BEACHES & WAVES - Barney Pipkin

A. Composition of Beaches

1. Sand - Here in Los Angeles we have a quartz/feldspar ratio of 1 to 1.
2. Black - In Hawaii, basalt is the main component with some olivine.
3. Coral - A distinctively white beach made of coral detritus.
4. Shingle - Elongated, flat stones, overlapping.

B. Types of Beaches

1. Coastal sand dunes as in Manhattan and Hermosa Beaches and also in Playa del Rey and El Segundo. The region was considered a coastal prairie and extended inland to the present day location of the 405 Freeway.

2. Barrier Beaches, often a 1/4 mile offshore, are along the eastern coast and about Florida in the Gulf states. Cape Canaveral, Ft. Lauderdale, Miami are on barrier beaches.

3. Sand spits are ridges of sand projecting across the mouth of a bay.

4. Pocket beaches form between headlands, protected from the waves. Palos Verdes Peninsula has many such beaches and headlands.

C. Source of the Waves

1. Wind-generated waves start out as ripples and may become local chop, then sea, then fast-moving waves with long wavelengths called swells.

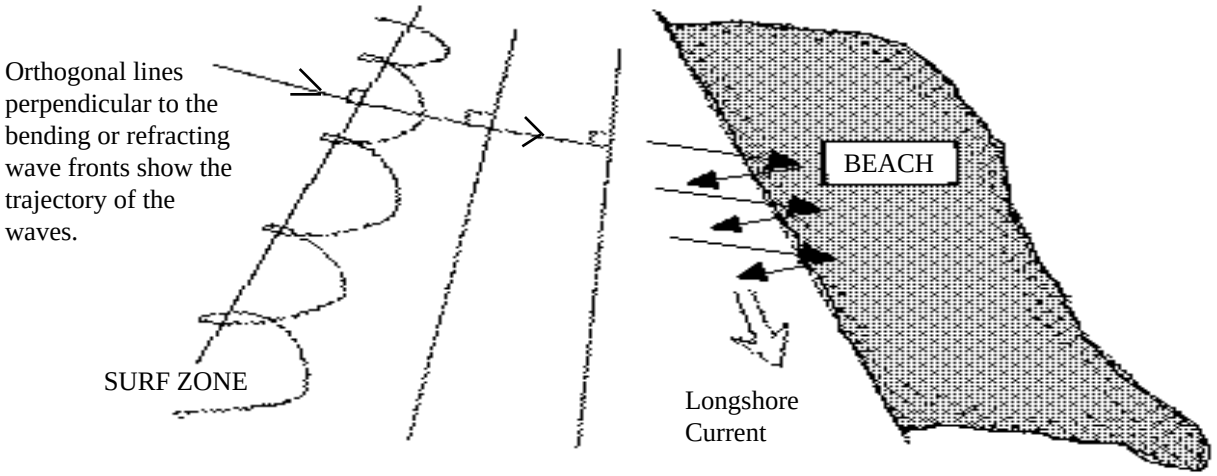
2. Seismic or impulse-generated waves are Tsunamis. These arise from an earthquake or a volcanic eruption.

3. Seiche is a wave oscillation in a closed “container” such as a lake or a yacht harbor.

D. Wave Characteristics

1. The circular motion is actually more trochoidal(big word?!). Below “wave base” (half a wavelength deep), there is no wave motion.

2. As the waves move toward the shallow shore, the top moves faster than the bottom of the wave, and the motion becomes translational and not oscillatory. Finally the top of the wave breaks.



E. The Surf

1. The “swash” is the water going up the beach. Because the wave fronts do not come in precisely parallel to the beach, there is a longshore or littoral drift. The physical transport of the sand is called beach drift. The land between high and low tide marks is called the littoral.

2. Notice how we can think of this situation as a “river of sand,” with the beach and the surf zone the “banks” of the river.

3. Generally, the longshore drift is from North to South in California, but in Redondo Beach, it switches depending upon the time of the year (south in the winter).

4. Plunging breakers are due to steep shorelines with slopes of say 2ft/100ft. (As in the “tubular” rides at the Banzai Pipeline!)

5. Spilling waves are where the top falls down, gently in the front as in Waikiki Beach where the bottom is flat.

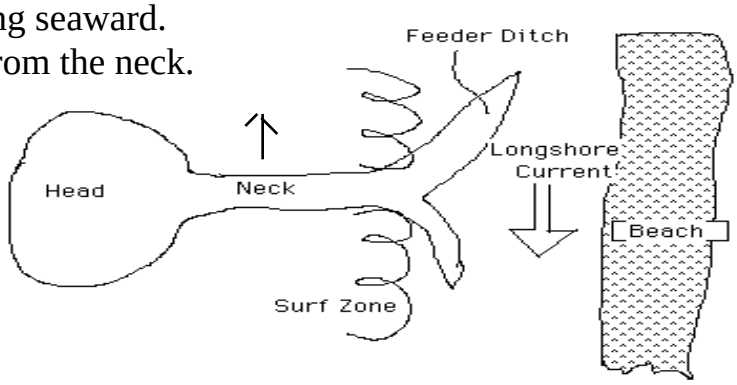
6. Rip currents (called riptides) can move the sand out at 20cm/sec or water at about 4 to 6 knots. They are much stronger in big surf. Indicators include:

a. Gap in the breakers.

b. White foam beyond the surf zone. This is the telltale sign.

c. Objects moving seaward.

7. Swim out sidways from the neck.



F. Beach Erosion

1. There are a few stable areas where supply (S) equals loss (L) of the sand.

2. Where S>L, as was the case in Hermosa and Manhatten Beaches and in Lake Michigan (where there is so much sand from glaciers), the beach becomes wider and wider with coastal sand dunes forming.

3. Where S<L, there are three causes.

(a) Urbanization such as the channelization of rivers and the dams. Prado Dam cuts off the sand which would have gone from the San Gabriel Mountains to the ocean via the Santa Ana River.

(b) Drought.

(c) Shoreline Structures (although this is part of man's doing and often part of urbanization).

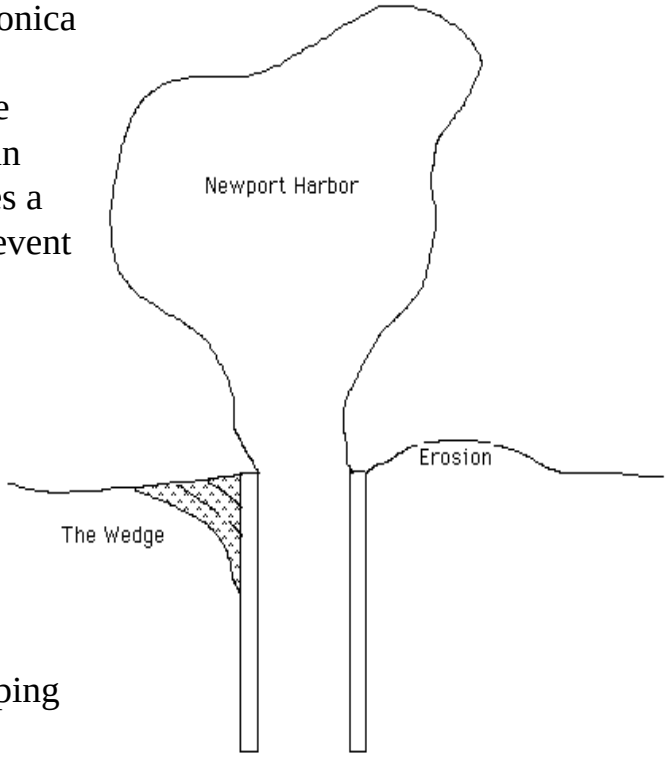
G. Structures

1. Groins (groyn is old Scottish for wall) are like dams in a river. The longshore drift builds up sand (beach) against the groin, while erosion occurs on the other side where we lose beach.

2. The King Harbor Marina has resulted in a lot of sand lost to the submarine canyon off the pier.

3. Jettys in pairs protect harbors such as Newport and Marina Del Rey, but notice the sand buildup on one side.

4. Breakwaters like the one in Santa Monica created a shadow effect with a beach formed reaching out toward the breakwater. At Venice the breakwater is so close to shore that one can walk out to it at low tide. Marina Del Rey uses a breakwater at the mouth of it's entrance to prevent the seiche caused by big surf and storms.



5. Seawalls have been found to often reflect the waves back. The erosion of the seawall is the long term effect.

H. Mitigation

1. Redondo Beach successfully pumps offshore sand back to the beach, but on the East Coast, this method has often been an expensive, dismal failure.

2. In Santa Barbara, dredging and pumping is necessary move the sand from the tip shoal forming in the harbor to the beaches southward. This is an example of an artficial bypass which needs to be planned ahead.

3. Regulating the shoreline structures has become necessary.

Redondo Beach was the original port of Los Angeles. Seal Beach south of Long Beach is a restored beach.

The Camp Pendleton Harbor resulted in the loss of Oceanside's beaches. With there own harbor, the city of Oceanside now dredges sand to the south to replace the lost beaches.

The south swell provided sand from the Tijuana River for San Diego beaches. Coronado Peninsula is a spit. However, today, this source of sand has been effectively removed and beaches such as Imperial Beach are losing their sand.

There is also a winter (shingle beach) vs summer (sandy beach) cycle in southern California. Refugio Beach north of Santa Barbara is a good example.