REGULAMENTAÇÃO PARA DRAGAGENS OFFSHORE EM DIFERENTES PAÍSES

(reproduzido de http://sandpit.wldelft.nl/workpage/right/wp2/dredging_regulation_table.htm)

1. Reino Unido

Items	Description
Future demands of sand and gravel coming 50 years (volumes in m^3)	500 to 1000 million m^3 sand and gravel of which about 50% gravel; annual demands over the last 5 years are about 24 millions of tonnes.
Purpose of mined sediment	General construction (aggregate for concrete), export, land reclamation, beach nourishment.
Overview of existing and future mining locations	Five main areas: Bristol Channel (sandbanks), South Coast either side of Isle of Wight, outer Thames estuary, and east coast off Great Yarmouth and off the mouth of the Humber (www.crownestate.co.uk). A potential new area (eastern English Channel) is now being investigated.
Overview of monitored mining pits and studies done	Many "Coastal Impact" and "Environmental Impact" studies for offshore dredging areas, with some subsequent monitoring. Studies and monitoring of nearshore shingle bank dredged for beach recharge (off Hurst Spit). Some data on infill of "accidental" pits off Bournemouth (1974/75).
Authorities and legal aspects involved	Office of Deputy Prime Minister (ODPM) (Waste and Minerals Division) – and equivalent bodies in Wales (Welsh Assembly Government) and Scotland (Scottish Executive) act as planning authorities and consult with . Dept of Environment, Food and Rural Affairs (DAFS in Scotland); Environment Agency; Local Councils; National Conservation bodies (English Nature, Countryside Council for Wales) etc. Seabed "owners", mainly the Crown Estate, arrange civil law contracts with dredging contractors, and monitor activities (e.g. amounts taken from where) but only after permission from Government.
Consultation procedure	Licensing system for offshore dredging started in 1963. Dredging companies now submit an application for a licence to the ODPM (or equivalent) to dredge a defined area at a given rate, having first agreed their proposals with the landowner (normally the Crown Estate), to avoid overlapping extraction areas etc. ODPM advise the applicants on their requirements for consultations and assessment of impacts of proposed

Items	Description
	dredging. This includes both a Coastal Impact Study and a wider-ranging Environmental Impact Assessment, and the Applicant has free choice on the selection of an appropriate consultant to carry out such studies. Once these reports have been written, with consultations normally undertaken before (to establish scope) and during the reporting, ODPM undertake further consultations on the basis of the Applicant's reports. They then decide whether to refuse permission for extraction, or grant it (usually subject to conditions) or to require further studies. Permissions now given for 15 years but can be withdrawn without notice if adverse effects occur. Once permission has been given by appropriate "competent authority", the Applicants enter a civil law contract with the seabed owners, including an agreed rate for each tonne extracted. Because the present system is presently non-statutory, there is no right of appeal against a decision.
Hydro and morpho-evaluation methods	Within the Coastal Impact Study, the following phenomena are studied and evaluated: 1) the beach should not be affected from draw-down into the dredged area (no permanent trapping of sediments of beach into dredged pit); 2) the supply of sediments to the coastline should not be affected; 3) any bars and banks providing protection to the coast from wave attack should not be damaged/affected; 4) any significant changes in wave refraction patterns altering nearshore waves and hence the alongshore transport of sediment 5) any changes to tidal currents close to the coastline. Item 2 requires an estimation of modified flow and wave patterns,. of changes to sediment transport over seabed and hence to (coastal) morphology based on regional and local modelling and existing field data. (e.g. bedforms, sediment distribution/ mobility calculations).
Ecological evaluation method	An environmental assessment report is required, often concentrating on the production of turbid plumes and deposition of sand or finer-grained sediment on the seabed outside the extraction area. Includes a description of existing environment and of the impacts of proposed

Items	Description
	dredging compared with alternatives. Consideration of "cumulative impacts" of multiple dredging (or other) activities in same general region.
Type of regulations and criteria	No fixed limits, but rare in water depths less than 15m (lowest tide). Each application subject to specific studies of effects on coast and of other environmental impacts. Beach draw-down: The approximate limit for onshore/offshore movement off the South Coast of England is considered to be about 10 metres below low water as being the minimum depth to ensure that beach draw-down will not take place; an additional limit is a minimum distance of 600 m from the shore. Almost all extraction areas are in much deeper water. Seabed sediment transport: Shingle (gravel) is unlikely to be mobile below 18 m (CD) based on field tracer studies, but more detailed and specific studies are required for sand transport (even if extraction is for shingle). Sand bar and banks: Minimum depth based on special studies depending on location; dredging of banks adjacent to coastline is not allowed; except in conditions with high accretion rates. Effects on wave refraction: An old rule-of-thumb was a minimum water depth of 14 m based on wave refraction studies along the south coast of England. Now it is sometimes simpler to carry out wave refraction modelling for areas even in much deeper water, than to risk criticism that the effect has been ignored. Effects on currents: Not a real issue except very close to the extraction area (near-field), but may affect sediment transport locally as well (and hence affect the biology of adjacent areas).
Existing experience (lessons learnt)	No discernible effects on coastline over last 50 years; Dredged areas in deep water do not subsequently infill with fine sediment. Dredged "pits" in shallow water, for example on sandbanks, are not discernible after a few months, as natural processes fill in depressions quickly, leading to small changes (not detectable) over a much larger area of seabed.

2. Holanda

Items	Description
Future demands of sand and gravel coming 50 years (volumes in m^3)	1600 to 3000 Mm^3 sand; the amount of gravel is negligible. The present demand is 32 Mm^3 sand per year.
Purpose of mined sediment	Beach and foreshore nourishment; land reclamation, general construction. At the moment 12 Mm^3 sand per year is used for beach and foreshore nourishment. Another 20 Mm^3 sand per year is used for general construction and strengthening/heightening of building areas. For the planned extension of the Maasvlakte about 400 Mm^3 sand will be needed. A future airport-island in the North Sea will need a further 2000 Mm^3 sand.
Overview of existing and future mining locations	Sand mining is done along the coast of the Netherlands. For beach and foreshore nourishment the sand is mined as close as possible. Most of the mining is done along the coast between Hoek van Holland and Den Helder. (see http://www.sandandgravel.com/)
Overview of monitored mining pits and studies done	1) One of the deeper mining pits (Verdiepte Loswal) has been monitored quite extensively. The monitoring programme is called PUTMOR. This PUTMOR data set contains mainly bathymetry and hydrodynamics. The pit is located near Hoek van Holland at a water depth of about 20 meter and had a depth of about 30m (about 10m below the surrounding area). The pit has been filled after half a year with dredging material of the Rotterdam harbour. Due to depth and the short period (half a year) the morphological changes are very small. 2) Dredging records from the approach channels to Ports of Rotterdam and Amsterdam 3) Temporary sand pits in the nearshore zone, e.g., a test trench near Scheveningen

Items	Description
Authorities and legal aspects involved	Licensing is done by the Ministry of Transport and Public Works, Rijkswaterstaat, North Sea Directorate. For mining of an area greater than 500 hectares an Environmental Impact Assessment will be necessary in the near future.
Type of regulations and criteria	In general sand mining is only allowed beyond the 20 m depth contour; while only deepening up to 2 meter is allowed. An area that has been mined once cannot be mined again. In case of harbour entrances, mining within the 20 m depth contour is allowed. For the “Verdiepte Loswal” (see above) a special Environmental Impact Assessment has been made. Because the pit was only temporary permission was possible. For the coming 10 years it is expected that deeper mining up to 10 to 30 meter below the surrounding surface will be allowed. With a smaller (and deeper) mining pit the damage to the seafloor will diminish. Also the sand needed as aggregate of concrete is only available at greater depth. At smaller depth only fine sand can be found which cannot be used as aggregate for concrete. An Environmental Impact Assessment will be necessary.
Hydro and morpho evaluation methods	Estimation of modified flow and wave patterns (modelling); estimation of morphological changes based on modelling and existing experiences.
Ecological evaluation method	Description of existing situation; environmental and ecological evaluation for all alternatives and special attention for an alternative with minimum environmental impact. Special attention is given to turbidity plumes and their consequences for primary production, benthos, fish and birds. In the mining area recolonisation of the fauna is an issue
Existing experience	No effects on present coastline; very slow migration of existing pits.

Items	Description
(lessons learnt)	Due to the fact that sand mining is not allowed within the 20 m depth contour there are no expected effects on the erosion of the present coastline.

3. Dinamarca

Items	Description
Future demands of sand and gravel coming 50 years (volumes in m^3)	300 to 500 million m^3 sand, shingle gravel and fill sand. About 70% fill sand for beach nourishment, reclamation and fill. About 12% sand and 14% gravel/shingle as raw material, primarily for concrete (figures obtained by extrapolation of annual demands over the last 5 years)
Purpose of mined sediment	General construction (aggregate for concrete), land reclamation, beach nourishment
Overview of existing and future mining locations	From 113 so-called transition areas located all around Denmark (about 70 of these are being exploited), see www.sns.dk. After 1 January 2007, mining shall take place from geographically delimited areas that have been the object of an impact assessment. The transition areas are primarily the source for raw materials for the construction industry. In addition permissions have been granted for areas to be used for mining material, 'fill sand', for beach nourishment or for specific large construction works.
Overview of monitored mining pits and studies done	Several "Environmental Impact Assessment" studies for offshore dredging and dumping areas, in few cases with some subsequent monitoring.
Authorities and legal aspects involved	Danish Forest and Nature Agency, Ministry of the Environment.
Consultation procedure	The Danish Law on Dredging of Raw Materials was changed in 1996. In order to facilitate the adaptation to the new legislation and to avoid placing the aggregate industry under unfavourable conditions, a transition period of 10 years was defined, during which sand/gravel mining from a large number of transition areas (113) could continue under present conditions.

Items	Description
	The 113 transition areas were chosen because they had already been under exploitation and, based on surveys, it was expected that they still contained enough materials to supply the country during a number of years. When these transition areas were defined, all of them were subject to an environmental impact assessment. Consultations with authorities and organisations were also carried out in order to ensure that mining should not have significant negative impacts on the environment. The transition period extends from 1 January 1997 to 31 December 2006. After this period, the areas that are still wanted to be exploited by the industry will have to go through a conversion procedure and be redefined as mining areas in agreement with the requirements in the new law.
Hydro and morpho-evaluation methods	The following phenomena would be typically studied and evaluated as part of a Coastal Impact Study: - Any bars or banks providing protection to the coast from wave attack should not be damaged/affected; - Dredging should not significantly interfere with nearshore transport processes; - Any significant changes in nearshore wave climate and hence the alongshore transport of sediment - Any changes to tidal currents, levels and tidal prism (in connection with dredging of tidal inlets).
Ecological evaluation method	Typical aspects investigated as part of an environmental impact assessment would include: - Spill and spreading of fine sediments during dredging operations and deposition on the seabed - Extension and thickness of deposition area - Impact on marine flora and fauna - Description of existing environmental conditions and of the impacts of proposed dredging. Suggestions for alternatives and changed extraction procedures
Type of regulations and criteria	No fixed limits. Mining from well-defined transition areas and other areas with a licence granted. After 1 January 2007, each application subject to specific studies of effects on coast and of other environmental impacts. A permission will specify conditions for the extraction such as: conditions on vessels to be used, methods to be used (e.g. trailing suction), records to

Items	Description
	be kept and reporting, limits for spill, relations with fishing activities, conditions of the sea bed, max. pit depth (typically 3m if allowed), no reduction of navigation depth.
Existing experience (lessons learnt)	No reports on negative effects on coastline or significant changes in tidal levels/prism.

4. Itália

Items	Description
Future demands of sand and gravel coming 50 years (volumes in m^3)	Not available
Purpose of mined sediment	Beach nourishment
Overview of existing and future mining locations	North Adriatic sea, south-central Tyrrhenian sea. Preliminary investigations to locate further sand deposits in northern Tyrrhenian sea and central Adriatic sea.
Overview of monitored mining pits and studies done	Studies have been done prior to mining, in connection to beach nourishment of Veneto coast and Lazio coast, particularly to detect sand deposits and to evaluate the opportunity and effects of sand extraction from the selected sites.
Authorities and legal aspects involved	Ministry of Environment, local authorities, Regions, civil engineers-maritime works (Genio civile opere marittime) Ministry of public works
Consultation procedure	Application to Ministry of Environment according to the law on dumping and handling of materials in sea waters. (Decreto Legge 24 Gennaio 1996 n. 24). The authorization is given by the Ministry of Environment also on the basis of the opinion of "Genio Civile - Opere Marittime" and of local administrations.
Hydro and morpho-evaluation	purpose of the work kind of environment (port, estuary, beach,..)

Items	Description
methods	dredging system dredge localization dredge extension
Ecological evaluation method	phytozoobenthos community existing in the quarry area physical, chemical and microbiological characteristics of sediments
Type of regulations and criteria	Mining areas should not be in protected areas (archaeological sites, biological protected sites, natural parks, …..) or sensitive areas (3 miles from coastline or from protected areas, grasslands of phanerogamae. …) and should not influence protected areas and fragile eco-systems and usage of marine resources. The distance from the coast should not be less than 3 nautical miles Water depth not less than 50 m. except for high and medium Adriatic sea.
Existing experience (lessons learnt)	Sand mining practice in Italy is rather new and related only to beach nourishment.

5. Noruega

Items	Description
Future demands of sand and gravel coming 50 years (volumes in m^3)	Mostly shell (carbonated) sand; approximately 108 kg per year
Purpose of mined sediment	Mainly used for agricultural purposes
Overview of existing and future mining locations	The main resources along the South-West coast of Norway
Overview of monitored mining pits and studies done	
Authorities and legal aspects involved	The Norwegian Government is the owner; the authority is given to regional authorities
Type of regulations and criteria	Very few strict rules exist; the assessment for giving permission is based on the local knowledge of the actual areas, based on e.g.: protected area; a regulated area for other purposes; hearings among others who are considered to be affected by the activity; environmental issues; breeding conditions for fish/spawn; fishing grounds
Hydro and morpho evaluation methods	
Ecological	

Items	Description
evaluation method	
Existing experience (lessons learnt)	

6. França

Items	Description
Future demands of sand and gravel coming 50 years (volumes in m^3)	Available ressources (in less than 30 m water depth and within economically reasonable distance from a harbor) : 600 Mm^3. Annual demands over the last 5 years are about 3 Mm^3 per year.
Purpose of mined sediment	General construction (aggregate for concrete), soil conditioner (carbonate sands);
Overview of existing and future mining locations	Brittany and the Loire region (Atlantic coast and English Channel) provide 2/3 of the national production (which amounts to 2.5 $Mm^3$of sand and gravel and 0.5 Mm^3 of carbonate sands and lithothamnium). The largest site is the Loire estuary, where 1Mm^3 of sand and gravel are extracted every year.
Overview of monitored mining pits and studies done	Every dredging site has been studied more or less thoroughly within Environmental Impact Assessments. Definition of an initial state is required before dredging, subsequent monitoring is recommended every 5 years thereafter. Experimental CNEXO pit offshore the Seine estuary has been several times monitored since 1981.
Authorities and legal aspects involved	Dept. of Industry Regional Dept. of Research, Industry and Environment (DRIRE) Port admiral (Préfet maritime) Port authority (Port autonome) Marine division of the Local Direction of Public Works (DDE) Local authorities

Items	Description
Consultation procedure	Dredging companies need to comply with 3 administrative procedures : obtaining a mining permit, an authorisation of using national land (all underwater territories are national), and a opening permit for dredging. Local investigation for the mining permit: According to a 1982 decree, the dredging company submits an application for a licence to the Department of Industry which forwards it to the Local government authority (Préfet) and the Port authorities when applicable. The application includes an Environmental Impact Assessment (coastal impact, impact on fisheries and benthic habitats), carried out by any consultant chosen by the dredging company. After consultation of the Port admiral, the investigation is undertaken by DRIRE, which consults with local departments (Public and Water Works, Telecommunication, Defence, Environment, Culture), local authorities and governmental scientific experts (including Ifremer). The investigation also includes public consultation and consultation of the Marine division of DDE. DRIRE and DDE reports are returned to the Local government authority which issues the license with or without conditions or requires further studies. National investigation for the mining permit: The Department in charge of Mining consults with the Departments of Public Works, Fisheries, Environment, which may refuse the permission. In all cases, the local government authority advises the applicant of the official answer. The whole licensing procedure takes about three year. Permissions were given for 15 years. They are now given for 20 years.
Hydro and morpho-evaluation methods	There is no particular regulation defining the content of the Coastal Impact Study. Reports issued by consulting companies usually rest on bibliographic syntheses describing local current and wave conditions as well as general trends for sediment transport (based on field data or existing modelling results if they are available). They assess changes in wave refraction patterns that may induce alteration of cross-shore or longshore transport of sediment.

Items	Description
Ecological evaluation method	A protocol defines how the inventory of the benthic habitat before and every 5 years during exploitation has to be carried out : method for bathymetry, acoustic imagery and sampling ; from the samples, granulometry, biological sorting, definition of species and genera, density of population. See www.ifremer.fr/drogm/Realisation/Miner/Sable/protocole.htm
Type of regulations and criteria	Filling of the pit: from wave tank experiments, Migniot and Viguier related the water depth (below low tide level) around the pit to the minimum waves that causes pit filling : df = 4.08 * Hs. If no wave exceeds this value, no filling of the pit due to waves is expected. Usually, the empirical formula of Nicholls et al., 1998, is used to evaluate a depth d_c (below low tide level) below which wave-induced sediment transport is very small: $d_c = 2{,}28 * H_{s(12h)} - 68{,}5 * \frac{H_{s(12h)}^2}{g * T_s^2}$ $H_{s(12h)}$ is the wave height of the heighest waves occuring 12h per year. A pit dredging offshore such depth may be accepted, apart from some cases (e.g. no dredging accepted if an adjacent beach already suffers erosion, or no dredging accepted on a narrow sandbank protecting the shore from wave attack…). No fixed criteria exist concerning the effect of currents. Effects on wave refraction : from wave tank experiments, Migniot et Viguier established that this effect is negligible for a pit of volume around 1 Mm3 situated at least 500m offshore from the breaking line of the highest waves. For the Atlantic coast of southern France, it means a minimum water depth of 20m below low tide level.

BREVE DESCRIÇÃO DO MODELO SWAN

Introduction

SWAN is a third-generation wave model which computes random, short-crested wind-generated waves in coastal regions and inland waters. The model predicts a 2D wave wave field on beforehand specified gridpoints. SWAN accounts for the following physics:

- wave propagation in time and space, shoaling, refraction due to current and depth, frequency shifting due to currents and nonstationary depth;
- wave generation by wind;
- three- and four-wave interactions;
- whitecapping, bottom friction, and depth-induced breaking;
- wave induced setup;
- propagation from laboratory up to global scales;
- transmission through and reflection from obstacles.

SWAN is a discrete spectral wave model solving the wave action balance equation. The wave action density is a function of the spectral parameter space variables as well as of location x, y and time t. E is the wave energy density and σ the intrinsic angular wave frequency, determined by

$$\sigma^2 = g\ k\ \tanh(k\ h)$$

fulfilling the dispersion relation equation

$$\omega = \sigma + k\ U$$

where U is the current vector and ω the absolute angular frequency. For details of the action balance equation used in the SWAN model refer to Booij et al. (1999) and Holthuijsen et al. (2004).

Physical processes

Physical processes considered in K-model and SWAN, in brief, are as follows:

Linear wind input:

The same form of the Philips input source function, based on the version of Cavaleri and Rizzoli (1981), and modified by Tolman (1991), has been used by both models.

Exponential wind input:

SWAN provides two different methods for exponential wind input; the first (default method) is also used in the WAM model (WAM Cycle 3, the WAMDI group, 1988) rescaling the Snyder input term in terms of friction velocity. The second method, used also in the most recent version of the WAM model (WAM Cycle 4, Komen et al., 1994) is due to Janssen and accounts explicitly for the interaction between wind and waves by considering atmospheric boundary layer effects and the roughness length of the sea surface.

White-capping:

SWAN provides two methods for taking into account this physical process. The first formulation (default method) is based on a pulse-based model proposed by Hasselmann, as adapted by the WAMDI group (1988). The second formulation is based on the Cumulative Steepness Method as described by Alkyon.

Bottom-interaction dissipation:

As a default method SWAN uses the bottom-interaction dissipation function as described in Hasselmann et al., (1973). Besides this default method SWAN could use two other methods, one is a non-linear formulation based on drag formulation proposed by Hasselmann and Collins and the other is an eddy viscosity model developed by Madsen.

Depth-induced wave breaking

Depth-induced wave breaking it is simulated by increasing non-linear energy dissipation with reducing depth. SWAN uses the total dissipation method (i.e., integrated over the spectrum).

Thus, wave breaking in a random field can be modeled well with the dissipation of a bore, as described by Battjes and Janssen.

Non-linear wave-wave interactions

SWAN uses the quadruplet wave-wave interactions computed with the Discrete Interaction Approximation (DIA) as proposed by Hasselmann, slightly adapted by Tolman. In addition SWAN proposes triad wave-wave interaction for shallow coastal regions; a method based on the Lumped Triad Approximation (LTA) of Eldeberky, which is a slightly adapted version of the Discrete Triad Approximation of Eldeberky and Battjes.

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Breve descrição do modelo SBEACH

Beaches erode and accrete in response to varying waves, water levels, and currents in the nearshore zone. During storms, catastrophic beach and dune erosion can occur in a matter of hours, resulting in significant shoreline recession and damage to property and upland resources. Consequently, protection of upland infrastructure against storm erosion, flooding, and wave attack is a primary concern in the field of coastal engineering. Beach nourishment has become a preferred method of providing such protection, and many beach-fill projects have been designed and constructed in the past several years. Effective design of beach fills for shore protection requires an understanding of and the capability to predict sediment transport processes that control beach response to storms. Numerical modeling of beach evolution is a powerful technique that can be applied to assist in project design. Numerical models provide a framework for predicting project response, objectively evaluating design alternatives, and analyzing data to develop an understanding of coastal processes. The Storm-induced BEAch CHange (SBEACH) numerical model has been developed as an engineering tool for simulating beach profile evolution in response to storms.

SBEACH is an empirically based model that calculates the net cross-shore sand transport rate in four zones from the dune or beach face, through the surf zone, and into the offshore past the deepest break-point bar produced by short period incident waves (Larson and Kraus 1989). Calculations can be performed for an arbitrary initial beach profile shape and a specified grain size in the sand range, and the inputs may include time series of water level; wave height, period, and direction; and wind speed and direction. Either monochromatic waves or waves that vary randomly in height can be specified. The wave model is relatively sophisticated and computes wave shoaling, refraction, breaking, breaking wave re-formation, wave- and wind-induced setup and setdown, and runup. SBEACH can generate, grow, move, and deflate the predominant longshore (wave break-point) bar.

SBEACH is applicable primarily to the dune, beach face, and surf zone (including the area of Iongshore bar). It was not developed to predict details of sediment movement or sediment movement under the (nonbreaking) waves in the offshore. The basic limitations of SBEACH carry over to the HB capability.

A fundamental assumption of the SBEACH model is that profile change is produced solely by cross-shore processes, resulting in a redistribution of sediment across the profile with no net gain or loss of material. Longshore processes are considered to be uniform and neglected in calculating profile

change. This assumption is expected to be valid for short-term storm-induced profile response on open coasts away from tidal inlets and coastal structures.

In calculating beach profile change, the model assumes that cross-shore sediment transport is produced by breaking waves and changes in water level. SBEACH includes an internal wave model which calculates the cross-shore variation in wave height and water level setup across the beach profile. With

information from the wave model, cross-shore sediment transport rates are calculated using relationships derived from empirical analysis of laboratory and field data of beach profile change. The wave model and sediment transport relationships previously used in SBEACH were developed based on monochromatic waves. In the present version of the SBEACH model, wave transformation and sediment transport rates are calculated using random wave properties to improve prediction of profile change in field applications.

SBEACH requires data typically available in engineering studies to calculate beach profile response. For project applications, primary input to SBEACH includes time histories of wave height, wave period, and total water elevation (tide and surge); pre- and post-storm beach profile survey data; and median sediment grain size. Optionally, wave direction and wind speed and direction can also be specified.