PIANC MarCom
Working Group 51 Report
“Guidelines for Water Injection Dredging (WID)”
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Presentation Outline

- Working Group 51 Objectives
- Elements of Report
- WID Background (Theory, Applicability, Environmental Impacts, etc.)
- WID Fleet
- WID Contracts
- WID Advantages and Disadvantages
- Case Studies
- Summary
Working Group 51 Objectives

- Provide guidance when WID is feasible.
- Provide guidance on contract conditions for WID-contracts between the contractor and the client.
- Describe potential environmental effects of WID.
- Produce a summary of WID projects executed, and their performance.
- Produce an overview of environmental studies related to WID.
- Produce an overview of existing WID-equipment (size, type, etc.)
Elements of Report

- Theoretical considerations and physical principles of WID
- Natural boundary conditions needed for an efficient use of WID
- List of typical applications for the WID technique
- List of available WID equipment throughout the world
- Environmental considerations to be taken into account when using WID
- Monitoring needs
- Typical contract conditions that can be used for WID projects
**Theory of WID**

The WID process can be divided in four sub-processes:
- Reduction of the soil’s cohesion;
- Fluidization of the soil layer;
- Flow of the density current;
- Settlement of the soil particles.
WID is NOT Agitation Dredging!

- In WID the vertical movement of the sediment is purposely limited to approximately 1 to 3 metres, just above the bed;
- During agitation dredging and hopper overflow the sediment is put into suspension, preferably over the whole height of the water column.
Applicability of WID Depends on:

- Soil characteristics;
- Site bathymetry and geometry;
- Hydrodynamic conditions;
- Geographic location (accessibility, proximity to structures, etc.);
- Type and level of contamination
Environmental Impacts of WID

Effect parameters such as:

- suspended solids,
- turbidity,
- contaminants
- dissolved oxygen

Special attention has to be given when following conditions occur at or nearby the dredging site:

- Sensitive habitats near the dredging area e.g. shellfish beds, spawning habitats, sandy gravely habitats, clear water estuaries, coral reefs…
- When contaminants are in the soil.
WID Monitoring

- Operational monitoring to control the process (mainly for the contractor)
- Contractual monitoring to control the contractual obligations (mainly for the client)
- Environmental monitoring to prove that all requirements are met (mainly for third parties)
### WID Dredgers (as per June 2010)

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Maximum dredge depth (m)</th>
<th>Jet bar width (m)</th>
<th>Jet pump diesel engine power (kW)</th>
<th>Company</th>
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<tbody>
<tr>
<td>Maasmond</td>
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<tr>
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<tr>
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<tr>
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<tr>
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</table>
Contractual Conditions

Four general categories of contracts which are typically used for WID are:

- the lump sum contract
- the re-measurable contract
- the charter (rental) contract
- the target cost contract on an alliance or partnership basis
WID Advantages

- In right conditions WID can be capable of high production rates at low costs.
- Can be operated with minimal crew and other auxiliary plant.
- Due to the relatively small amount of auxiliary equipment it can offer a relatively rapid excavation alternative.
- WID has a continuous operating methodology. There is no need to transport the dredged material to a placement site.
- Sediment remains in the natural system
- It can be highly mobile, operate while leaving the shipping channel relatively unimpeded.
- Can used underneath jetties and moored vessels), and have a reduced risk of damaging submerged infrastructure i.e., pipelines, cables, quay walls, lock aprons, dry-docks, etc.
- Portable WID vessels can allow rapid deployment to relatively remote sites
- Can be used for levelling water bottom for pipelines, tunnel sections, etc., or increasing depth of pipelines and cables.
- An ambient current is not necessarily required if conditions right.
- Can result in reduced carbon footprint.
- WID may provide either a standalone dredging solution or a complement to conventional dredging methods.
WID Disadvantages

- WID can only be used where in-water dredged material placement is allowed.
- Applicability is more restricted by site-specific conditions than more traditional types of dredgers. Discharge channels, where necessary, require maintenance.
- WID cannot be used where unacceptable environmental impacts can be caused by the generated density current (i.e., contaminate resuspension, unacceptable suspended solids impacts, etc).
- Production can only be measured by pre- and post-dredge hydrographic survey, and surveying in fluid mud can be complicated (nautical depth concept).
- Destination of dredged material is more difficult to predict.
6 Case Studies

- Water Injection Dredging in the Weser Estuary
- Port of Antwerp – Controlling Sediment Accumulation Behind Zandvliet Lock Using WID
- Demonstration on the Michoud Canal, Louisiana
- Outer Harbours of Bremerhaven
- WID Assisting Trailing Suction Hopper Dredge Kakinda (India)
- Sao Luis - Brazil
Summary

- Report Status – Pending PIANC approval of final draft.
- While WID is a relatively new dredging method, its existed for approximately 25 years, can currently be considered as proven technology - WID fleet available on the market growing every year.
- As opposed to agitation dredging, the WID generated density current does not disperse the sediment over the whole water column. The density current is more controllable than agitation dredging.
- The exact destination of displaced material is difficult to predict.
- The use of WID is more restricted by site-specific conditions than more traditional types of dredgers.
- When applicable, WID has been demonstrated to be extremely effective and economical in tidal harbours, rivers, and estuaries, especially for fine grained soils.
- All types of contract are possible however, currently most clients prefer a charter contract.