ENGINEERED SHORELINE PROTECTION
CASE STUDY FROM THE JERSEY SHORE
Material Selection Process, Sustainability, and Impacts from Sandy

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Sand is an economical building material, and has predictable engineering properties.
But sand lacks cohesion and erodes easily under the influence of current and waves.
Geosynthetics can encapsulate sand to form containment structures to protect against erosion, build waterfront structures, and reclaim land.
Typical Design:
Background

• Previous geotextile tube installation in 2006.
• A series of five storms caused severe shoreline erosion August – November in 2009.
• Storms eroded almost all of dunes on Waverly Beach and undermined a section of East Atlantic Blvd.
Possible cross-section of previous installation
Time of Action

• As a temporary measure, the Public Works Dept placed harvested sand along the former dune line of Waverly Beach to hold back high tides from entering East Atlantic Boulevard.

• Failure to add more permanent protection in a timely fashion may result in the loss of the road as well as the utilities within the road. This cost could be significant depending on the extent of the erosion, as well as utilities being lost.

• An analysis of possible solutions was conducted.
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<thead>
<tr>
<th></th>
<th>Cost</th>
<th>Life</th>
<th>Permits</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosynthetic</td>
<td>$667/LF</td>
<td>25 years</td>
<td>No additional permit needed</td>
<td>Cost effective, low carbon footprint, community familiar</td>
<td>Could be damaged, public skeptical, lack of sand on beach may be an issue</td>
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<td>Containment</td>
<td></td>
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<td>Tubes</td>
<td></td>
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<tr>
<td>Steel Bulkhead</td>
<td>$2,000/LF</td>
<td>50 years</td>
<td>Lengthy process unlikely to obtain</td>
<td>Longer term solution</td>
<td>Large carbon footprint, costly, permitting, scour of beach at tow of bulkhead</td>
</tr>
<tr>
<td>Gabions</td>
<td>$333/LF</td>
<td>25 years</td>
<td>May not be viewed favorably</td>
<td>Quick and easy to install</td>
<td>Cages will deteriorate in water, damaged cages = stones all over the beach, public not familiar</td>
</tr>
<tr>
<td>Stone</td>
<td>$3,500/LF</td>
<td>100+ years</td>
<td>May not be viewed favorably</td>
<td>Most permanent option, proven effective, community familiar</td>
<td>Expensive, large carbon footprint</td>
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<td>Revetment</td>
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Recommendation

• Install geotextile tubes on Waverly Beach.
• Most cost effective and timeliest solution considering that the tubes could be installed as part of the upcoming beach fill.
• Use existing beach and dune maintenance permit.
• For all future beach fill projects, the City would have an on site inspector present whenever mechanical equipment is utilized on the beach.
• In addition, the beach rake would not be utilized on this beach as to eliminate any other possible damage to tubes.
GT 1000M TAN GEOTUBE UNITS
34' IN CIRCUMFERENCE. 4' OF SAND PLACED OVER THE GEOSYNTHETIC CONTAINMENT UNITS.

GT 1000M TAN SHROUD
ATTACHED TO FRONT AND TOP
OF SEAWARD GEOTUBE UNITS
OR APPROVED EQUAL

EL. 8.75 NAVD

4'C - ANCHORING TUBE

EL. -3.25 NAVD

EL. -8.25 NAVD
FILL VOID BETWEEN TUBES
WITH BEACH SAND

GT 500M SCOUR APRON
42' WIDE WITH TWO ANCHOR TUBES
OR APPROVED EQUAL

4'C - ANCHORING TUBE
GT 500M SCOUR APRON 35' WIDE WITH TWO ANCHOR TUBES

EXISTING SEAWALL SURF BEACH TO SEASPRAY BEACH
TOP OF WALL ELEVATION: 3.75 NAVD TO 5.25 NAVD

VARIES 100' TO 120' TO CENTERLINE OF EXISTING REVETMENT

NEW DUNE WIDTH VARIES 35' TO 45'

EL. 12.75 NAVD

EL. 8.75 ± NAVD

EL. 5.25 ± NAVD
The equations used in the Geotube® Simulator are based on the paper "Two-dimensional analysis of geosynthetic tubes" by R. H. Plaut and S. Suherman, Acta Mechanica, Volume 129, 1998, pages 207-218, and on further research by Professor Raymond H. Plaut. The software was developed by Benjamin Z. Dymond. The work was performed at Virginia Tech.
Summary

• Properly designed dune structure using 1,767 LF of tubes installed Dec 2010 – Jan 2011.
• Previous design failed during 10-year storm event.
• Super Storm Sandy hit NJ shore October 2012 and tubes performed well during 100-year storm event.
Questions Are Welcome.
Thank you for your interest.

Special THANKS to Ocean City, NJ Public Works Dept

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