



Scour protection in coarse pebbles. Øresund Fixed Link, 1995.

#### DELIVERABLES

- Planning
- Analyses
- Design
- Site Supervision
- Full Scale Testing
- Behavior of Dredged Materials

#### SELECTED WORKS

LICENGINEERING has designed a large number of scour protections and executed many repairs of underscoured structures.

The offshore projects in particular comprises:

- Pipelines
- Pipeline Crossings
- Subsea Valve and Production Structures
- Wind Turbine Foundations

#### CLIENT LIST

- Great Belt Link
- Øresund Fixed Link
- Mærsk Oil and Gas A/S
- Mærsk Oil Qatar
- Statoil
- Dangas
- Vestas, Danish Wind Technology



**LICENGINEERING A/S**

EHLERSVEJ 24  
 DK-2900 HELLERUP, DENMARK  
 PHONE: + 45 3962-1642  
 FAX: + 45 3962-5480  
 E-MAIL: mail@liceng.dk  
 WWW: http://www.liceng.dk



## Slurry and Sediment Transport-Scour

March 2015



Picture above shows open channel carrying sediments in very high concentrations. The channel was designed to be completely self-cleaning under all flow situations, including temporary stops. Great Belt Link.

- Slurry Transport
- Soils Handling
- Sedimentation
- Soils Investigations
- Re-use of Dredged Materials
- Scour Protection



Scour protection of cliff by pebble revetments. A "natural appearance" is obtained together with a sufficiently strong beach profile. Sprogø 1996-97.

## SCOUR

Scour protection in stones or concrete materials is a well-established engineering discipline.

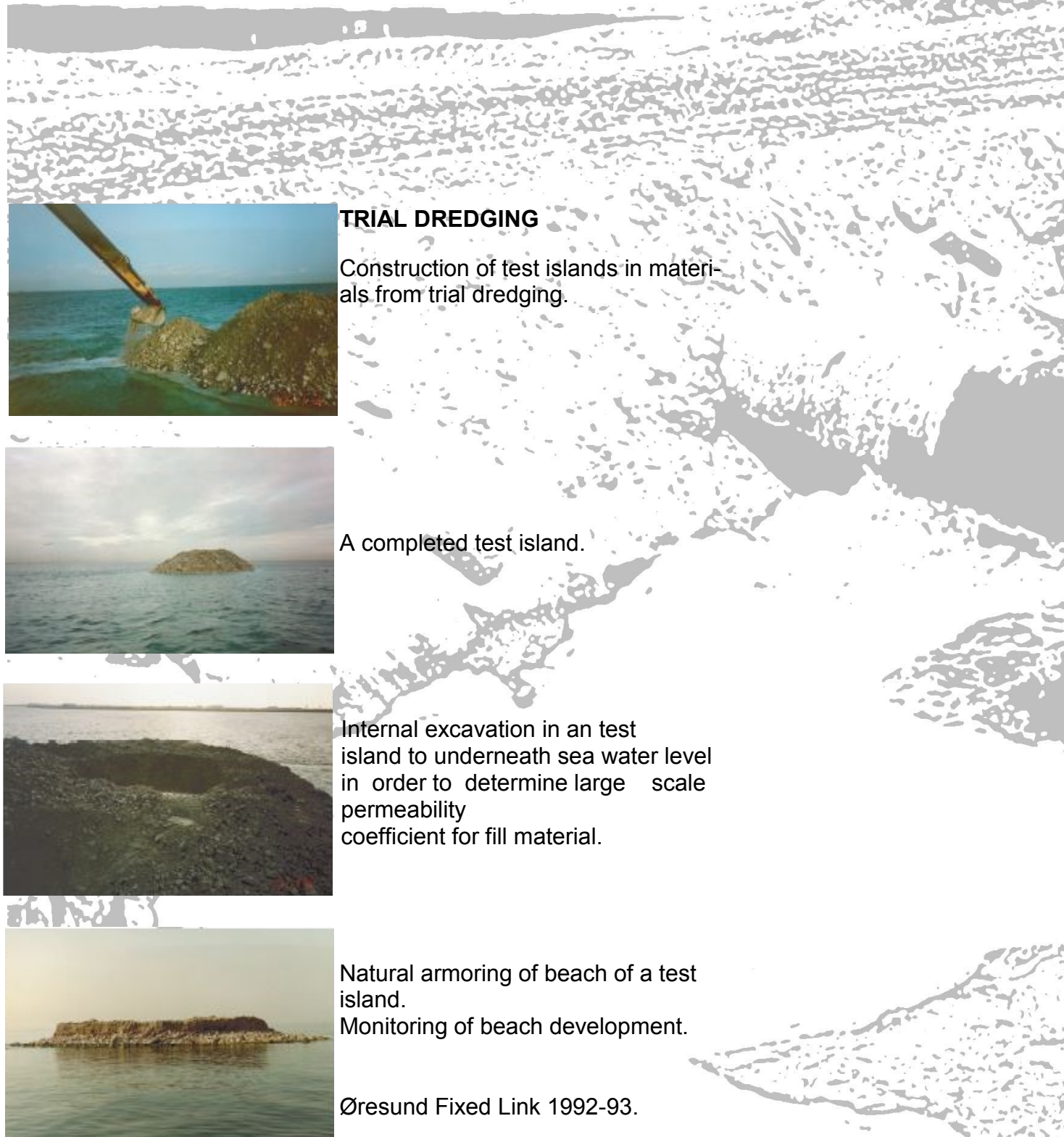
It is, however, also a discipline where accidents still takes place due to lack of understanding of the basic physics. LICENGINEERING has specialized itself in making scour protections of lighter materials which may move and rearrange themselves under the action of waves and current.

In spite of this, they continue to protect the structures. Further, they establish stable transitions to the ambient soils.





Scour Protection of Outlet from Storm Surge Relief Culvert.  
Great Belt Link, 1995.



### TRIAL DREDGING

Construction of test islands in materials from trial dredging.



A completed test island.

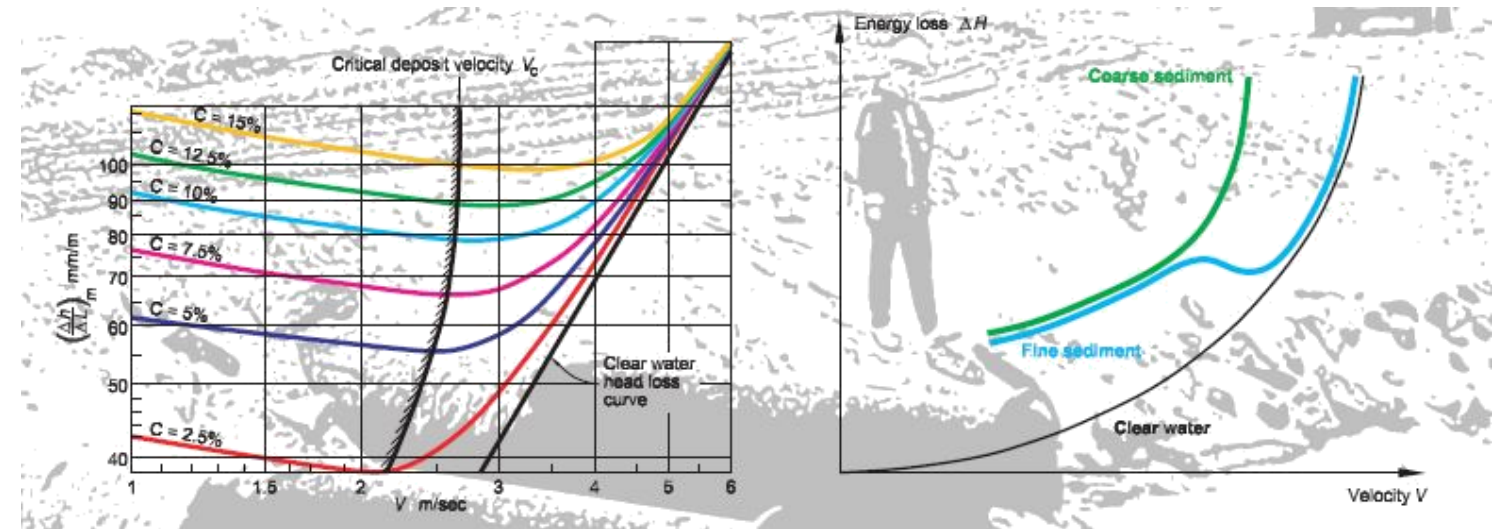


Internal excavation in an test island to underneath sea water level in order to determine large scale permeability coefficient for fill material.



Natural armoring of beach of a test island.  
Monitoring of beach development.

Øresund Fixed Link 1992-93.



### ANALYSIS OF SLURRY TRANSPORT IN PIPELINES

The graph to the left shows the traditional head loss versus flow velocity for slurry transport of sand with the famous minimum.

The graph to the right shows the head loss versus flow velocity when the sediments comprises both fine and coarse fragments.

The coarse sediment remains on bottom of pipe in dune formations, which maintains flow resistance also at higher flow velocities.



### TRIAL DREDGING

Fracturing of limestone by blasting.  
Øresund Fixed Link, 1992.