Physical Modeling of Nearshore Placed Dredged Material

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**Physical Modeling of Nearshore Placed Dredged Material**

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### Report Documentation Page

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Study Motivation

- The U.S. Army Corps of Engineers (USACE) continues to seek opportunities for the beneficial use of dredged material.
- Quantify benefits of nearshore dredged mound placement
- Determine movement of mound sediment
- Provide data for development of C2Shore numerical model
LARGE-SCALE SEDIMENT TRANSPORT FACILITY

- Large-scale facility with 18-m wide (cross-shore) by 30-m long (longshore) sand beach (0.15 mm median grain diameter)
- Waves produced by four synchronized wave generators oriented at a 10-degree angle to shoreline
- Wave-driven currents supplemented by an external recirculation system to simulate infinitely long beach
- Longshore sediment transport rate measured with traps installed at the down-drift boundary.
Mound Experiments

- Base case scenario was performed to measure the natural movement of sand and to help isolate the influence of each mound.
- Mounds were located at approximate prototype depths of 11 ft (Mound 1) and 4 ft (Mound 2) relative to the still water level with a prototype height of 5 ft, and placement onshore (Mound 3) with a 10 ft prototype height.
- Each mound was dyed with a different color to increase the contrast between the placed material and the beach.
- Incident wave conditions simulated at a 1:20 scale for an offshore incident wave height ($H_{mo}$) of 10.8 ft with a peak period of 6.7 sec and a breaking wave angle of ~6.5 degrees from shore normal.
- Each case was run for a prototype time of ~9 hours.
Test Cases
Mound Profiles

![Graph showing Mound Profiles with different profiles represented by lines. The x-axis is Cross-Shore Location (m) and the y-axis is Elevation (m). Legend includes Base Condition, Mound 1, Mound 2, Mound 3, and Waterline.]
Base Condition Longshore Current

![Graph showing the relationship between longshore current (m/s) and cross-shore location (m).]
Base Condition
Bathymetry Change

Erosion    Waves    Accretion
Initial Mound Experiment
Dyeing Sediment

- Provided contrast to natural sand
- Dyeing Procedure:
  - Sand mixed with liquid cement color until all sand was of uniform color.
  - The sand allowed to air dry and subsequently oven-baked at 70 to 80 deg C for a minimum of 24 hours.
  - After removal from oven, the sand was suitable to be placed on the beach for testing.
Mound 1 after 120 minutes

T = 0 min

T = 120 min

T = 0 min

T = 120 min
Mound 1 Bathymetry Difference
Mound 2 Location

Base Condition
Mound 1
Mound 2
Mound 3
Waterline

Cross-Shore Location (m)

Elevation (m)

Wave Absorber

Mound 2

Pump Discharge
Toe of Beach

20 Vertical Turbine Pumps

3.0 m

9.0 m

4.0 m

10.0 m

0.75 m

7.62 m

8.0 m

9.0 m

10.0 m

11.0 m

12.0 m

13.0 m

14.0 m

15.0 m

16.0 m
Mound 2 after 120 minutes
Mound 2 Bathymetry Difference

Erosion

Accretion

Waves
Mound 3 after 120 minutes

T = 0 min

T = 120 min

T = 0 min

T = 120 min
Mound 3 Bathymetry Difference

Waves

Erosion

Accretion

Innovative solutions for a safer, better world
Conclusions

- Sand placed in the surf zone remained in the surf zone for the given wave conditions
- Accretion often occurred onshore of the mound due to sheltering
- Mound sand transported downdrift and onshore
- Dispersion and mixing occurred quickly for each case