CHAPTER 20

QUANTITATIVE TRACING OF LITTORAL DRIFT

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ABSTRACT

Tests were run at Fernandina Beach, Florida, using fluore-
scent tracers and bed load traps with automatic doors and hy-
draulic lift to determine the thickness of the bed load trans-
port layer on the bottom ("bottom creep") (ref.1). Four spe-
cial bed load traps with hydraulic remote controlled doors
were installed on an ab. 800 ft. long pier. Fig. 1. Tracers
of various colours were dumped at various distances from the
pier. Two types of bottom profiles, Fig. 2, "berm profile" and
Fig. 3, "bar-profile" were tested. As an example Fig. 4 shows
test arrangement and wave action for test No. 17 (berm profile).
Longshore wave power for this particular test was 1,5 Watts per
ft of wave (one Watt is ab. 0,1 kg m/sec or ab. 0,0014 Horse
Power), $H_{1/3}$ was 0,45 m, $T_{1/3}$ was 4-5 sec.

Fig. 4 shows average velocities of grains up to the point
of maximum concentration as well as average velocities during
the test of 1,3 to 1,5 hours (in paranthesis). Thickness of
the moving bed load sheet layer based on the average veloc-
ities found during the testing period (ref.1) and the migrating
quantities per meter of bottom were as indicated in Table 1.

Table 1. Sheet layer thickness, ave. grain velocity and
quantities per meter per hour. Longshore wave
power ab. 1,5 Watts) ft or ab. 5 Watts/meter.

<table>
<thead>
<tr>
<th></th>
<th>Station 2</th>
<th>Station 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer thickness in cm</td>
<td>0,00064</td>
<td>0,00073</td>
</tr>
<tr>
<td>Number of grains of 0,2 mm</td>
<td>1/35</td>
<td>1/30</td>
</tr>
<tr>
<td>Average velocity of grains meters/min.</td>
<td>1,3</td>
<td>0,95</td>
</tr>
<tr>
<td>Quantity in liters per hour/m</td>
<td>0,48</td>
<td>0,42</td>
</tr>
<tr>
<td>Quantity in kilograms per hour/m</td>
<td>0,28</td>
<td>0,25</td>
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</tbody>
</table>

It is interesting to note from this and other tests that
quantities of drift seemed to be related to the longshore wave
energy. Fig. 5 shows longshore drift per ft as function of
longshore wave energy per ft for a number of tests which in-
clude berm as well as bar profiles and wave energy input rang-
ing from a few Watts to ab. 50 Watts per ft of wave crest.
Tidal currents could not be eliminated. Results seem to bear
some witness hereof.
From Fig. 5 it may be seen that:

a) Longshore transport as bed load seems to increase with longshore wave energy. Not enough results are available however to draw any conclusions, and it should be noted that all results refer to bed-load in narrow areas only. Most littoral drift formulas assume a linear relationship between longshore drift and longshore wave energy.

b) The importance of a longshore (tidal) current superimposed on the wave-energy current may be noted for the low-energy section.

c) The importance of the longshore incl. tidal currents combined with the stir-up may be seen from the results for the higher energy levels. The perpendicular-to-shore component of the wave energy is twice as high for the $44 \text{ Watt/ft}$ longshore wave energy case as for the $32 \text{ Watt/ft}$.

d) The importance of the longshore current is also evident from the trough transports predominance over bar transport for the energy levels under consideration. This is undoubtedly going to change for higher inputs of wave energy accompanied by frequent wave breaking and stir-up activity on the bar.

e) The results mentioned above are of preliminary and indicative nature only. Larger equipment and continuous recording is necessary in order to draw conclusions of more general value. Such test should if possible be carried out on a shore without longshore tidal currents. Two piers a few thousand feet apart on a straight shore would be a great advantage for the tracer tests and for comparison between quantities.

Other results from this testing program are mentioned in paper by E. Thornton at this conference.


This paper will be published in the Proceedings of the 22nd Congress of the Permanent International Association of Navigation Congresses, Paris, 1969.
TRACING INSTALLATION
FERNANDINA BEACH, FLA

OPERATION

Bed-load Traps
Using a manifold valve system, 2 pumps operate one bed-load trap, one providing pressure, one, suction for removal of sediment.

Suspended-load Traps
Each pump operates a suspended-load sampler.

LEGEND:

Bed-load trap (1 through 4)
Suspended-load sampler
(A through D)
Electrical Outlets:
110 VAC - 6 each location
220 VAC - 2 each location
Pump
Pipes
Sample collector screen
Portable dark room

COASTAL ENGINEERING LABORATORY
UNIVERSITY OF FLORIDA

FIGURE 1 FERNANDINA BEACH PIER WITH SAMPLING STATION
FERNANDINA BEACH, FLORIDA
MAY 13, 1965

FIGURE 2 BOTTOM PROFILE, TEST NO. 17 (berm)
FIGURE 4 TRACER INJECTION PLAN, TEST NO 17 (berm)

FERNANDINA BEACH
TEST NO 17

DIRECTION OF WAVE PROPAGATION BEFORE BREAKING

$H_o=45\text{cm}$  $T_o=4.5 \text{ sec}$  
LONSHORE WAVE POWER 1.5 WATTS

TRAP NO. 4
35 ft/min (2.7)

TRAP NO. 3
2.6 ft/min (2.6)

TRAP NO. 2
5.5 ft/min (3.6)

TRAP NO. 1

BEACH
FIGURE 5  LONGSHORE DRIFT AS FUNCTION OF LONGSHORE WAVE ENERGY PER ft