



# Research Notes

Oregon Department of Transportation

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## Defending the Coast with Dynamic Revetments

Many portions of the Oregon coastline are subject to erosion due to wave action. This natural evolution of the shore becomes a problem when highways or other structures have been constructed close to the shore. The traditional approach to preventing coastal erosion from threaten constructed features is to armor the shoreline with riprap. There are aesthetic, environmental, and functional problems with riprap that often make it an unacceptable solution.



Neskowin rip rap (Neskowin cell)

Traditional rip rap shore protection near Neskowin, Oregon.

Natural cobble or gravel berm beaches have long been observed to be generally more stable than sand beaches. This has led them to be used as an alternative approach to shore protection. This type of shoreline protection has been referred to as a, dynamic revetment, or cobble berm. Since this type of shoreline occurs naturally, in some settings it could be more aesthetically and environmentally acceptable than riprap. Depending on the proximity of materials, dynamic revetments are potentially less expensive to construct than riprap

armoring. Since they are dynamic features, they can absorb more of the wave energy rather than reflecting much of it the way riprap does. This mitigates some of the functional problems associated with riprap.



Cove Beach (Cannon Beach cell)

Natural cobble beach at Cove Beach near Cannon Beach, Oregon.

The Oregon coast has a number of naturally occurring cobble or gravel beaches, so a man made dynamic revetment would not appear out of place.

The Oregon Department of Transportation worked with the Oregon Department of Geology and Mineral Industries to conduct research aimed at eventually using dynamic revetments to protect the coast highway or its bridges. The research had two main objectives. The first was to observe the geometry of natural cobble and gravel beaches and how the geometry related to the beach stability. The second was to identify possible source material to use in the construction of dynamic revetments.

Oregon State Parks has already constructed an artificial dynamic revetment to control erosion at Cape Lookout State Park south of Netarts Bay. Construction of this structure was facilitated by being adjacent to a natural cobble beach. The Cape Lookout State Park dynamic revetment has been in place for 6 years and is performing as expected.



Dynamic revetment at Cape Lookout State Park near Netarts, Oregon.

Thirteen naturally occurring cobble or gravel beaches on the Oregon coast were studied. Heights ranged from 15 to 24 feet, slopes from  $6.9^\circ$  to  $23.8^\circ$ , widths from 20 to 433 feet, and mean grain sizes from 1 to 5 inches. Based on the relative stability of the natural cobble beaches the report recommends a minimum height of 23 feet, a slope

of  $11^\circ$  and minimum grain size of 2.5 inches for a constructed dynamic revetment.

A significant number of sources for crushed rock are available at or near the Oregon Coast. Rounded rock tends to occur in environmentally sensitive settings and therefore sources are fewer and at greater distances from the coast. The naturally occurring cobble beaches are not composed of angular rock and so rounded rock would appear more natural. The length of time it would take for crushed rock to begin to look natural through being exposed to wave action in a dynamic revetment is uncertain.

Cobble berms, whether natural or constructed, provide greater stability than sand beaches, but less than engineered riprap. It is likely that the aesthetics, cost, and environmental impacts of dynamic revetments could make them the preferred method of shore protection in some settings. By mimicking naturally occurring cobble beach geometry, dynamic revetments should yield predictable performance and have a natural aesthetic. Further information regarding environmental advantages and the feasibility of using crushed rock will need to be gleaned from carefully constructing and monitoring experimental dynamic revetments.

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**To request a copy of the report “*Defending the Coast with Dynamic Revetments*” by Jonathon C. Allan, Ron Geitgey, and Roger Hart, contact the ODOT Research Unit by phone, or view the report on the Research Unit web page listed below**



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