

This bulletin provides a synopsis of the papers presented at the European marine sand and gravel group – Shaping the future, conference. Full papers are available from the EMSAGG website, www.ciria.org/emsagg

Introduction to the conference

On 21 and 22 February 2003 the European Marine Sand and Gravel Group (EMSAGG) hosted its inaugural conference, European marine sand and gravel - shaping the future, in Delft, the Netherlands. The conference continued EMSAGG's aim of disseminating knowledge and encouraging the exchange of information between those involved in marine sand and gravel.

The conference, chaired by Daniel Leggett, chairman of EMSAGG, was attended by more than 150 representatives from 13 countries and was opened by Mr J H G Jacobs, chief engineer director of the North Sea Directorate of the Ministry of Transport, Public Works and Water Management of the Netherlands. In his opening speech Mr Jacobs explained the role of the North Sea Directorate, highlighting the importance of balancing the many uses of the sea with the protection and preservation of its ecology and resources. Mr Jacobs also noted that to achieve this sustainable use, exploration needs to be partnered with exploration and research, as demonstrated by the presentations that followed.

Delegates enjoyed presentations on many issues concerning marine aggregate dredging, including:

- markets and materials
- resource exploration and development
- research and monitoring
- technology and data management
- regulators - legislative and environmental.

The conference also included a site visit to Hanson Aggregates Nederland NV, in Amsterdam, Europe's largest and newest marine sand and gravel processing plant outside the UK. The plant produces 1.3 million tonnes a year, working 24 hours per day, five days a week in three shifts. Hanson's two largest dredgers, the Arco Dijk (8300 t capacity) and the Arco Humber (8000 t capacity), supply the wharf with sand and gravel dredged from the English Channel and the North Sea. This aggregate is then processed and distributed by barge to customers in and around Amsterdam.

EMSAGG would like to take this opportunity to thank the conference sponsors, speakers and delegates for their contributions to an interesting and successful conference.

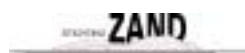


Delegates enjoying the tour around Hanson's site



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Conference sponsors



Markets and materials

UK perspective on resources and use of marine sand and gravel, Kevin Seaman, BMAPA and UMA Ltd

The UK marine aggregate industry is second in scale only to Japan, with 22-26 mt of marine aggregate being dredged annually from more than 70 UK licences. Much of this sand and gravel is extracted from licences in the southern North Sea off eastern England. Other important industry centres are the Bristol Channel and Irish Sea, where sand is supplied without the need for onshore processing.



UK licensed areas (source: BMAPA)

Resources of marine sand and gravel are of equal quality to their terrestrial equivalents. They are used in the same applications, commonly in concrete and concrete products, although they are also making an important contribution to coastal defence around the English coast.

In common with most aggregates, reserves are finite and the industry is continually assessing new dredging areas. Most importantly, huge deposits have been identified in the eastern English Channel, which, if licensed, can be exploited in place of the diminishing reserves of the southern North Sea, securing supplies for many decades to come.

Quality demands on aggregates - European standards, Ronald de Vree, Certificatie-instelling BMC

CEN TC 154 has been working on the preparation of European Standards and test methods for aggregates. These standards will be introduced between March and July 2003 and can be used alongside national standards until 1 June 2004, when the European standard will replace the existing national standards for aggregates and become a legal obligation.

This CE marking obligation means that before 1 June 2004 every aggregate producer must write and implement a factory production control (FPC) system for their quarry, which should describe the tests they have to carry out. If the aggregates produced are meant for uses with high safety requirements, the producer has then to apply for a certificate from a notified certification body (NCB). The producer is responsible for carrying out the tests and determining whether the aggregates comply with the requirements and whether a declaration of conformity can be issued. Based on the declaration and the FPC certificate, the CE marking can be affixed to the aggregates. More information can be found at www.cenorm.be



Marine aggregate at Hanson Aggregates Nederland NV, Amsterdam

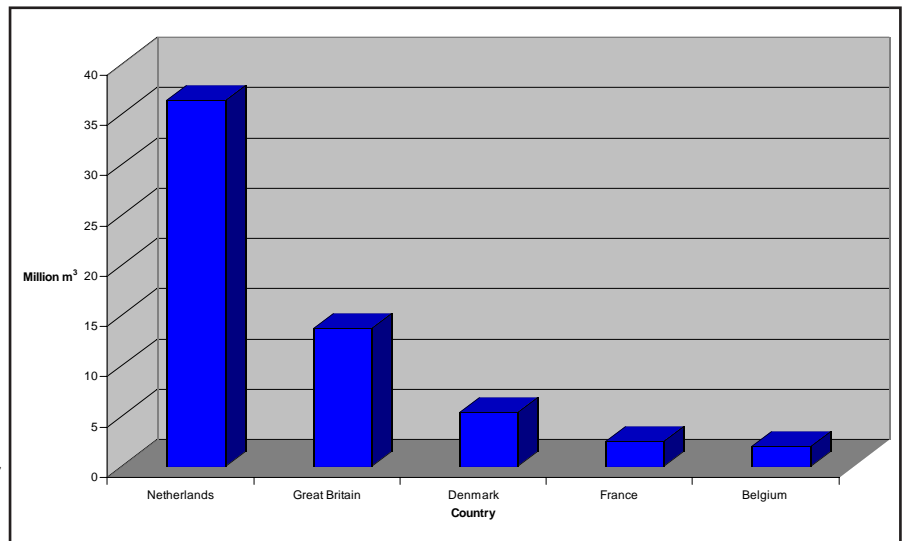
Markets and materials

European overview of marine sand and gravel, David Harrison, British Geological Survey

Marine sand and gravel make an important contribution to the overall provision of aggregate materials in most countries in north-western Europe. The aggregates dredging industry has expanded rapidly over the past 40 years and continues to grow, as acceptable land-based sources of sand and gravel are being depleted.

Dredging for aggregates takes place mainly off the coasts of the Netherlands, Great Britain, Denmark, Germany, Belgium and France. Marine aggregates are also traded commodities within Europe. The Netherlands and Belgium, for example, are strongly dependent on imports of aggregate materials, mostly

from the UK and Germany. The principal uses of marine sand and gravel are in concreting aggregates, in beach nourishment schemes and for fill in coastal reclamation projects.



Aggregate extraction in Europe, 2001 (ICIES, 2002)

Resource exploration and development

The use of sonar techniques for a standardised resource evaluation and its ecological value, Vera Van Lancker, University of Ghent

Seabed mapping and classification techniques based on sonar technology have been evaluated for their effectiveness in resource prospecting and for their ability in discriminating benthic habitats in soft bottom sedimentary environments. From this, cost-benefit and time-efficient monitoring tools and strategies were put forward, with applications for seabed mobility studies and benthic habitat mapping. These have had promising results, enhanced through the GIS-integration of very-high-resolution side-scan sonar and multibeam data, and the major environmental parameters.

Setting up an acoustical habitat classification scheme can help improve our understanding of the relationships between the environment and living organisms, and provides an indication of the ecological value of the sea floor. The scheme, which is based on side-scan sonar imagery, provides perspectives for interpretation of multibeam backscatter imagery in terms of biological richness and diversity.

Exploration and extraction of sand and gravel resources in the Polish Exclusive Economic Zone of the Baltic Sea, Szymon Uscinowicz, Polish Geological Institute

In the Polish Exclusive Economic Zone of the Baltic Sea, gravel deposits are the most notable aggregate resource. Three deposits, totalling around 2 798 1000 m³, are documented:

- Slupsk Bank - 64.5 million tonnes
- Southern Middle Bank - 57.1 million tonnes
- Koszalin Bay - 37.7 million tonnes

From the Slupsk Bank deposit, some 2 977 000 m³ of gravel have been dredged since 1985. The Koszalin Bay and Southern Middle Bank deposits have not yet been exploited.

Sand resources, which are becoming ever-more important because of increasing coastal erosion, are recognised in five deposit areas: four offshore and one in the Puck Lagoon. The geological resources documented in offshore deposits total 16 549 750 m³ and in the Puck Lagoon total 18 500 000 m³. Between 1990 and 2000, 1 466 650 m³ and 3 757 182 m³ of sand was extracted from offshore deposits and the Puck Lagoon respectively.

Resource exploration and development

Marine resources in Danish waters – exploitation potential and sustainable management, Poul Erick Nielsen, Danish Forest and Nature Agency

During the last decade, marine resources have been of increasing importance for the Danish national supply of aggregates for construction, land reclamation and coastal protection. In the Danish EEZ, marine aggregates are dredged in up to 150 designated dredging areas, located in coastal waters as well as on the continental shelf in the North Sea and Baltic. Total average yearly extraction is 5-6 million m³, depending on local and international demands. Projects that have necessitated an increase in this sand extraction have included Århus harbour (requiring 12 million m³ of sand fill) and beach nourishment for the west coast of Jylland, which requires 3 million m³ of sand annually.

This growth in extraction will require the implementation of an environmentally sustainable spatial planning policy for the exploitation of the marine resources, to ensure that society always has access to sufficient volumes of aggregates of the right quality. Resource management systems therefore need to include dynamic resource assessment, mapping of conflicting interests and estimation of future demands.

Best practice: resource evaluation and dredging management, Ian Selby, BMAPA and Hanson Marine Ltd

Resource management is a key factor in the operation of a successful marine aggregates business and is integral to the development of sustainability. It is based on the combination of a thorough evaluation and understanding of the resources on the seabed, and a dredging plan targeted to permit the effective and efficient extraction of the resources.

The goal of resource evaluation is a clear understanding of the sediments to be dredged: their distributions, geometries, volumes and compositions. Interpretation of the origins of the sediments, their depositional environments and the associated geological processes allow us to characterise confidently the resources to be dredged and their variability.

Dredging management is based on the translation of the resource assessment into a viable dredging strategy with clear commercial and environmental benefits. Dredging is typically managed through a zoning system. This enhances control of quality, ensures efficient extraction and offers a mitigation strategy to restrict the dredging area, which helps to minimise any environmental impacts of dredging activities.



Trailer suction hopper dredger in UK waters (source: BMAPA)

Research and monitoring

Assessing the impact of sand extraction on the shore stability: project for a methodological framework, Florence Cayocca, Ifremer

Extractions along the English Channel and Atlantic coasts of France take place in 1-8 m water depth, 1-6 km from the coastline. French regulations require that dredging companies provide an environmental impact assessment (EIA) in order to obtain an authorisation to extract sand, gravel or carbonate sands. Currently, however, the content of such EIAs has not been precisely defined.

As a governmental research agency, Ifremer is charged with assessing the scientific content within these studies. A research programme has been initiated to deliver a methodological guideline to end-users, so as to limit the impacts on the stability of the coastline more effectively, as well as to set up appropriate monitoring.

Research and monitoring

Monitoring morphological features in relation to sediment transport and ecology – project Ecomorphodynamics, Cees Laban, Netherlands Institute of Applied Geoscience TNO

The Ecomorphodynamics project has been carried out by a broadly based consortium, which includes the Netherlands Institute of Applied Geo-Science-TNO. The aims of the Ecomorphodynamics project are to:

- monitor the seabed over four seasons, for three years at four locations
- quantify and model the morphodynamic processes
- identify the role of zoobenthos with regard to the ecomorphologic processes and sediment characteristics.

The four areas monitored were two sandwave areas on the inner continental shelf, a sandwave area on a shoreface-connected ridge and the transition from lower shoreface to inner continental shelf. Monitoring methods used included multibeam, side-scan sonar and boxcorer sampling.

Results for the sandwave area A showed a migration of mega ripples between March and June 2001 of 0-2 m in a northern direction, with a lee migration of 7.5-15 m. In sandwave area D, 10 m displacement was detected south of the shipping route to Rotterdam between two



Project monitoring areas

seasons. The project also concluded that while the relationship between the species distribution and the sediment characteristics is difficult to establish, there does seem to be a relationship between the morphology and species composition. Species composition varies significantly between different areas and between the seasons.

Review of current state of knowledge of the impacts of marine aggregate extraction – a UK perspective, Sian Boyd, CEFAS

Concerns over the effects of marine aggregate extraction on the environment have grown over the years and include damage to spawning grounds and fish stocks, restriction of access to fishing grounds and the destruction of habitats and species.

On behalf of the UK Government, CEFAS is undertaking a range of research programmes to provide the scientific data needed to guide and advise the development of policy in this area and ensure that debate is evidence-based. Methods used for assessment have included Hammon grab for sampling of macrofauna and sediments, remote methods (eg side-scan sonar), giving an indication of the spatial distribution of sediment, and an electronic monitoring system that provides information on the location and intensity of dredging.

Noted consequences of dredging include the creation of dredge tracks or depressions on the seabed, changes in the composition of sediments and effects on benthic fauna. The study has concluded the following:

- the effects of extraction are still evident up to nine years after the cessation of dredging
- assumptions of recovery rate within two to three years are not always applicable
- there is some evidence that areas of the seabed have changed from a gravelly to sandy substrate as a result of aggregate extraction.



Sabellid polychaete (source: Alison Hewer, CEFAS)

Experience of ASR in the Netherlands, Timo Nijland, TNO Building and Construction Research

Alkali-silica reaction (ASR) in concrete was mentioned for the first time in Dutch literature in 1957, in a paper in the Dutch journal Cement (Bosschart, 1957). This stimulated some early research on the reactivity of aggregates (Van de Fliert et al, 1962). However, no cases of concrete damage due to ASR were reported until 1991, when ASR was found in a bridge in Schoonhoven (Heijnen, 1992; Heijnen et al, 1996). At the same time, in response to the expected major imports of aggregates, CUR commissioned work to devise guidelines that would prevent ASR in the Netherlands. As a result, the first Dutch recommendation on the prevention of ASR, CUR-Recommendation 38, was published in 1994.

Since its publication, ASR has been diagnosed in between 40 and 50 structures across the Netherlands, notably a series of around 20 bridges in and over the A59 motorway in the south, all built between 1960 and 1970. Discussions and new research provoked by this discovery resulted in two commissions by CUR, one to revise CUR-Recommendation 38, the other to devise a guideline on how to deal with ASR-affected structures.

The new guideline on ASR prevention, CUR-Recommendation 89, was published in 2002; publication of the CUR-Recommendation on structural consequences of ASR is pending.

GIS and seabed management (the UK Crown Estate's experience), Jason Golder, the Crown Estate

The Crown Estate (CE) manages the seabed around the UK within the 12 nautical mile limit, as well as the rights to all minerals, excluding hydrocarbons, within the continental shelf. The Crown Estate is responsible for monitoring tonnage removal and compliance with licence conditions, which is achieved by an electronic monitoring system (EMS).

The EMS, introduced in 1993, was set up to monitor dredging licensing conditions and is installed on all dredging vessels operating on CE-licensed dredging areas, providing information relating to the location of a ship during operations. When operating in UK waters, the system is switched on and recording begins automatically when dredging starts. The information processed by the EMS is submitted to CE every month, with any breaches followed up with the licensee and all incidents of out-of-area dredging reported.

In 2001, the EMS recorded more than 31 000 hours of dredging. Of this, less than 0.002 per cent was out of area, usually by less than 100 m. Since the introduction of the EMS, more than 1 million km of tracks have been recorded. A review of its 10-year history has concluded:

- there is no evidence of intentional out-of-area dredging
- industry has never disputed the accuracy of the EMS
- data is used in research, shaping future applications
- industry uses the data for management purposes.



Marine aggregate at Hanson Aggregates Nederland NV, Amsterdam

Technology and data management

EU-SEASED: European searchable Internet meta-database of seafloor samples, Peter Davis, MARIS BV

EU-SEASED aims to improve access to the European marine sediment archive. It is a European joint project of EUMARSIN (European Marine Sediment Information Network) and EUROCORE, supported by the EU FP4-MAST III programme of the European Commission. It aims to set up a central-access searchable Internet database of seabed samples from the ocean basins held at European institutions. The database will list the metadata (data describing data) on the cores and sediment samples. Access to the full datasets and/or actual samples (and associated analytical datasets) will have to be negotiated between the requestor and the institutions where the data are stored.

The work is divided between the two actions as follows:

- EUMARSIN will provide metadata from samples and cores collected in the European Seas by 14 of the European Geological Surveys. As far as possible, it will include samples from commercial and survey companies in each EU member state
- EUROCORE will provide metadata from cores collected from anywhere in the world oceans, providing the data was collected by, and is held at, a European marine research institute, marine station or university.

EU-SEASED can be found at www.eu-seased.net

Regulators – legislative and environmental

UK approach to environmental assessment of sand and gravel dredging proposals, Chris Vivian, CEFAS

In the UK, mineral extraction from the seabed requires a licence from the Crown Estate, which is subject to a non-statutory procedure - the Government View Procedure - which has been operating since 1968.

Applications for a licence are accompanied by an environmental impact assessment (EIA) of the proposed marine aggregate dredging operation. This EIA should:

- be a systematic, thorough and objective analysis and presentation of information about the environmental effects of the proposed operation
- be in a form that provides a focus for scrutiny of the project by specialist as well as non-expert decision-makers and interested members of the public
- allow the importance of the predicted effects, and the scope for modifying or mitigating them, to be properly evaluated.

UK policy has required an EIA in nearly all cases since 1989. In November 1992, the first environmental statements were submitted. Initially, the submitted environmental statements were heavily criticised, but there has been a steady improvement in the general standard of these statements over the years.



Trailer suction hopper dredger in UK waters (source:BMAPA)

Regulators – legislative and environmental

Belgian governmental control on the extraction of marine sand and gravel, Patrik Schotte, Fund for Sand Extraction

The extraction of marine aggregates in Belgian waters is regulated by law (13 June 1969) on the exploration and exploitation of non-living resources of the territorial sea and the continental shelf, and by several royal decrees. Since exploitation of minerals started, the government has tried to apply an effective control on this industrial activity and on its effects on the environment, adapting its tools when the technology became affordable. Today, every extraction vessel operating in Belgian waters is equipped with a sealed electronic monitoring system. In addition, controls at sea are executed in collaboration with the navigation police, and regular surveys are made in the extraction areas using a multibeam echo-sounder system.

Each aggregate producer wishing to extract sand or gravel in Belgian waters has to obtain a concession from the minister responsible for economic affairs. This ministerial decree is accompanied by a royal decree stipulating the conditions that must be respected.

A large part of the financial contributions paid by the holders of concessions is used to monitor the effects of the extraction activities on the environment.

Legislative and environmental development in the Netherlands, Ad Stolk, Ministry of Transport, Public Works and Water Management, North Sea Directorate

In the last five years an average of 23 million m³ of sand a year has been extracted in the Dutch part of the North Sea. The sand is partly extracted from approaching channels, and partly from other parts of the shelf outside the 20 m depth contour. The sand is used for coastal nourishment and landfill. To safeguard ecology and coastal defence, extraction within the 20 m depth contour is not allowed. Currently, the maximum extraction depth is 2 m below the seabed. For small-scale extraction (less than 10 million m³) this depth will be maintained. For large-scale extractions, greater depths can be allowed if the EIA points in that direction.

The Dutch Government has been proactive in stimulating extraction from the seabed, both by executing an extensive coring campaign to locate resources of coarse sand for use in concrete, and by drafting EIAs for deep extractions and for special areas (e.g. Cleaverbank). Research has also been carried out on the morphological and ecological effects of extraction. Recently, central government has stated that the market should be responsible for these actions and that the government should confine itself to legislation and licensing.



Aggregate on shore at Hanson Aggregates Nederland NV, Amsterdam

Marine minerals dredging in English waters - policy and consent procedures, Brian Marker, Minerals Planning Division, Office of the Deputy Prime Minister

Marine dredging for sand and gravel for use as aggregate and in beach replenishment has been undertaken in English waters for many years. It is expected that demand will continue at present levels.

A licensing system, used since 1968, is to be replaced by a new statutory system later in 2003. The new Regulations will consolidate environmental legislation for this sector, make better provision for public hearings or inquiries on contentious applications, and clarify arrangements for variations to conditions and revocation of permissions, should the need arise. Recently published policy guidance provides a better context for preparation and determination of applications. A key aim is to limit environmental impacts by reducing the total area being dredged at any one time and securing good operational practices through conditions attached to each licence. Conditions also provide for monitoring and review of licenses.

Research on management of the marine environment, improved methods for survey, mapping and assessment, and on rates of rehabilitation of the seabed following minerals dredging, supports these initiatives.