Wave Attenuators and Fixed Wave Screens

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Wave Attenuators and Fixed Wave Screens

• Boat Launch and Perimeter Protection
  • Need?
  • What are the options?
  • How do you select?
• Example projects
Do I need a wave attenuator or fixed wave screen?

- Exposure to waves and wakes
- Storm Exposure
- Tranquility Conditions
  - Annual
  - Weekly
Exposure

- Obvious
  - Open water, ferry traffic, reported issues

OR

- Fully protected basin

- Uncertain, Possible?
  - “Wind/Wave Analysis”
Exposure

• Storm Exposure
  • 25/50 year event
  • Waves greater than ~2-ft.
  • Potential for infrastructure damage
  • Boaters not likely “out”

• Tranquility
  • Annual/Weekly

  • Marina - Varies based on wind direction/vessel orientation “martini test”

  • Boat Ramp - 6” (Tobiasson and Kollmeyer)
What are the options?

• Do nothing/accept risk

• Floating Wave Attenuator

• Fixed Wave Screen

• Other
Do nothing/accept risk
Floating Attenuator

- Floating structure that reduces wave energy
  - Width, depth, mass, movement

- Many types

- Generally limited by wave period (crest to crest timing)
  ~3s, maybe 4s
Floating Attenuators
Fixed Wave Screens

• Fixed construction structure that reduces and/or reflects wave energy
  - Depth, rigidity, porosity

• Generally limited by regulatory aesthetic factors
  - Penetration depth of screen allowable
  - Exposed height of screen tolerable
Fixed Wave Screens

BEWARE OF GAPS
Other Alternatives

- Rubble Mound Breakwaters

- Earthen Dikes/Breakwaters
How do I pick?

- Level of exposure (“Wind/Wave Analysis”)
- Site Characteristics
  - Water depths
  - Geotechnical
  - Spatial constraints
  - Function (dockage)
- Regulatory parameters
- Aesthetics
- Cost
Floating Wave Attenuators

**PROS**
- Multi-use (dockage)
- Regulatory
- Water quality/circulation
- Overtopping resistance
- Aesthetics
- Less reflection
- Cost

**CONS**
- Limited effectiveness with longer period waves
- Larger footprint required
Fixed Wave Screens

**PROS**
- Limited footprint (thin)
- Effective for longer period waves (up to ~8 sec. +)
- Options on materials

**CONS**
- Wave reflection and overtopping
- Aesthetics (height)
- High structural loads and rigidity requires conservative design
- Cost
Floating Wave Attenuators

Example Projects
Example 1 – Mid-Atlantic
Problem and Solution

• Substantial exposure
  • Resort on the point
  • 3 directions

• Wakes
  • Shipping
  • Recreational

• 5.2’ tide

• Substantial Water Depths

• Robust concrete floating wave attenuator w/dockage

• Chain and Mass Anchor
Photo Details
Example 2 – Mid-Atlantic
Problem and Solution

- River setting, but exposed
  - 3 directions
  - Bridge of little protection
- Substantial tide
- Varying Water Depths
- Cost sensitivity
- Riverwalk

- Aluminum frame floating wave attenuator
- Steel anchor piles
Example 3 – Mid-Atlantic
Problem and Solution

- River setting, but exposed
  - “Hurricane Alley”
- Minimal tide
- Limited Water Depths
- Ground Out Possible
- Cost sensitivity

- Timber frame floating wave attenuator
- Steel anchor piles
Photo Details
Other Floating Attenuator Examples
Other Floating Attenuator Examples
Fixed Wave Screens

Example Projects
Example 1 - Gulf Coast
Problem and Solution

- Tide range $\sim 1.5'$ (100-yr RP $\sim 17'$ MSL)
- Agitation problem - monthly SE $H_s \sim 1.6'$, $T_p \sim 3$ sec
- Inside Basin $H_s \sim 0.2'$ to 0.5'
- Alts evaluated and 160' wave screen recommended
- Avg wave height reduction $81\% (<0.1')$
Design Details

- 36” PC pipe piles, vinyl sheet piles, timber wales
- 24” gap over seabed
- Design load 25-yr RP wave height (piles & wales)
- Panels accept damage to control costs

Example 2 - Florida

Existing Wave screen

Site

Damaged Docks
Problem and Solution

- Limited performance from existing floating attenuator; lack of protection along south flank
- Wind waves and wake damaged floating docks
- Fetch ~ 3 miles
- Tide range ~ 1'

- Goal - Provide tranquil basin under typical conditions
- Reduce storm wave $H_s$ ~ 3.5', $T_p = 3-4$ sec
- Inside Basin less than ~ 1' during storm condition
Design Details

- 35’ x 16” x 20” H-piles, 9’ x 8.5’ x 7.5” concrete panels
- 36” max gap over seabed
- Design load 25-yr RP wave height
Construction
Example 3 – New Jersey
Problem and Solution

- Tide range ~ 5.5'
- Deep water in adjacent Arthur Kill
- Agitation problem - commercial vessel wakes
- Existing open piled pier parallel to Federal Channel
- Goal of $H_s < 0.5'$ typical, 1' occasional acceptable
- Retrofit pier for wave screen
Design Details

- HP pile frame (existing pier)
- Steel sheet pile panels with stingers
- Crest elevation to match pier
- 24” gap over seabed
- Design load governed by local vessel wake (up to 4’, 4-5 sec)
Other Example - Georgia
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Other Example - Georgia
Conclusions

• Determine protection needs/goals

• Evaluate feasible alternatives (including regulatory requirements)

• Use current guidelines for design

• Determine your acceptable balance of risk, costs, and desired protection needs