UPHAM BEACH STABILIZATION PROJECT
BOUSSINESQ WAVE MODELING TO ADDRESS CONCERNS OF LOCAL SURFING COMMUNITY

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Presentation Overview

• Project Area History
• Study Objectives
• Model Results
• Alternatives Comparison
• Policy Considerations
• Conclusions & Recommendations
Upham Beach, Pinellas County, FL

- North end of Long Key
- Downdrift of Blind Pass
- History of being highly erosional
1995-2008 Time Series

- Persistent Erosion Hotspot
- Periodic Nourishment
- Structural Stabilization
- Geotube Experiment
Inlet Management Plan

• Required and cost-shared by FDEP
• Evaluated erosion related to inlet
• Recommended corrective actions
• Completed 1992 by CPE
Blind Pass Inlet Management Plan (IMP)

• Goals:
  • 100% sand bypassing
  • Maintain Upham Beach
  • Maintain Navigation (recreational)

• Option I: Close Inlet
  1. No Action
  2. Remove Jetties / Fill Channels
  3. Nourish Upham Beach with offshore borrow area

• Option II: Sand Bypassing Methods
Blind Pass IMP Sand Bypassing Options

1. Dredge inlet / nourish Upham every 6 years
2. Install groins and dredge inlet / nourish Upham every 6 years
3. Dredge inlet & deposition basin / nourish Upham every 4 years
4. Purchase and operate dedicated dredge
5. Crane mounted jet pump on Treasure Island
6. Jet pump / fluidizer system in inlet
7. Dredge inlet every 6 years / nourish Upham every 3 years
8. Install breakwaters and dredge inlet / nourish Upham every 6 years
### Upham Beach Nourishment History

<table>
<thead>
<tr>
<th>Project</th>
<th>Year</th>
<th>Length (ft)</th>
<th>Volume (cy)</th>
<th>Sand Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of St. Pete Nourishment</td>
<td>1975</td>
<td>2,500</td>
<td>75,000</td>
<td>Blind Pass</td>
</tr>
<tr>
<td>Initial Upham Beach Construction</td>
<td>1980</td>
<td>2,640</td>
<td>253,760</td>
<td>Blind Pass</td>
</tr>
<tr>
<td>1st Beach Renourishment</td>
<td>1986</td>
<td>2,400</td>
<td>96,712</td>
<td>Pass-A-Grille Channel</td>
</tr>
<tr>
<td>2nd Beach Renourishment</td>
<td>1991</td>
<td>2,400</td>
<td>229,950</td>
<td>Blind Pass</td>
</tr>
<tr>
<td>3rd Beach Renourishment</td>
<td>1996</td>
<td>2,400</td>
<td>225,000</td>
<td>Egmont Shoal</td>
</tr>
<tr>
<td>4th Beach Renourishment</td>
<td>2000</td>
<td>2,700</td>
<td>281,000</td>
<td>Blind Pass</td>
</tr>
<tr>
<td>5th Beach Renourishment</td>
<td>2004</td>
<td>3,600</td>
<td>385,000</td>
<td>Pass-a-Grille Channel and Ebb Shoal</td>
</tr>
<tr>
<td>2006 Corps Storm Repair</td>
<td>2006</td>
<td>1,960</td>
<td>124,000</td>
<td>Egmont Shoal</td>
</tr>
</tbody>
</table>

Geotextile Groins (Geotubes) installed in 2005 to test stabilization of Upham Beach and evaluate reduction of nourishment needs.
Long Term Cost Savings

• Historic nourishment events have required multiple distant sand sources

• County 25-yr nourishment cost projections:
  • $53.5 M without structures
  • $22.5 M with structures
  • Potential Cost Savings = $31,000,000 (25 yrs)

• Estimated structure cost = $5 M

• Skipping just one nourishment event in 25 years pays for installation cost of structures
Pre-nourishment, Pre-geotubes
Post-nourishment, Geotube Construction
Post-nourishment, Post-geotubes

2008
How did we do??

Each photo represents two years after nourishment

2002

2008

>100 ft wider beach!
“Overall, during the 2006-2008 nourishment monitoring period, the beach retained more sand [38%] with the structures as compared to the 2000-2002 nourishment monitoring period without structures.” (USF, 2009)
No Downdrift Impacts Observed

Downdrift shoreline is uniform and straight

February 2009
Re-cap ...

• Geotubes installed in 2005 to test effectiveness of reducing erosion without downdrift impacts

• Performance monitoring:
  • Structures retained sand
  • No negative downdrift impacts
  • Seawall only exposed after damage to geotubes
  • Some improvements can be made

• County planning to install permanent structures

• City of St. Pete Beach support (July 2008)
Stakeholder Concerns

• Existing geotubes have been damaged
• Safety of beach goers
• Aesthetics and durability
• Effects on surfing:
  - wave quality, break location, reflection
What to do?

County offered to develop a modeling study to evaluate structural alternatives that would maintain storm protection and minimize impacts to beach users

- Stakeholder Meetings (Feb-09, June-09)
- Design Alternatives Development
- BOUSS2D Wave Modeling
Project Objectives

- Storm protection
- Maintain minimum 40 ft wide beach
- Provide structural stabilization to hold sand
- Not cause downdrift erosion
- Reduce frequency/volume for nourishment
- Minimize impacts to surfers and beach goers
- Minimize cost & permitting effort
Alternatives Development

• Existing Design

• 4 Alternatives
Existing Design

Predicted Shoreline Response

- T-Heads add protection but affect wave quality
Alternative 1: Straight Groins, Extended Jetty

Similar/less protection, no wave reflection, surfing areas next to groins
Alternative 2: Modified T-Head Design

Improved protection, less wave reflection, surfing area at public beach
Alternative 3: Curved T-Heads, Artificial Reef

Similar protection, reduced wave reflection, surfing reef

Reef placed in area of wave focusing
Alternative 4: Modified Existing Design

Similar to existing design with minor modifications of T1 and T2 to increase beach width fronting the northern seawalls.
BOUSS-2D Wave Breaking Model

- Simulates waves and surface currents
- Model simulations included cold fronts and hurricane conditions
- Verified through comparison with observed conditions
- Evaluation of existing conditions and potential alternatives
Simulation of Observed Conditions
2004 Bathymetry
“Good Old Days”
(surfing)

Growth of ebb shoal

2006 Bathymetry
Model Results

• 2009 Conditions

• 4 Alternatives
Existing Conditions for Model Runs (2009 Bathymetry)
Alternatives Analysis with 2009 Bathymetry

Alternative 1

Alternative 2

Alternative 3

Alternative 4
# Model Wave Cases

<table>
<thead>
<tr>
<th>EVENT</th>
<th>Hs (ft)</th>
<th>Tp (s)</th>
<th>Nearshore Direction (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Front A</td>
<td>2.5</td>
<td>9.2</td>
<td>270 (b) - higher angle</td>
</tr>
<tr>
<td>Cold Front A (b)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Front B</td>
<td>3.0</td>
<td>6.5</td>
<td>282</td>
</tr>
<tr>
<td>IVAN</td>
<td>3.3</td>
<td>11.8</td>
<td>250</td>
</tr>
</tbody>
</table>

Note: Wave height at breaking is larger due to wave shoaling.
Example Model Simulations

Video

- Existing Conditions
- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 4
Study Findings

• Shoal affects wave energy and surfing conditions.

• Existing geotube design is effective in maintaining storm protection, but impacts surfing areas.

• T1 and T2 can be modified slightly to improve performance at north end.

• T5 still buried 3+ years after beach construction.

• Modifying groin field can address concerns without compromising storm protection.

• Safety issues remain and can be addressed.
# Alternative Comparison Matrix

<table>
<thead>
<tr>
<th>Objective</th>
<th>Existing Design</th>
<th>Straight Groins ALT 1</th>
<th>Modified T-Heads ALT 2</th>
<th>Curved Heads w/ Reef ALT 3</th>
<th>Modified Existing Design ALT 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Protection to Upland Properties</td>
<td>**</td>
<td>*</td>
<td>***</td>
<td>**</td>
<td>***</td>
</tr>
<tr>
<td>Limit Erosion to Downdrift Beaches</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Reduce Nourishment Needs</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Minimize/Mitigate Impacts to Surfers</td>
<td>*</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>*</td>
</tr>
<tr>
<td>Maximize Public Beach Width</td>
<td>***</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>***</td>
</tr>
<tr>
<td>Minimize Permitting Effort</td>
<td>***</td>
<td>**</td>
<td>**</td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td>Cost Estimate</td>
<td>$5M</td>
<td>$6M</td>
<td>$4M</td>
<td>$8M</td>
<td>$5M</td>
</tr>
</tbody>
</table>

Note: Cost estimates provided for comparison purposes only.
Recommendations to County

- Repair existing geotubes with upcoming nourishment project to retain sand
- Move forward with permit application for permanent structures:
  Alternative 2 – Modified groin field with one less structure fronting public beach

“It maintains an area for the surfing stakeholders thus creating a win-win situation for all.” Steven J. Hallock, Public Services Director, City of St. Pete Beach.
Guidelines & Policy Considerations

• Ground Rules: No consideration of aesthetics. Functionality only.

• Are structural systems functionally interchangeable?

• Are their performances equally sensitive to an understanding (or lack of understanding) of nearshore processes?

• Can they be pre-filled to absolutely negate any possibility of downdrift effects?

• Are adjustable groins viable?

• Can numerical models be used to discriminate between the performances of different types of stabilizing structures?

• Selection criteria for your design if appropriate.
Conclusions

• Structures can and should be used strategically to cope with hotspots and limited sand resources

• Structures can and do effect wave quality and recreation; there are safety issues

• Science and monitoring should be the basis for design

• Coordination with stakeholders is important

• Design guidelines can be developed, but policies may be difficult

• “one size doesn’t fit all”
The authors would like to acknowledge Pinellas County for funding this study and taking proactive steps toward addressing concerns of the surfing and beach community.

Thank You!