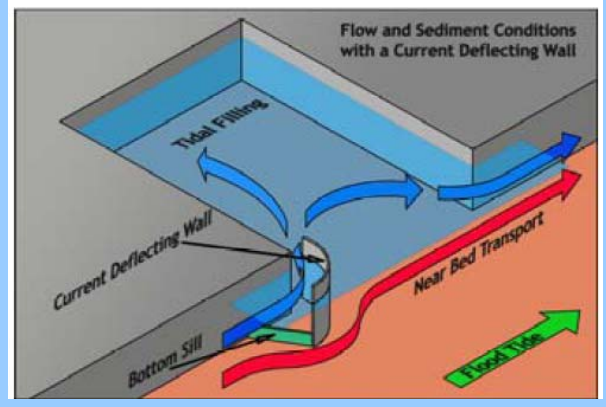
KSN : keep sediment navigable (passive or active and introduced by the nautical depth concept)

WG 43 Minimising harbour siltation (2008)

KSO: keep sediment out of the port by means of a current deflecting wall
; example Köhlfle Port of Hamburg







WG 43 Minimising harbour siltation (2008)

KSO: keep sediment out of the port by means of training walls- Kumamoto - Japan

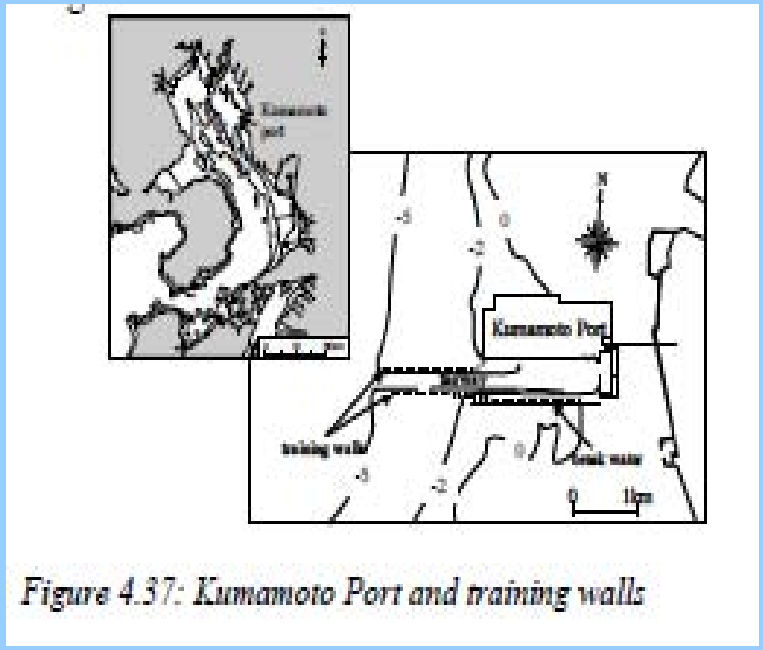


Figure 4.37: Kumamoto Port and training walls

WG 43 Minimising harbour siltation (2008)

KSM: keep sediment moving through mechanical devices by means of scour jets or vortex foils

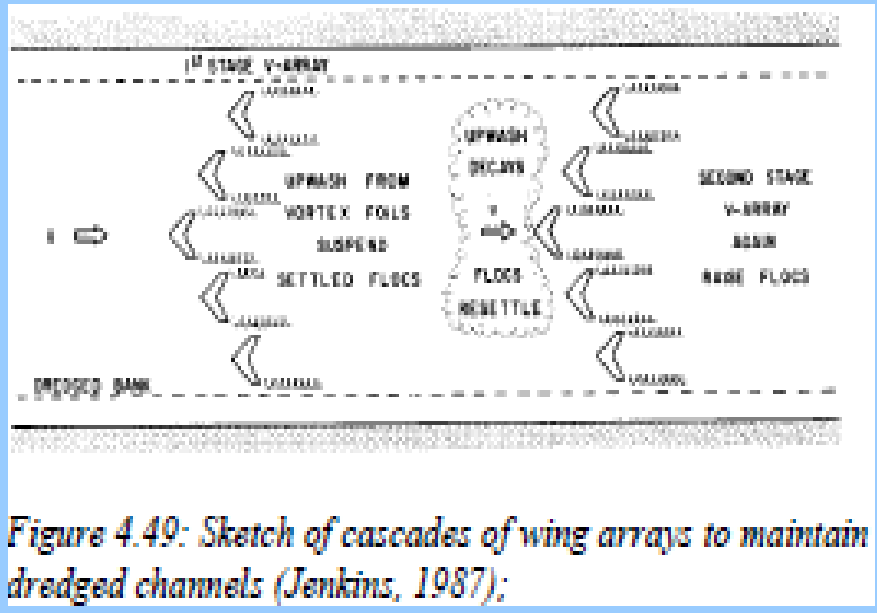


Figure 4.49: Sketch of cascades of wing arrays to maintain dredged channels (Jenkins, 1987);

WG 43 Minimising harbour siltation (2008)

KSN: keep sediment navigable through active nautical depth
Example : Emden – Germany

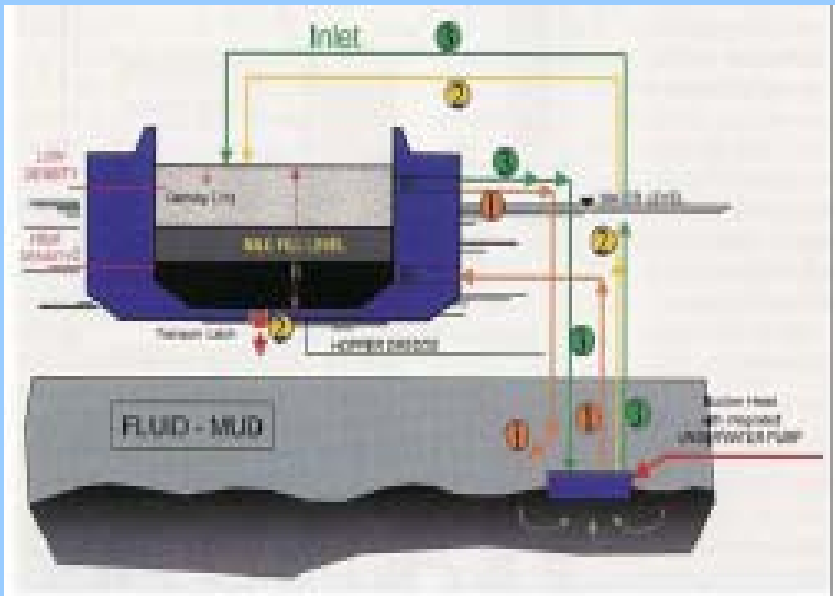


Figure 4.55: Self-propelled hopper with low power under-water pump for infrequently fluidising, raising, oxidising and redepositing fluid mud. (Wurpts, 2005).

MARCOM 51 Water injection dredging

Objective of the study:

Give guidance when Water Injection Dredging is feasible.
Give guidance on payment conditions for contracts between the contractor and the client.
Give guidance on environmental effects of Water Injection Dredging

Report presented at the next MARCOM meeting (Ostende september 2010)

3- Recent presentations from PIANC in Liverpool

76 Min Gao-Qijn Fan : New progress on the research of navigation channel in Yangtse estuary

168 J.van't Hoff and al : Hydraulic fills manual

246 P.M.Vercruijsse : Steps towards development of green dredging teconologies

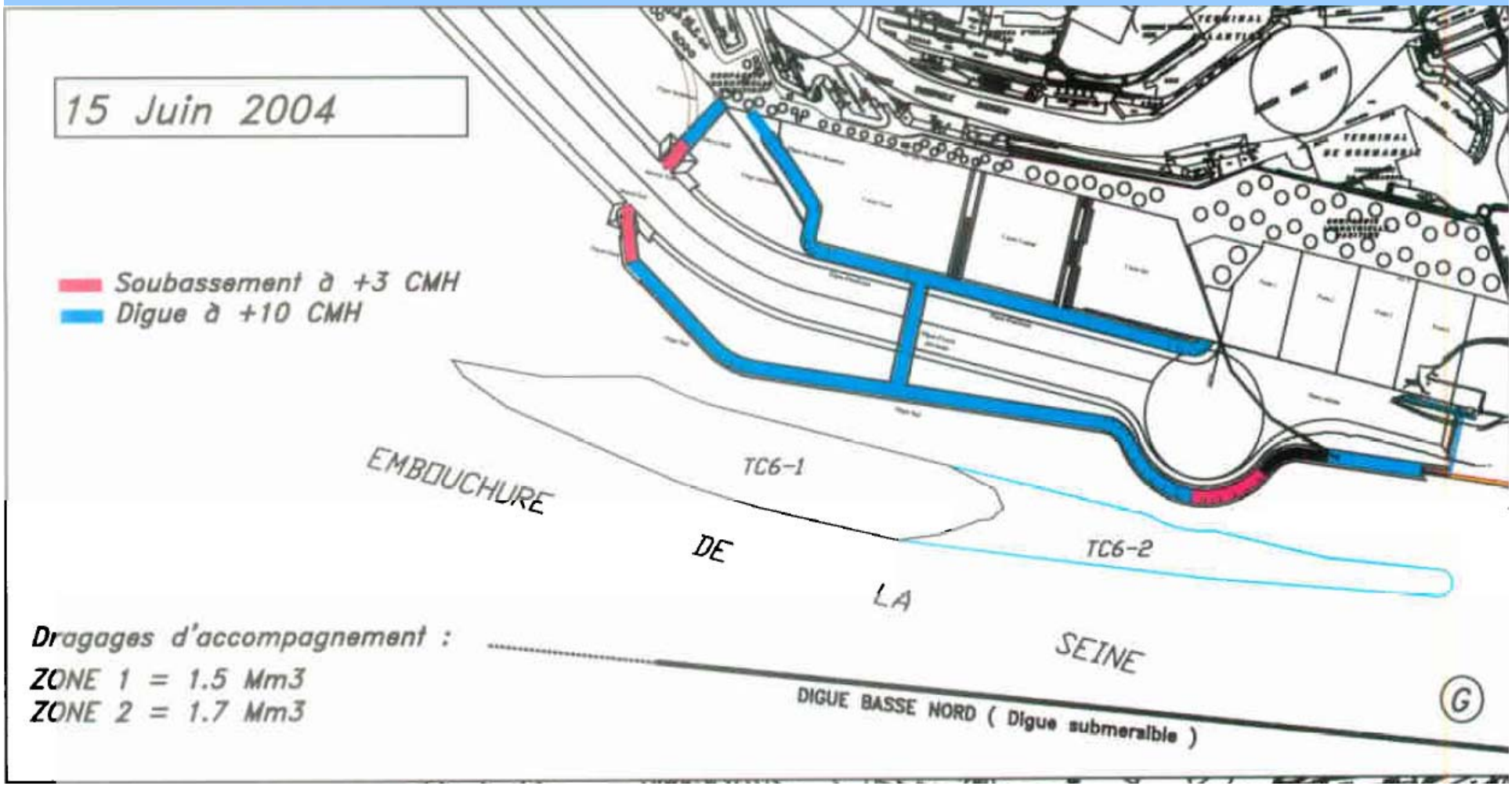
4- MARCOM networking about port dredging

4-1 MARCOM 2005 Le Havre – PORT 2000 and the river Seine estuary sedimentation pit case

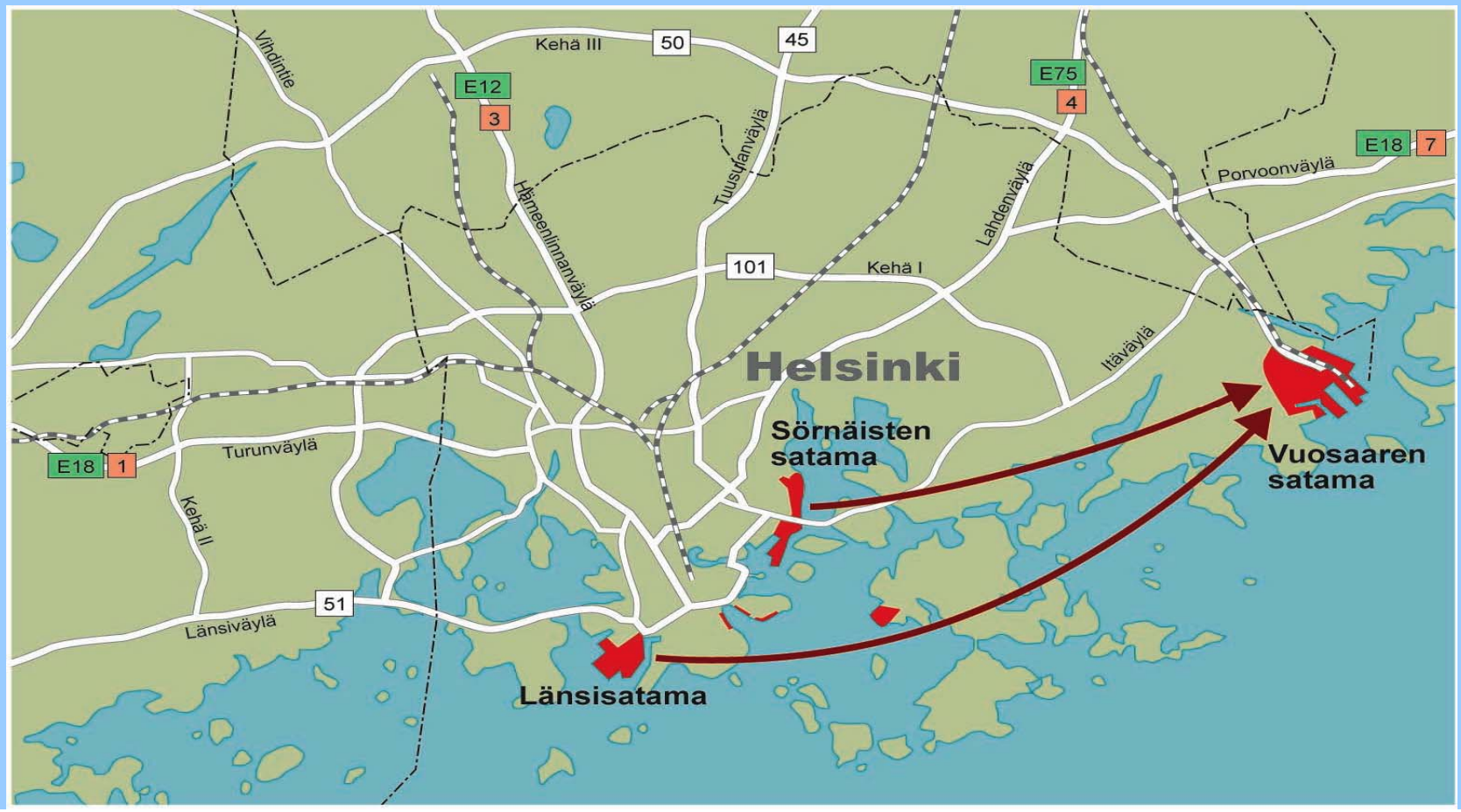
4-2 MARCOM 2007 Helsinki -Vuosaari port works : dealing with TBT during works

4-3 MARCOM 2010 Ostende

4-1 MARCOM 2005 Le Havre- PORT 2000 at the mouth of the river Seine estuary: sedimentation pit created



4-2 MARCOM 2007 Vuosaari port works (port of Helsinki-Finland): dealing with TBT during works



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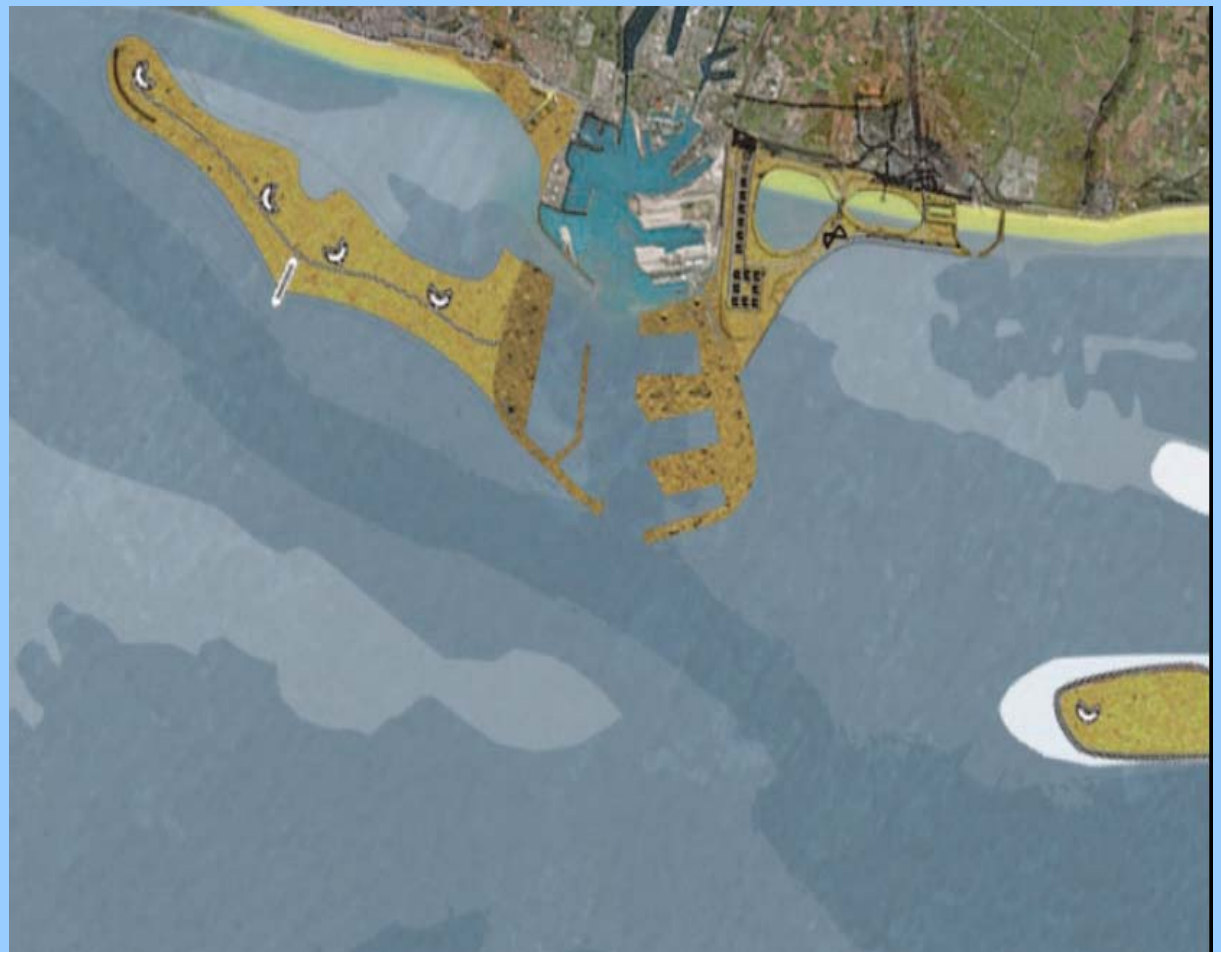
Expert group on sedimentation topics


Le barrage
Le couesnon
Moidrey
Parking
Stationnement
Le Mont-Saint-Michel
Epi écarteur Ouest
Epi écarteur Est
Terre-plein et gué
Epis Ouest
Seuil de partage
Digue-route actuelle
Pont-passerelle
Epis déflecteurs
Epis Est (à adapter en fonction du nouveau tracé de la digue-route et du pont-passerelle)
Polders de l'Ouest
GR 34
Ouvrage plein (digue-route)
GR 22
Barrage
La Caserne
Vers Avranches
Couesnon
Parc de stationnement
Vers Pontorson

MARCOM 2010 Ostende-Zeebrugge
Vlaamse baaien 2100



5- Concluding remarks