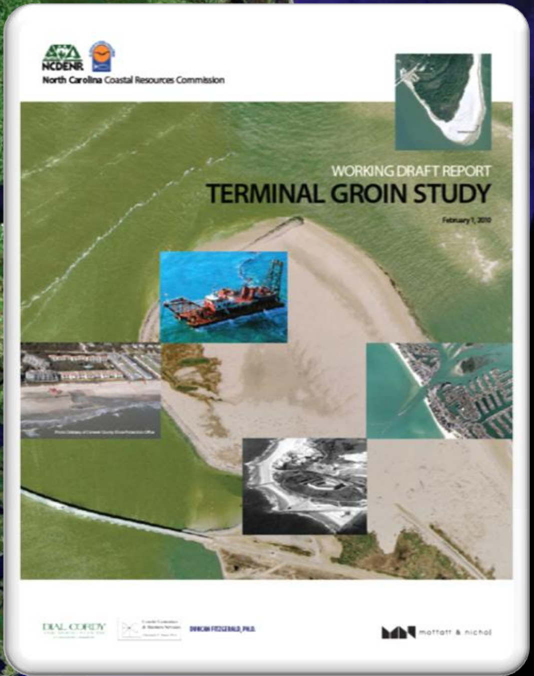
NC Terminal Groin Study:

Feasibility and Advisability of the Use of a Terminal Groin as an Erosion Control Device

DISCUSSION OF DRAFT REPORT

Science Panel Meeting

February 8, 2010



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Meeting Agenda

- Introductions
- Discussion of Draft Report
  - Coastal Engineering Analysis and Geological Assessment (Section II & III)
  - Environmental Assessment (IV)
  - Economic Assessment (VI)
  - Construction Techniques, Costs, Locations (V, VII, VIII)
- Next Steps

II & III – Coastal and Geological Assessment

Method/Approach

- Gather and Compile Physical Data
- Shoreline Change
  - GIS Shorelines (DCM, NCDOT, FL DEP) from available pre- and post-terminal groin periods
  - Measure shoreline change along transects every 50 m for 3 miles each side of inlet
  - Calculate pre and post shoreline change rates (cumulative averages and averages over intervals)
- Beach Volume Changes
  - Use available profiles near each site to shoreline change to beach volume relationships
  - Compute beach volume changes based on shoreline change

II & III – Coastal and Geological Assessment

Method/Approach (con't)

- Nourishment
  - Determined nourishment and placement volumes and locations
  - Calculated volume changes pre- and post-structure netting out all nourishment (subtract nourishment volumes)
- Dredging
  - Determined dredging volumes
  - Presented scenarios for amounts of dredge material (excluding sidecaster) that may have otherwise have naturally bypassed the inlet (add back percentage of dredging volumes)
- Geologic setting
  - Review literature for 5 sites
  - Discuss physical and geologic processes as they relate to terminal groins (examine aerial photography, longshore sediment transport behavior, morphological changes, human impacts)

II & III – Coastal and Geological Assessment

Summary Results

- Shoreline Change (only based on shorelines)
  - All shorelines on the structure side of the inlet were eroding prior to groin construction
  - Shorelines on opposite side of inlet do not display a clear trend
  - However due to nourishment and dredging activities assessments cannot be made on shorelines alone
- Nourishment and nearshore disposal volumes
  - On structure side of inlets after removing (netting out) all beach nourishment and nearshore disposal, the beach along 3 miles generally display a reduction in eroded volume (except Amelia and one of the Pea Island time periods calculated)
  - Beach volume changes on opposite side of the inlet again do not show a clear trend

II & III – Coastal and Geological Assessment

Summary Results (con't)

- Dredging
  - If 25% of material dredged had naturally bypassed the inlet and deposited on the beach no negative impact would be shown on Shackleford Banks or Pea Island only remaining increased eroded volume is Bodie Island

II & III – Coastal and Geological Assessment

Discussion

IV - Environmental Analysis

Method/Approach

- Contacted and Collected Biological Resource Data
  - State and Federal Agencies
  - Non-Profit Organizations
  - Non-Governmental Organizations
  - Resource Experts
- Reviewed Existing Data and Literature
- Evaluated Available Data and Compared Regionally
- Currently Addressing Science Panel Comments from 19 January meeting

IV - Environmental Analysis

Summary Results

- Resources continue to use locations where terminal groins exist
- Anchoring the end of an island may curtail an inlet's natural migration patterns but also can restore degraded habitats
- Minimizing natural overwash at the end of an island prevents natural barrier processes which affects inlet habitats, thus affecting species use

IV - Environmental Analysis

Summary Results (con't)

- Fillet material should be compatible to minimize effects on benthic infauna recovery and upper trophic levels
- Terminal groins can reduce the number of beach placements needed to manage an erosional hot spot by retaining littoral and placed material
- Proper terminal groin designs and placements can minimize littoral transport effects, thus minimizing resource use effects

IV - Environmental Analysis

Discussion

VI – Economic Study

Method/Approach

- Identify Properties and Infrastructure at Risk (Use Proposed 30-yr Risk Lines)
- Assemble Current Property and Infrastructure Location and Value Data – Location (County Parcel Data) – Value (County Appraisals, NCDOT, Utility Companies)
- Add Up Economic Value – Tabulate Each Side of Inlet
- Include Property Loss, Public Infrastructure, and Tax Base Losses
- Discussions on Diminished Market Value, Impact on Second Row, Environmental and Recreational Values

VI – Economic Study

Summary Results

- Economic Impacts Vary Widely By Inlet and Side of Inlet
- Inlets With Higher Development May Have In Excess of $100 M of Infrastructure and Property at Risk Over the Next 30 Years
- All Areas Denoted By 30-yr Risk Lines May Not Be Protected By a Terminal Groin Structure
- Additional Factors Such as Recreation, Environmental Economic Value, and Property Transfer Value Can Be Important

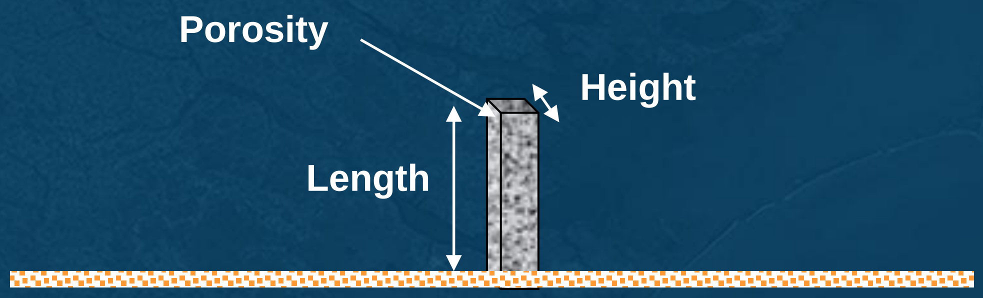
VI – Economic Study

Discussion

V – Construction Techniques

Method/Approach

- Literature Review of Techniques Used to Limit Impacts on Adjacent Shorelines:
  - Limits on Groin Height and Length
  - Porosity of Structures (Sediment Transmission)
  - Materials, etc.
- Parametric Study With Available Data for Five Sites



V – Construction Techniques

Summary Results

- Longer Length Has More Effect - Threshold
- Higher Elevation Has More Effect – Threshold
- Leaky Groin at Amelia Appears to Have Minimal Impact and Limited Length of Benefit
- Groin Structure Shape Also Has Influence - Inclined And Notched Structures As Well As Various Planform Shapes (T-shaped, L-shaped, Dogleg, Etc.)
- Material Types Have Also Been Shown To Affect Sediment Transport Rates And Shoreline Behavior. Concrete, Steel, And Timber Sheeting And Pilings Allow For Adjustments In The Field As Well As Removal Of The Structures If Shown To Have An Unacceptable Adverse Impact.

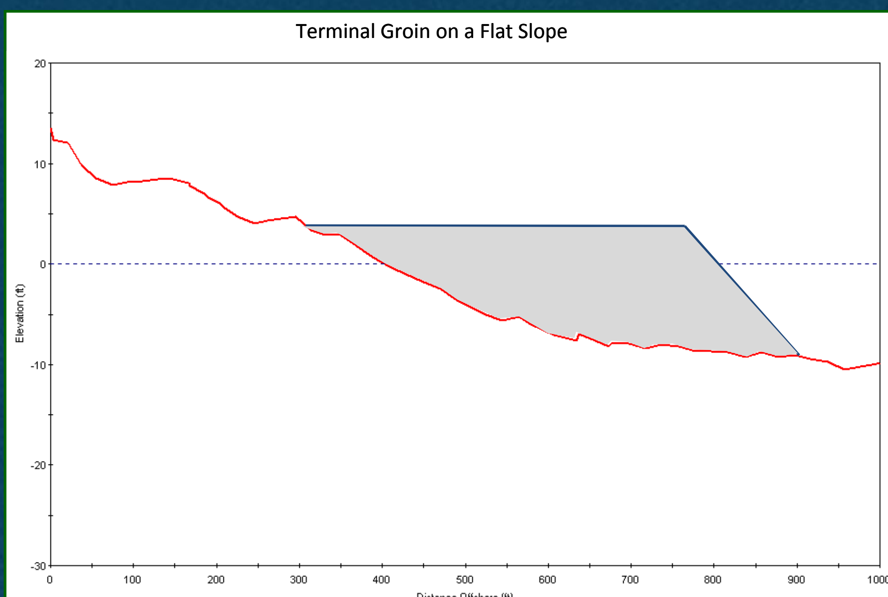
V – Construction Techniques

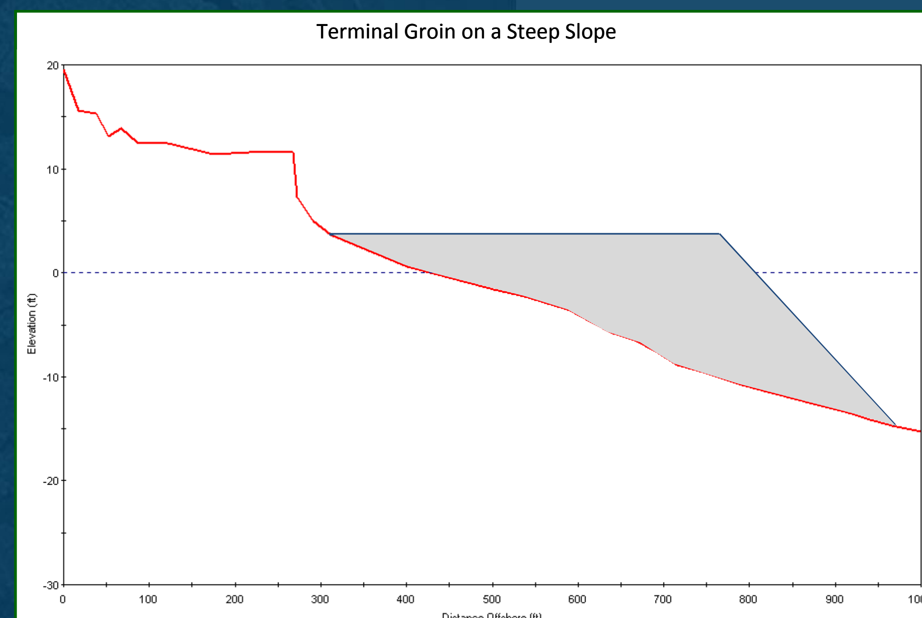
Discussion

VII – Initial Construction & Maintenance Costs

Method/Approach

- Review Available Cost Data For Existing Terminal Groins Including Public and Private Costs
- Develop Ranges of Potential Costs Based on Typical Expected Terminal Groin Dimensions and Typical North Carolina Offshore Slopes





VII – Initial Construction & Maintenance Costs

Summary Results

- Typical $/ft Costs (Depending on Structure Height and Section)
- Rock: $1200 - $6500/ft; Steel and Concrete: $4000 - $5000/ft
- Timber: $4000 - $5000/ft; Geotextile Tube: $250 - $1000/ft
- Some Materials Not Suitable for Larger Structures in Deeper Water
- Annual Maintenance Costs – Between 5-10% of Initial Cost – 10-15% Including Sea Level Rise and Storms
- Initial Beach Nourishment Costs Should Also Be Included 100,000 – 300,000 cy – $1.2 - $3.6 M
- Permitting & Design (20%), Monitoring ($100k-$500k) and Removal Costs ($500/ft) Should Also Be Included

VII – Initial Construction & Maintenance Costs

Summary Results (con't)

Initial Costs	Cost	Short (450')	Long (1500')
Initial Cost (LS)	--	$1,000,000	$6,000,000
Initial Beach Nourishment (LS)	--	$1,200,000	$3,600,000
Permitting and Design	20.0%	$200,000	$1,200,000
Total Initial Costs	**Total**	**$2,400,000**	**$10,800,000**

Removal ($/LF)	$500	$225,000	$750,000

Annual Costs			
Annual Maintenance ($/yr)	12.5%	$125,000	$750,000
Annual Monitoring (LS/yr)		$300,000	$300,000
Total Annual Maintenance Costs	**Total**	**$425,000**	**$1,050,000**

VII – Initial Construction & Maintenance Costs

Discussion

VIII – Potential Terminal Groin Locations

Method/Approach

- Literature Review of Existing Locations (Inlets – dredged, natural)
- Issues With Respect to Use at Navigable, Dredged Inlets vs. Non-dredged Inlets
- Inlet Behavior
- Assess And Comment On The Locations Of Terminal Groins With Respect To The Inlet Conditions As Well As The Geologic And Hydrodynamic Setting Of Each Of The Five Study Cases

VIII – Potential Terminal Groin Locations

Summary Results

- Most Existing Sites Include Navigable, Dredged Inlets
- Only Inlet Locations Considered for Study
- Five Sites Have Similar Hydrodynamic Conditions As NC Inlets
- Significant Range of Inlet Management Also Covered
- Level of Interventions (Nourishment & Dredging) Along With Terminal Groin Dimensions Determine Relative Scale Effect of Groin
- Nourishment and Some Level of Inlet Management Would Likely Be Required to Limit Potential Impacts and Inlet Behavior

VII – Potential Terminal Groin Locations

Discussion

Next Steps

- Steering Committee Meeting – February 15, 2010 New Bern
- Next CRC Meeting and Public Hearing – February 17, 2010 – Wilmington
- Final Draft Report – March 1, 2010
- Science Panel Meeting – March 12, 2010 – Raleigh
- Steering Committee Meeting – March 18, 2010 – New Bern
- Final CRC Meeting and Public Hearing – March 25, 2010 – Sea Trail/Sunset Beach
- CRC Report to ERC – April 1, 2010