A Line In The Sand

A Proposal For Buried Structures On Critically Eroded Beaches Threatening Severe Damage to Roads and Buildings

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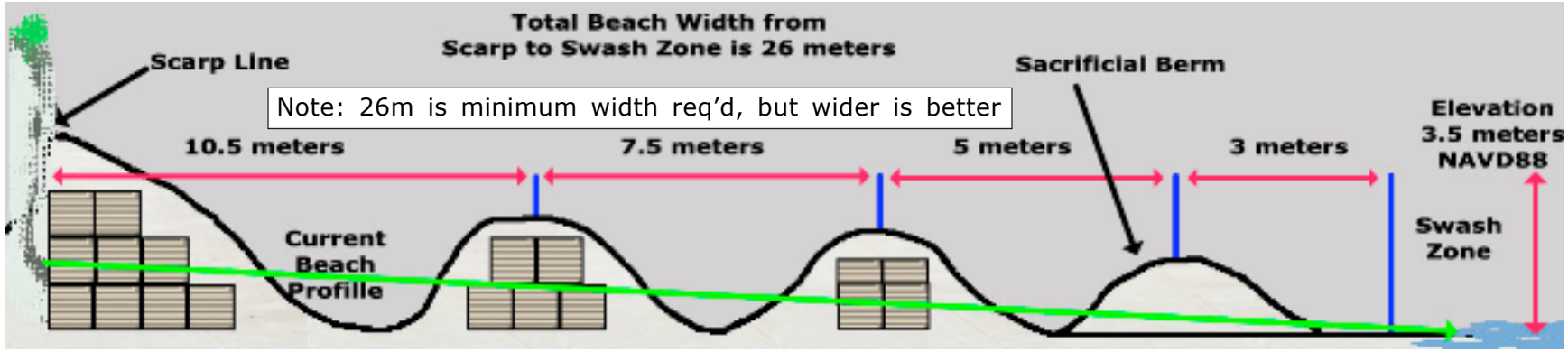

1. Wire baskets lined with geotextile material and filled with natural sediment used to create a buried "backbone" (structure) over which "white" sand is deposited to create a "natural" dune (Note: in the graphic above, each square container holds a cubic meter of sand)...container sand can be darker than "normal" beach sand because container sand can't mix with beach sand (www.hescobastion.com)
2. One meter of white (burial or facing) sand is placed over the containers with 1.5 meters used on the "turtle" face of the dune that marks the turtle nesting boundary (for subsequent erosive events, this sand should be the only sand that may need to be renourished, thereby dramatically reducing the future expense of renourishing the beaches)
3. Vegetation is seeded in the horizontal areas of all containers to help long term vegetation growth
4. Vortex Sand Fencing is used in the swales between dune lines landward of the turtle line to accrete sand and help vegetation grow
5. Turtle (and tourist) friendly Pressure Equalization Modules used to widen beach (www.ecoshore.com)

These five steps will create a "Line in the Sand" that defines the edge of maximum transgression.

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Comments and Considerations:

- Pre-Ivan, two to three small, vegetated dune lines plus an active beach berm were present on beaches with high dunes that supported buildings
    -- Ivan eliminated these small dunes and severely eroded narrow beaches without small dunes in front of the larger dunes supporting buildings (i.e., St Joseph Peninsula and St George Island)
- Rebuilding this natural topography is key to prevention of future critical erosive events
- Policy should create a multiple dune line environment favoring a stable or slightly regressive coast

- Best solution is buried wire basket container structure...already permitted on east coast
    -- Faster and cheaper to create than extensive vegetation cover
    -- Provides superior erosion protection from large storm erosion events
    -- Allows hydrology of beach to act "normal" as opposed to impermeable structures
    -- Burial (facing) sand that covers the structure can be thick enough for turtle nesting
    -- Facing sand can move in wind and maintain equilibrium within the back beach sand budget
- Only multiple lines of extended lengths (several kilometers) of buried wire basket container structure placed in a parallel and sinuous path will prevent erosion
- The most shoreward buried wire basket container structure line must contain short perpendicular or oblique structures to prevent channeling of erosive floodwater in case of a massive storm surge
- Buried wire basket container structures use native sediments

- Buried structures (such as geotubes - i.e., St Joseph Peninsula) that do not bound an extended length of coastline will not work to stop erosion once the buried structure is exposed by wave action
- Piling loose sand on the scarp face does not reduce erosion from large storm event
    -- South Walton County faced the scarp at Seagrove Beach with 2-3 meters of sloped sand
    -- No facing of scarp done at Rosemary Beach
    -- Scarp damage at both locations was 9-14 meters with no significant reduction of damage discernible from one scarp to the other (i.e., piling loose sand on the scarp face does not reduce erosion nor protect the dune line supporting buildings
- Top of scarp is 6-8 meters in some locations...well above a "normal" armored structure height
    -- Buried wire basket container structure can be stacked 4-5 meters without ground anchors

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The Mechanism of Undercutting Erosion Patterns to Road Edges and Shoulders

West end of Navarre Beach - July 11, 2005

1. The pattern of overwash and inundation flooding during storms indicates that erosion to the road edge can begin in very low energy flooding situations where wind blown water reaches the road surface and drains off the leeward side along grade. This creates a small channel running downhill along the edge of the shoulder of the paved road surface as sand is eroded away from the road shoulder gravel.

2. As the channel fills with more water, both from rain run-off and overwash or inundation flooding, the channel deepens and creates a waterfall effect for the water dropping off the paved surface and into the channel. In a waterfall effect, much of this water follows the surface of the pavement and curls under the edge of the pavement as it erodes softer sediments while some of it pours directly into the channel and adds to the erosive force of the fast moving water in the narrow channel being created by the erosive energy of the moving water.

3. As the narrow channel deepens along the pavement edge, the velocity of the water moving through this channel is fast enough to remove sediment being eroded by the waterfall effect as well as the sediment falling into the channel from the undercutting action of the fast moving water in the channel.

4. As the storm passes through, receding waters continue to drain through these newly created drainage pathways and the erosion pattern continues to occur until this water has drained from the saturated surface. In addition, once overwash or inundation flooding has damaged the landward side of a road, wave action and other high water level erosion mechanisms in the sound or bay will add to

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the erosion being done to the landward side of the road. It is important to note that this pattern exists because the landfall location of recent strong storms has been on the western side of NW Florida. A strong storm making landfall to the east of the NW Florida panhandle could easily reverse this pattern by driving local inland waters seaward across the low spots of the barrier islands.

Considerations for Prevention of Undercutting Erosion Patterns to Road Edges and Shoulders

1. Buried structure placed under the road edge and shoulder area offers a good possibility to prevent the undercutting erosion damage to road edges and shoulders. In addition, a parallel line of buried structure offset from the road could be used to create a protective dune and provide an armored underground path for placement of utility lines such as water, sewer, electrical, and communications.

2. Use of buried structure would not increase the width of the road pathway and its right of way easements for utility lines. Buried structure within the road right of way utility easements would create an artificial dune one or both sides of the road and block or diminish the water views from the road surface. This consideration may be important along stretches of the beach road located in parks.

3. The next schematic diagram shows a cross section of buried structure used to support a road edge and shoulder and provide a protective dune anchored with buried structure that can be used as an underground conduit corridor for utility easements. Please note that the square baskets depicted in the diagram represent one cubic meter and rectangular baskets are one-half of a cubic meter in volume. Larger baskets can be found in the private sector, but the one cubic meter size shown here is used to simplify the illustration. Several assumptions are made with this proposal as listed next.

a. Wire baskets will not be damaged from undercut erosion beyond design specifications.
b. The line of wire baskets are interlocked and continuous for the length of entire road.
c. Both sides of the road surface are supported by the wire basket buried structure line.
d. Burial sand is sufficiently thick to allow the buried structure to appear as a natural dune.
e. Vegetation will be seeded or planted in the uppermost horizontal surfaces.
f. Scenic view turn outs will either be elevated or required to drive over a buried structure line to access the scenic view turn out in order to preserve the integrity of the buried structure line.

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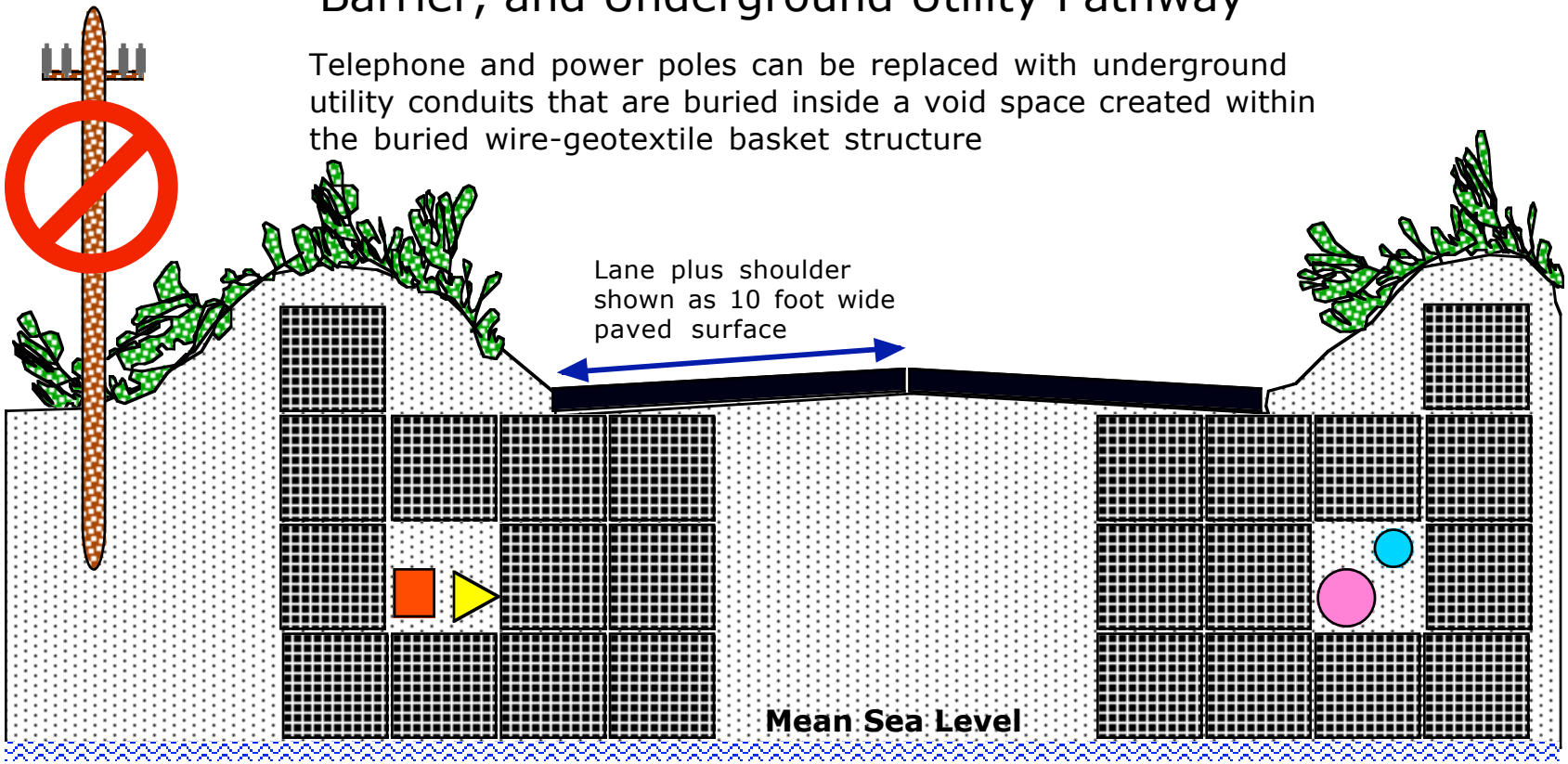
Buried Structure Used As Road Shoulder Support, Anti-Erosion Barrier, and Underground Utility Pathway

Telephone and power poles can be replaced with underground utility conduits that are buried inside a void space created within the buried wire-geotextile basket structure



Legend

- Wire-geotextile Basket
- Paved road surface
- Communication Lines
- Potable Water Pipe
- Waste Water Pipe
- Power Lines

Scale in Feet

0 2 4 6 8 10

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Considerations for the Use of Buried Wire-Geotextile Baskets

1. Sediment used to fill the baskets is already on site.

2. Subsurface road fill material and pavement surface will be contained within the basket lines, thus no contamination of surrounding land if basket lines protect paved road surface as expected.

3. Utility lines can be moved underground by creating a cavity in the basket line, placing the utility conduits and burying the conduits. Currently, water, sewer, and communication lines are buried in the sand adjacent to the road. Every major storm has exposed and destroyed these buried utility lines.

4. Adding the electrical power to the list of buried utility lines will allow cross island operations at locations currently not accessible due to power poles and overhead lines.

5. Underground electrical and communication lines have fewer catastrophic lightening strikes than pole mounted lines. However, in the event of a rare catastrophic lightening strike that creates damage within the underground electrical conduit, repairs to the line could take longer than a pole mounted line repair.

6. Although initial repair or retrofit to the road might be more expensive than past repairs to the road from overwash erosion damage, once in place, the buried structure should eliminate repairs to the road for all but the most severe overwash situations caused by category 3 or higher hurricanes.

7. The long term cost savings in infrastructure repairs and ability to return to normal operations on a barrier island after a major storm should overcome any objections to the expense of this solution.

8. Using the wire-geotextile basket design instead of a fixed barrier seawall such as vinyl sheet piles or concrete allows the normal hydrology of the barrier island to continue. This is critical to the maintenance of salt water marshes and wetlands currently supported on a barrier island.

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