Marine Aggregate: Its role in development, construction & infrastructure

Ceri James
Marine, Coastal & Hydrocarbons Programme
British Geological Survey

Kingsley Dunham Centre
Keyworth
Nottingham NG12 5GG
Tel 0115 936 3100

Aggregates

- Primary component for construction and infrastructure
- Bulk mineral - High volume – low value
- Sand & gravel aggregate generally minimal processing
- Transport is large component of cost
- Traditionally on land aggregate sources have been close to markets
- In Europe and Asia marine sand and gravel is an important component in meeting demand for aggregate
- Aggregate usage in Europe - 7 to 9 tonnes per person per year

2000 - Aggregate Production Terrestrial & Marine

	Sand & Gravel Mt	Crushed Rock Mt	Total Mt
The Netherlands	116	0	116
Great Britain	89	130	219
Belgium	30	27	57
Denmark	46	0	46

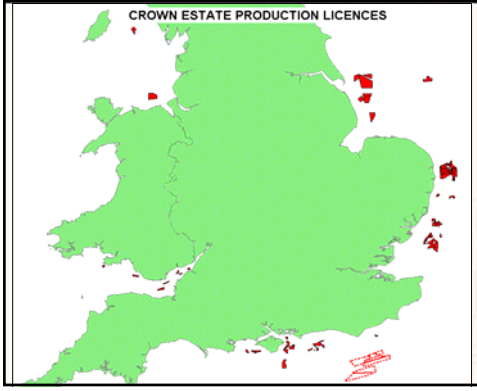
Marine Aggregate in NW Europe (Mt)

	1997	1998	1999	2000	2001
The Netherlands	36.4	34.4	35.8	40.6	58.2
Great Britain	24.8	22.9	23.7	23.1	22.7
Denmark	9.0	10.7	18.4	11.9	?
Germany	6.8	22.2	7.2	9.2	?
France	3.6	3.5	3.0	3.9	3.8
Belgium	5.5	2.2	2.7	3.0	3.0

Marine Aggregate in UK

- Steady increase in production since 1960
  1960 - 69 Averaged - 9.4 Mt/year
  1970 - 79 Averaged -14.9 Mt/year
  1980 - 89 Averaged -17.7 Mt/year
  1990 - 99 Averaged - 23.5 Mt/year
- Maximum annual production of 27Mt in 1989
- Annual production for 2004

Total	21.5 Mt
Fill & Beach Nourishment	1.8 Mt
Exports	6.2 Mt



European Legislation

- nearly all countries have legislation for licensing marine dredging
- legislation is administered by a Government Department or Ministry

e.g.	France	-	Ministry of Industry
	Netherlands	-	Ministry of Transport and Public Works
	Sweden	-	Geological Survey of Sweden
	United Kingdom	-	Department of the Environment, Transport and the Regions

- an EIA is normally required to support a dredging proposal
- licences are issued to cover a specified area
- extraction is constrained by a range of licence conditions

Licensing

- dredging needs permission of the owner
- mineral rights are mostly owned by the State or the Crown
- owner grants licences in return for royalties
- licencing is usually controlled by Government
- it usually involves consultation with all interested parties (a range of Government departments, the private sector and the general public)
- this varies from advertisment of licence application to formal public enquiry

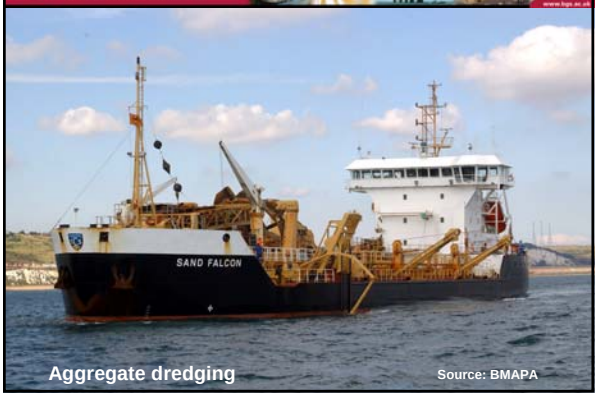
Marine sand and gravel – end use

PROCESSED

- Concreting aggregate – readymix, blocks, pre-cast concrete
- Sand – mortars, asphalt etc
- Drainage – pipe bedding, back fill
- Roadstone – coated surfacing materials
- Minor uses – sports materials, water filtration, industrial sands etc

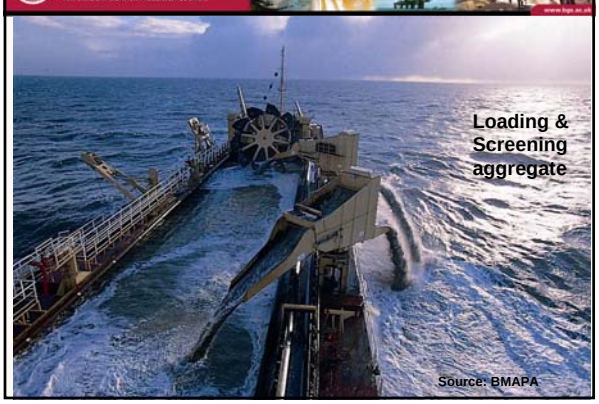
UNPROCESSED

- Beach recharge
- Fill materials
- Earthworks materials – sub-base roadstone, drainage layers etc



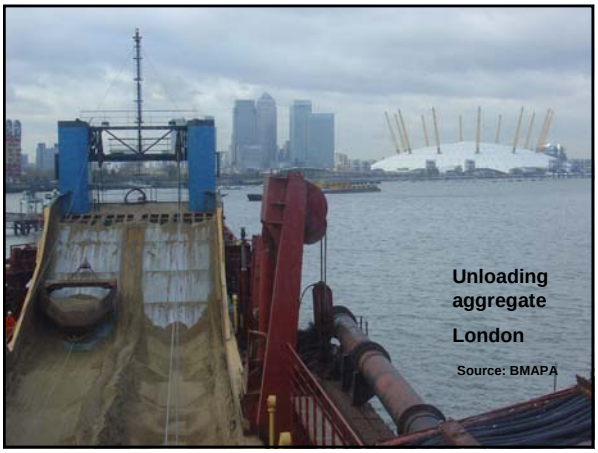
Aggregate dredging

Source: BMAPA



Loading & Screening aggregate

Source: BMAPA



Unloading aggregate

London

Source: BMAPA

Beach Replenishment
Bournemouth

Source: BMAPA

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South-east Asia – Location Map

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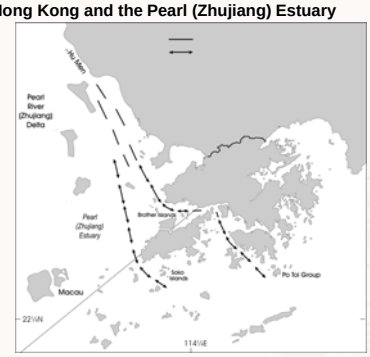
Hong Kong and the Pearl (Zhujiang) Estuary



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HONG KONG'S REPLACEMENT AIRPORT & RELATED CORE PROJECTS

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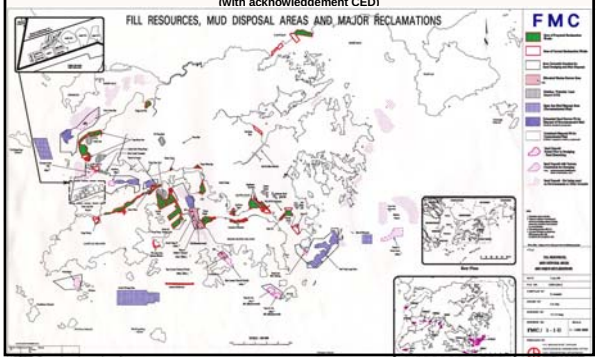
Hong Kong: Fill resources, mud disposal areas and major reclamations

(with acknowledgement CED)



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Hong Kong

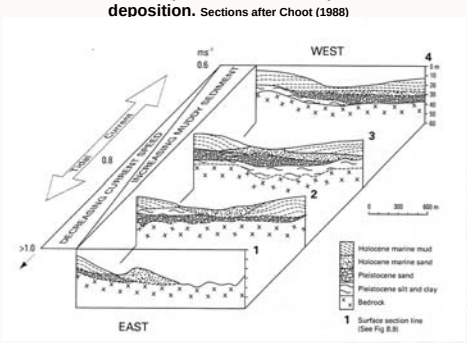
- 1990s - huge demand for marine fill
- 234 Mm^3 dredged from 13 borrow areas
- Exploration based on regional interpretation of geology
- Seismics, boreholes and CPTs
- Interpretation produced model for deposition of marine sand and associated deposits
- Target areas identified on the basis of the model

Borrow Area Example

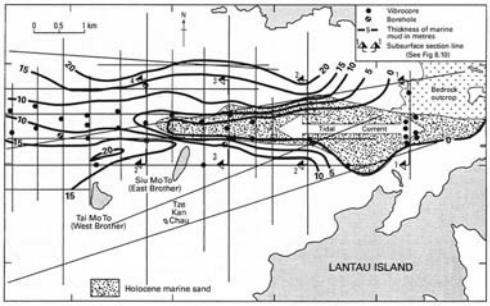
The Brothers

- Major tidal channel of Pearl River Estuary
- Sea bed depth - 20 to 28 m
- Rock floored channel - tidal currents >1 ms^{-1}
- Sand bank 2.5 km long - 0.5 km wide - max 15 m high
- Bank declines to west and sediment becomes muddier
- Velocity gradient to the west
- Holocene marine sands, med qtz - ave fines 30%
- Underlain by Pleistocene sands, med-c, fines 10% and some gravel, some interbedded clay and silt

The Brothers: relationship between current speed and sand/mud deposition. Sections after Choot (1988)



The Brothers: seismic tracks, coring sites and aggregate resources. After Choot (1988) and Sheet 10, Hong Kong Geological Survey (1991)



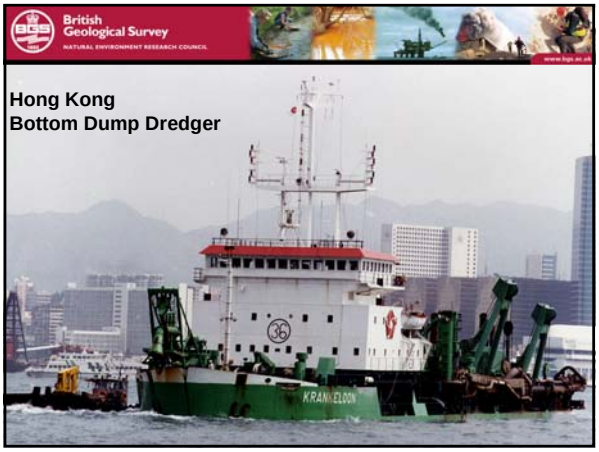
Borrow Area Example

The Brothers

- Assessment of area with <10 m overburden mud
- 25 Mm^3 Holocene sand - ave thickness 4.4 m
- 15 Mm^3 Pleistocene sand - ave thickness 5.3 m
- 27 Mm^3 beneath sea bed not covered by mud
- Total of 50 Mm^3 within borrow area but 25 Mm^3 of mud would have to be dredged to extract all reserve
- To date 34 Mm^3 has been dredged

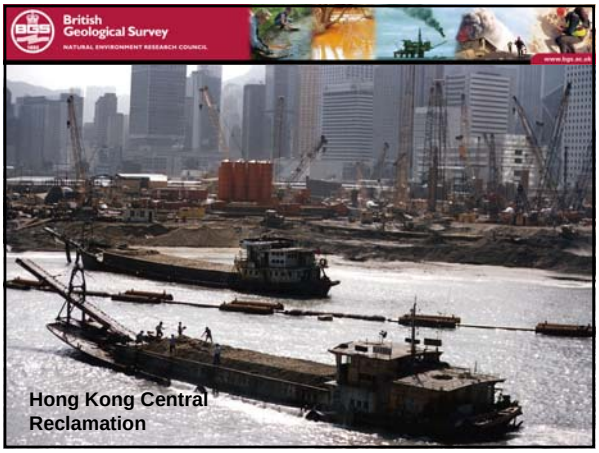
Hong Kong
Sand spraying
on reclamation

Hong Kong
Sand spraying on reclamation

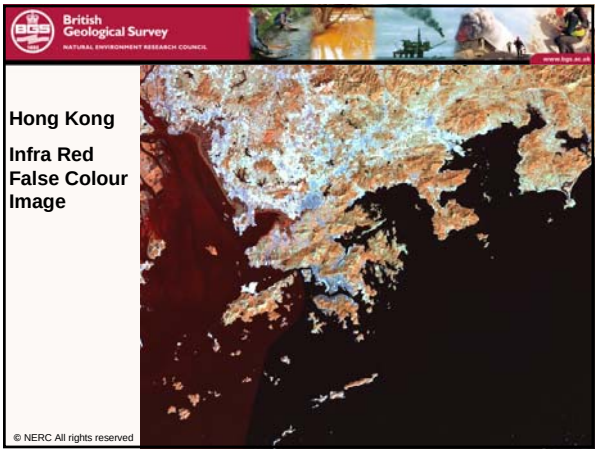


Hong Kong
Bottom Dump Dredger

Hong Kong
Bottom Dump Dredger

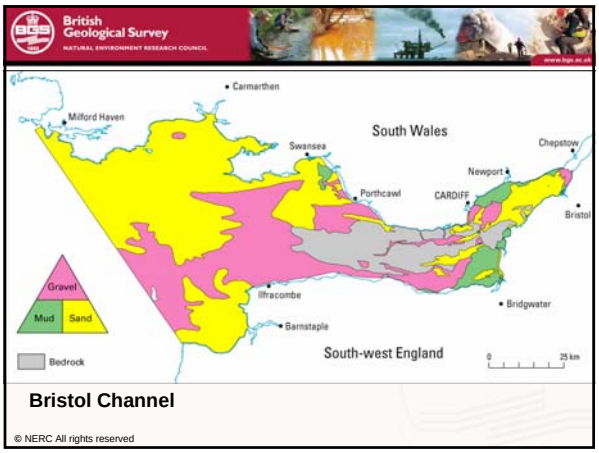


Hong Kong Central
Reclamation

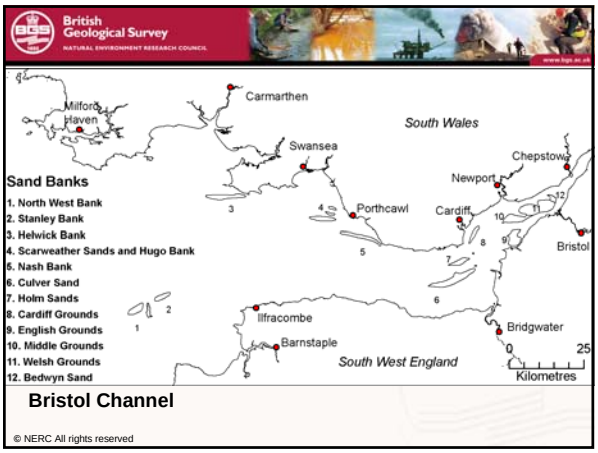


Hong Kong

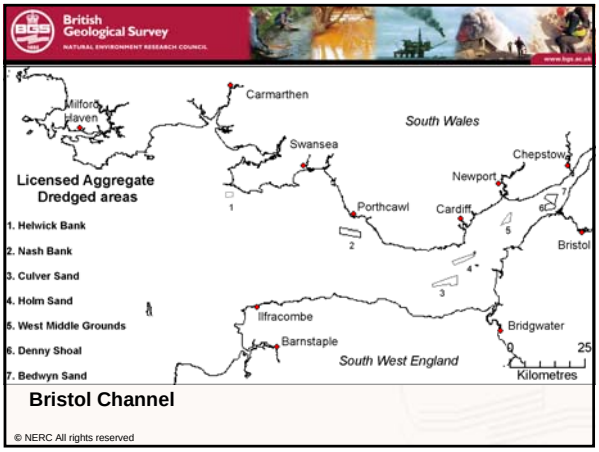
Infra Red
False Colour
Image



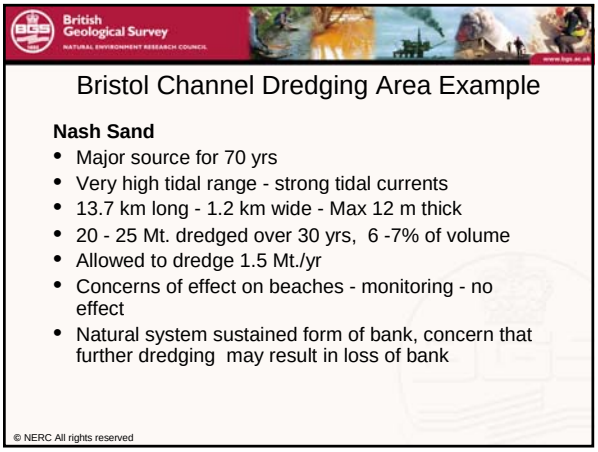
Bristol Channel



Bristol Channel



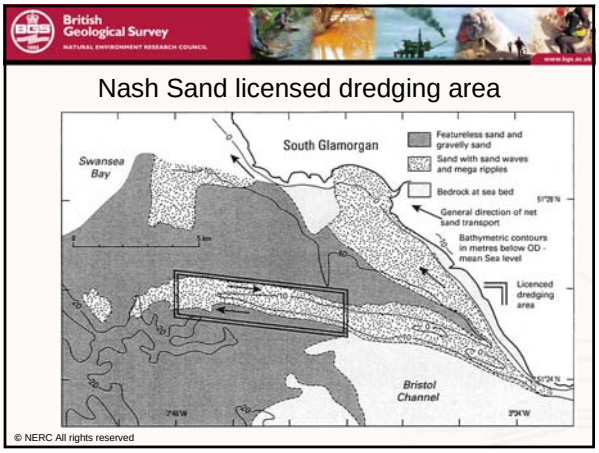
Bristol Channel



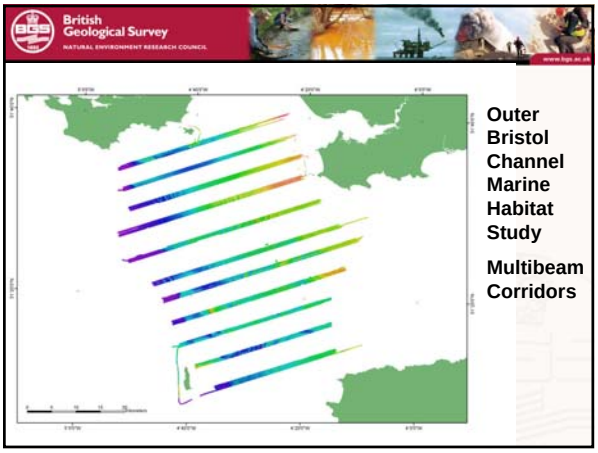
Bristol Channel Dredging Area Example

Nash Sand

- Major source for 70 yrs
- Very high tidal range - strong tidal currents
- 13.7 km long - 1.2 km wide - Max 12 m thick
- 20 - 25 Mt. dredged over 30 yrs, 6 -7% of volume
- Allowed to dredge 1.5 Mt./yr
- Concerns of effect on beaches - monitoring - no effect
- Natural system sustained form of bank, concern that further dredging may result in loss of bank

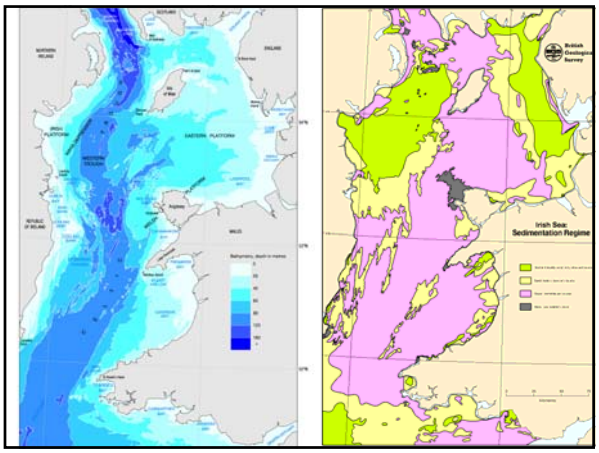


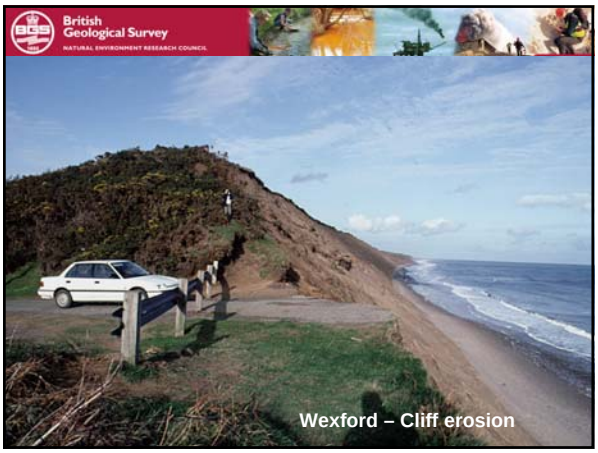
Nash Sand licensed dredging area



Outer Bristol Channel Marine Habitat Study

Multibeam Corridors


Irish Sea:
Sedimentation Regime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Wexford – Cliff erosion


IMAGIN
irish sea marine aggregates initiative
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News:
03/02/2005 - IMAGIN Launched
The Irish Sea Marine Aggregates Initiative (IMAGIN) started officially on Feb 3rd 2005, and is a 2-year project funded under the Ireland/Wales INTERREG IIA Community Initiative Programme 2000-2006.
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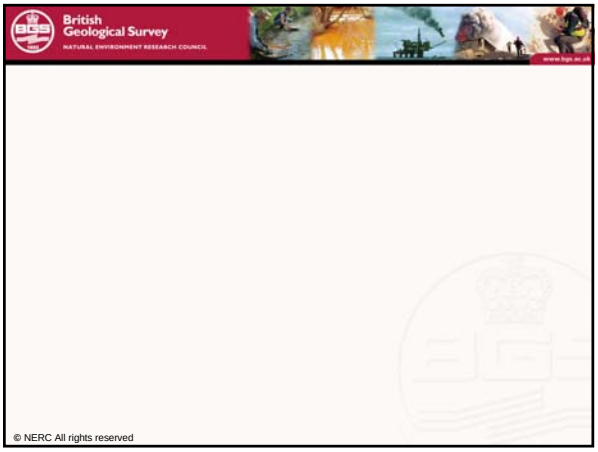
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