Coastal Engineering Design Criteria for Living Shorelines

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Disappearing Barrier Islands
Severe Land Loss
Transmission Coefficient vs. Oysterbreak Transmission Number

Equation 4.1:

Oysterbreak transmission number, \( \Omega = \frac{H^2}{L_{sw} \times \left(c^2 \times \Psi\right)} \)

Pressure sensor 1

Oysterbreak

Pressure sensor 2

Pressure sensor 3

Transmission Coefficient, \( K_t \)

Time (days)
What is a “Living Shoreline”?

Soft Solution
Bioengineered shoreline
Productive shoreline
Vegetated shoreline
Green Infrastructure
etc............

Background Photo courtesy of Oyster Restoration Workgroup
http://www.oyster-restoration.org/living-shorelines/
Typical Living Shoreline Profile

Coastal Shoreline Continuum & Typical “Living Shorelines” Treatments

- **Upland Buffer**: Native Deciduous Trees in Buffer
- **Bankface**: Deep Rooted Native Grasses & Shrubs on Banks
- **Coastal Wetlands & Beach Strand**: Wetlands Plants Matched to Tidal Hydrology & Salinity, Sills, Stone Surface Groins, Marsh Toe Revetments, Marshy Islands etc. Matched to Wave Climate & Shoreline Environment
- **Subtidal Waters**: Submerged Aquatic Vegetation, Artificial Oyster Reefs - Marl Stone with Oyster Spat

Figure courtesy of NOAA Habitat Conservation Restoration Center
http://www.habitat.noaa.gov/restoration/techniques/lsimplementation.html
Louisiana’s Living Shoreline Projects

2012 Coastal Master Plan

Projects Included:
- Structural Protection
- Bank Stabilization
- Oyster Reef
- Ridge Restoration
- Shoreline Protection
- Barrier Island Restoration
- Marsh Creation
- Sediment Diversion
- Hydrologic Restoration

[Map showing various coastal projects in Louisiana]
Living Shoreline Products

- Marine Mattress
- Ecodisks
- Reef ball
- Oysterbreak
- Biohaven Floating Island
- Reefblk
- Ajax
- HESCO
- WADs
Merging Ecological and Engineering Goals

Ecological goals
- Habitat functional value
- Increase specific habitat type
- Resilience

Engineering goals
- Design criteria
- Performance criteria
- Cost effective
- Constructible project
Typical Coastal Engineering Criteria

Design Criteria vs Performance Criteria
Typical Coastal Engineering Criteria

Design Criteria vs Performance Criteria
Typical Coastal Engineering Criteria

Design Criteria
- Design life
- Shoreline protection length
- Cost

Performance Criteria
- Wave energy reduction
- Decrease shoreline erosion rate
- Minimize impacts to adjacent shoreline
Living Shoreline Criteria

Ecological

- Habitat Functional Value
- Complexity & Diversity
- Salinity Regime
- Soil Composition
- Water Quality

Engineering

- Design Storm = Stability
- Wave/Current Interaction
- Geotechnical Loading
- Planform & Cross Section
- Material Properties

Oyster Reef Elevation
Size of Oyster Cultch/Substrate
Tidal Marsh Elevation
Wave Tolerance of Smooth Cordgrass
Example: Indian Point Mitigation Site
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Reproduced from Roland and Douglass, 2005.

No Wetland Exists

Wetland Exists

Reproduced from Roland and Douglass, 2005.
Example: Indian Point Mitigation Site

Reproduced from Roland and Douglass, 2005.

Potential Smooth Cordgrass Area

Seagrass Line

No Wetland Exists

Wetland Exists

Reproduced from Roland and Douglass, 2005.
Example: Bioengineered Oyster Reef Demo
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Example: Bioengineered Oyster Reef Demo

BW-A ARMOR UNITS TO BE CONSTRUCTED OF OYSTERKRETE CONCRETE, SEE SPECIFICATIONS

Top Oysterbreak Armor Unit Layer

Bottom Oysterbreak Armor Unit Layer

2.5' FIELD VERIFY PRIOR TO PLACING OYSTERBREAK ARMOR UNITS

Section of Oysterbreak Armor Unit

Staggered Oysterbreak Armor Unit

T.O. BREAKWATER VARIES

B.O. TOE VARIES

MIN. 30' B.O. ACCESS CHANNEL NO DEEPER THAN EL -7.0

Distance in Feet

Scale in Feet
Example: Bioengineered Oyster Reef Demo
Summary

- Merging of Ecological and Engineering Goals
- Design vs Performance Criteria
- Ecological & Engineering Criteria
Future Steps & Potential Research Areas

- Research of engineering properties of various products applicable to coastal environment
- Development of tolerance curves of various coastal biota