UPDATE: COASTAL MONITORING PROGRAM, OREGON INLET TO RODANTHE

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NCDOT Coastal Monitoring Program

- Initiated during construction of Oregon Inlet Terminal Groin
- Expanded in 2010
- Goal: to assist the agencies in planning efforts for future phases of the NC 12 Transportation Management Plan
Program Elements: Data Collection

• Aerial photography 4x annually
  • Flight altitude 4500 ft above mean ground level (AMGL), ground controlled, ± 0.5 ft accuracy
  • Topographic data developed using digital photogrammetry
  • 1x yearly, IR data processed

• Aerial photography 2x annually
  • Flight altitude 7500 ft AMGL, ground controlled

• Physical and Biological Monitoring
Program Elements: Data Analysis

- Ocean shoreline position
- Estuarine shoreline position
- Island width
- Beach width
- Dune elevation and position
- Dune vegetation coverage
- Volume of sand between NC12 edge of pavement and shoreline, above mean high water
- Storm effects
- Erosion rate and road vulnerability
Island Width (Distance from Ocean to Estuarine Shoreline)
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Island Width (Distance from Ocean to Estuarine Shoreline)

Pea Island Width on June 8, 2015
Island Width (Distance from Ocean to Estuarine Shoreline)
Island Width (Distance from Ocean to Estuarine Shoreline)
Island Width (Distance from Ocean to Estuarine Shoreline)

Distance from Ocean to Estuarine Shoreline: December 8, 2015

Transect No.
Beach Width (Distance from Dune Toe to Shoreline)

- Beach widths < 100 ft indicate dunes vulnerable to wave action
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October 2015
Beach Width (Distance from Dune Toe to Shoreline)

- Beach widths < 100 ft indicate dunes vulnerable to wave action

December 2015
Beach Width (Distance from Dune Toe to Shoreline)

- Beach widths < 100 ft indicate dunes vulnerable to wave action

August 2016
Dune Elevation and Position

- Increased vulnerability when dune crest elevation less than 10 ft above NC 12 elevation

October 2015
Dune Vegetation Coverage

- Highly vegetated areas more resistant to erosion

<table>
<thead>
<tr>
<th>Level of Vegetation</th>
<th>Percentage of Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>April 13, 2012</td>
</tr>
<tr>
<td>Unvegetated</td>
<td>57%</td>
</tr>
<tr>
<td>Moderate Vegetation</td>
<td>27%</td>
</tr>
<tr>
<td>Fully Developed Vegetation</td>
<td>16%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>
Erosion Resistance (Subaerial Profile Volume)

- Volume of sand between shoreline and NC 12 edge of pavement, above mean high water
- Larger volumes resist undermining of road
- Generally corresponds to larger dunes

Region of Rodanthe Beach Nourishment

![Graph showing profile volume (cy/ft) vs. distance from Old Coast Guard Station (Transect 170), miles. The graph includes data for different years and stages of the project, with labels and notes. Project had been completed north of T50 and construction was moving south as of 20140814.]
Storm Effects

- Since expanded program began in 2010, area impacted by:
  
  Irene (2011)
  
  • Breaching and overwash, required construction of temporary bridge, filling breached areas within NC 12 right of way, road repair

  Sandy (2012) and subsequent nor’easters
  
  • Overwash, undermining of road, erosion and damage to recently reconstructed dunes

Matthew (2016)
Ongoing Breach Monitoring
Erosion Rates

- Linear regression
- Within first 4 miles south of groin, 1989-present
- South of groin influence, 1946-present
Erosion Rates: Terminal Groin Monitoring

- First 6 miles
- Endpoint
- Historical Rate (Pre-Groin, Sept. 84-Oct. 88)
- Project Rate (1989-present)
230 ft Buffer

- Where road is within 230 ft of present shoreline, considered vulnerable
- Areas expected to be within 230 ft of shoreline within 5 years based on erosion rates also identified
5-Year Prediction Evaluation

Shoreline Position:
Predicted 1/1/2016 and Observed 12/8/2015

- Observed Landward of Predicted
- Observed Seaward of Predicted
- Prediction Interval

Difference between predicted and observed (ft)

- less erosion than predicted
- more erosion than predicted

Beach Nourishment

Transect number
Projected 2060 Shoreline

- Future expected vulnerable areas identified
- Uncertainty quantified using prediction interval

Figure 57
Projected 2060 Shoreline with 95% PI
Prepared for the North Carolina Department of Transportation
Horizontal Datum: North Carolina State Plane Feet 1983 FIPS 3200
Orthophoto Date: December 8, 2015; Map Created: May 18, 2016
2060 Shoreline Prediction Changes

- Terminal groin built
- Landward (greater distance from baseline)
- Coastal Monitoring Program begins
- Seaward (smaller distance from baseline)
- Emergency beach nourishment 2014
- Range of prediction intervals

Date:
- 1/1/1945
- 1/1/1965
- 1/1/1985
- 1/1/2005
- 1/1/2025
- 1/1/2045
- 1/1/2065

Distance from Baseline (ft):
- 3000
- 3200
- 3400
- 3600
- 3800
- 4000
- 4200
- 4400
- 4600
- 4800
Composite Vulnerability End of 2015

Graph showing the number of vulnerability criteria met at different distances from T170, miles. The graph includes different colored bars indicating:
- Island width less than 1000 ft
- Dune crest elevation less than 10 ft above NC12
- Within 230 ft of shoreline

The graph highlights specific distances with annotations such as "Pea Island Breach."
NCDOT Current NC 12 Pea Island Projects

INTERIM BRIDGE OVER PEA ISLAND BREACH AND PHASE IIa BRIDGE WITHIN EXISTING NC 12 EASEMENT ALTERNATIVE
Summary

• NCDOT-NCSU team is closely monitoring barrier island morphologic changes in the context of NC 12 vulnerability

• Efforts are being made to identify not only current vulnerable areas but future expected vulnerable areas

• Results are contributing to transportation planning