
Field Data Collection for
Coastal Protection Works
Central Water and Power Research Station

NECESSITY OF FIELD DATA COLLECTION

- **OUT OF 7500 Km LENGTH OF INDIA'S COAST LINE ABOUT 1400 Km FACING PROBLEM OF EROSION**
- **OPTIMUM SOLUTIONS OF COASTAL PROTECTION NEED SYSTEMATIC COLLECTION OF FIELD DATA**
- **VARIOUS TYPES OF DATA (OCEANOGRAPHIC, METEOROLOGICAL AND SHORLINE/BEACH SURVEY) FOR ALL COASTAL STATES IN UNIFORM FORMAT NEEDS TO BE COMPILED**

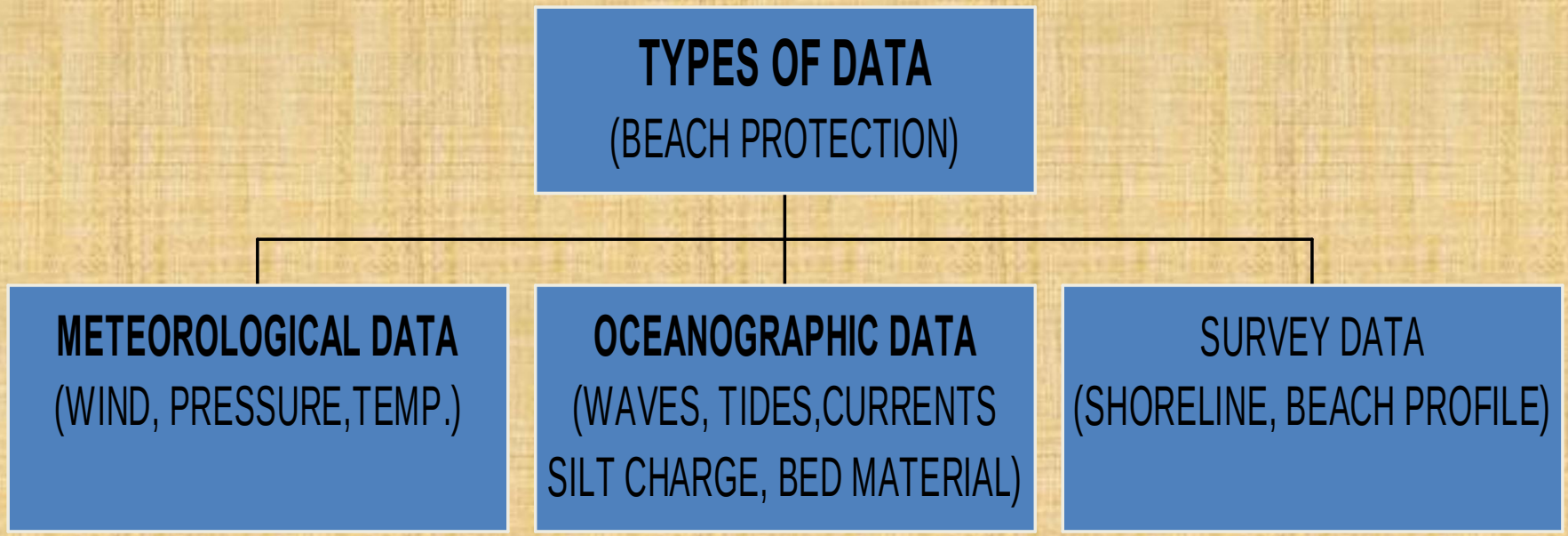
LENGTH OF COASTLINE STATEWISE

1	GUJARAT	1214.70 km
2	MAHARASHTRA	652.60 km
3	GOA, DAMAN, DIU	160.50 km
4	KARNATAKA	280.00 km
5	KERALA	569.70 km
6	TAMIL NADU	906.90 km
7	ANDHRA PRADESH	973.70 km
8	ORISSA	476.40 km
9	WEST BENGAL	157.50 km
10	ANDAMAN –NICBAR	1962.00 km
11	LAKSHADWEEP ISLAND	132.00 km
12	PONDICHERRY	30.60 km
	TOTAL LENGTH	7516.60 km

Factors affecting beach stability

- Deflation
- Waves
- Tides
- Storm surges
- Unplanned construction of structures at coast

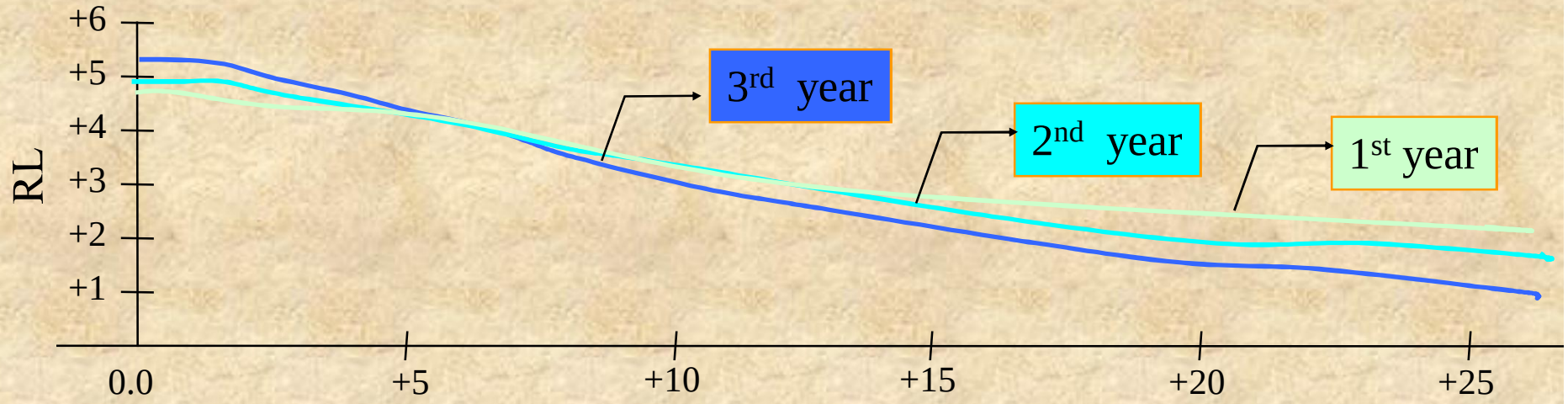
FIELD DATA COLLECTION

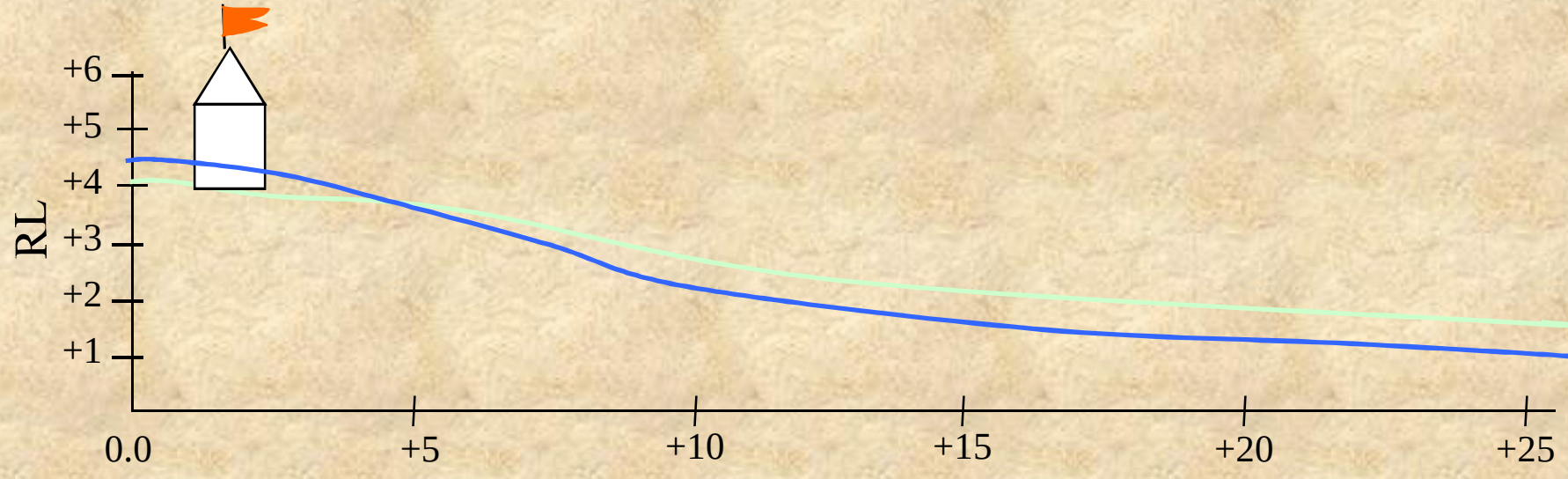


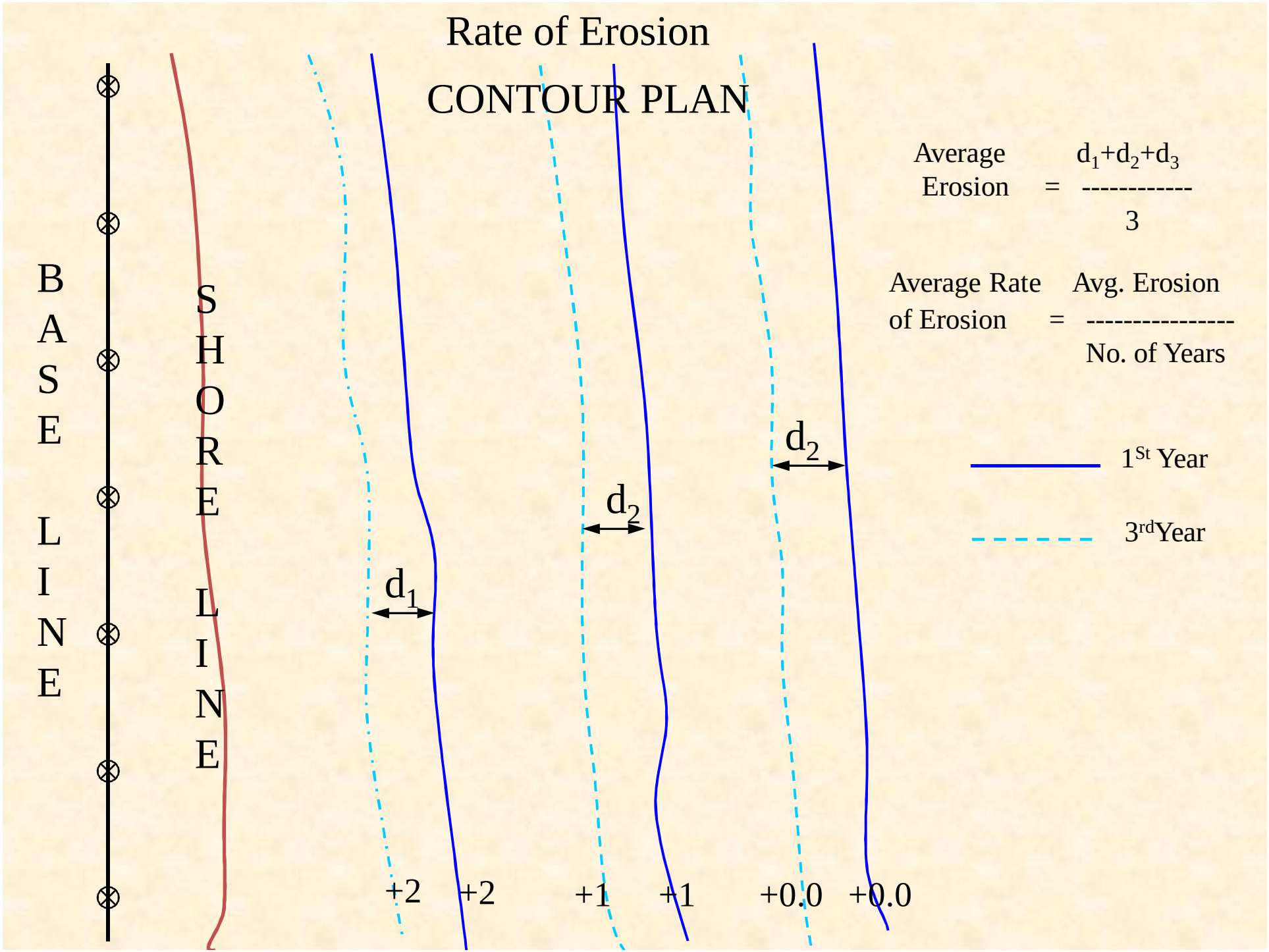
Analysis of Coastal Erosion Problem

Step 1 : To Establish Rate of Erosion

Beach cross sections for 2 to 3 years are required.






Rate of Erosion
CONTOUR PLAN
BASE LINE
SHORE LINE
d1
d2
d2
+2
+2
+1
+1
+0.0
+0.0
Average Erosion = d1+d2+d3 / 3
Average Rate of Erosion = Avg. Erosion / No. of Years
1St Year
3rdYear

Analysis of Coastal Erosion Problem

Step 2 : Cause of Erosion

- Waves
- Tidal Currents
- Obstruction in Littoral Drift
- Onshore Offshore movement of beach material
- Any others reasons

Analysis of Coastal Erosion Problem

Step 3 : Design of Coastal Protection works

- Hudsons Farmula

$$W = \frac{w_r H^3}{K_D (S_r - 1)^3 \cot \alpha}$$

W = Weight of armour units (kg)
w_r = Unit weight of armour block (kg/cum)
H = Wave height at location of the proposed structure (m)
S_r = Specific gravity of armour units
θ = Angle of breakwater slope measured with horizontal
K_D = Stability coefficient which varies with the type of armour unit (which takes into account roughness, sharpness of edges, quality of interlocking etc).

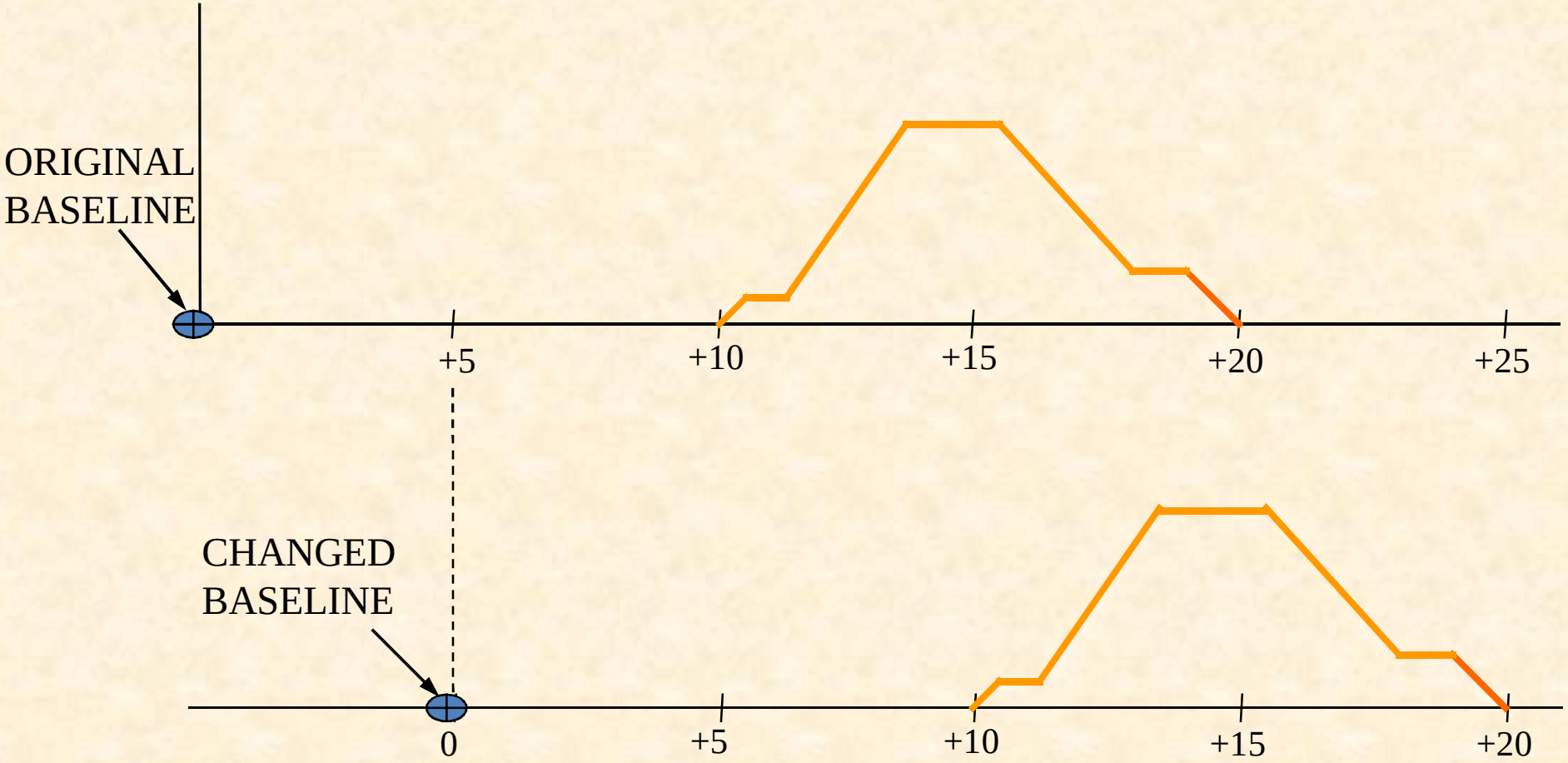
Analysis of Coastal Erosion Problem

- Wt. Of Armour Unit ∝ Cube of Design Wave Height
- Small Error in Wave Height ⇨ Big Mistake in Design
- Drawbacks in Hudsonôs Farmula
  - Wave Period Not Considered
  - Wave Energy ∝ Wave Period
  - No Toe is Considered
- Correct Data ⇨ Model / Design Wing ⇨ Correct Design

Importance of Base Line

- To monitor erosion /accretion
- To collect beach profile data
- To align coastal protection work
- Once the structure is aligned ⇨ could be designed
- For the construction of coastal protection works.
- To monitor the performance of coastal protection works.

Importance of Base Line



- Shifting of Base line ⇨ Change in design conditions

⇩

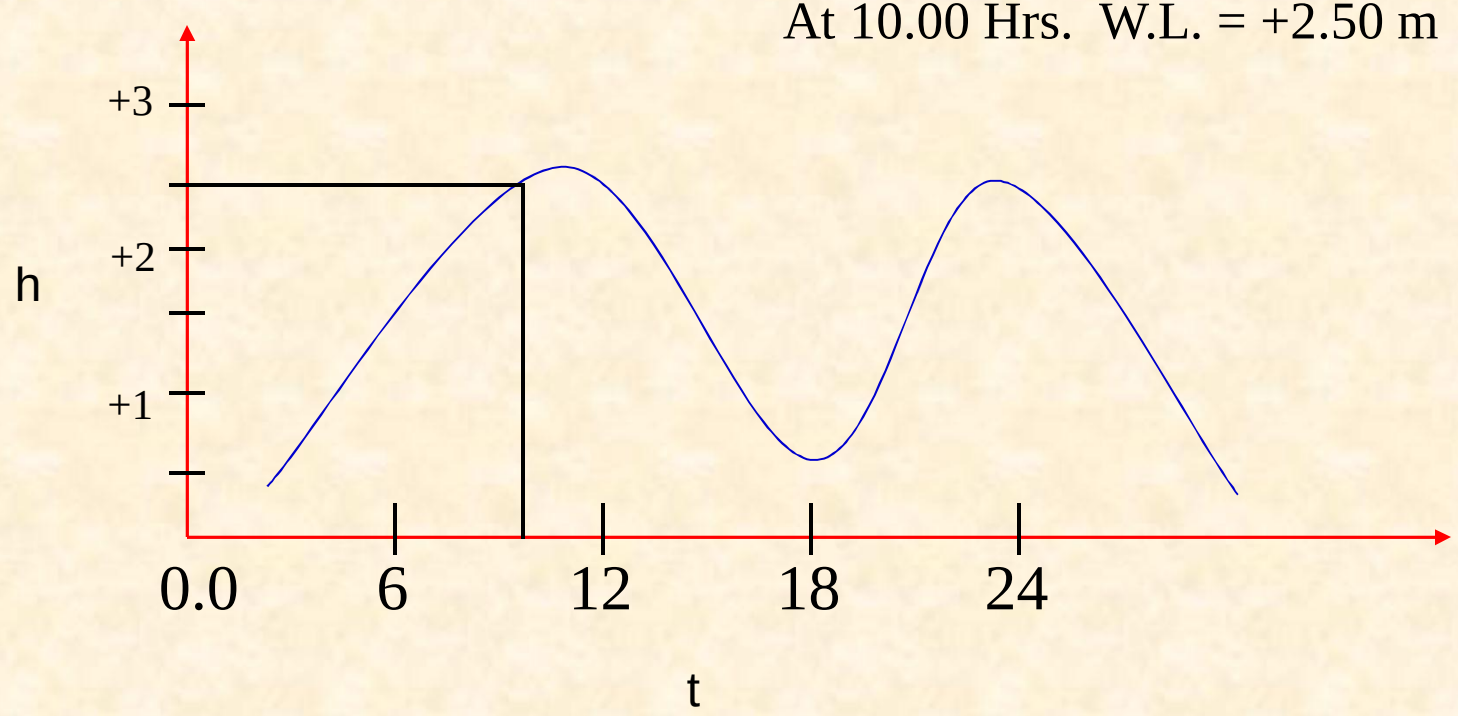
Change in design

Connecting Levels w.r.t. Chart Datum

Tide Table
Date: 10/03/2007

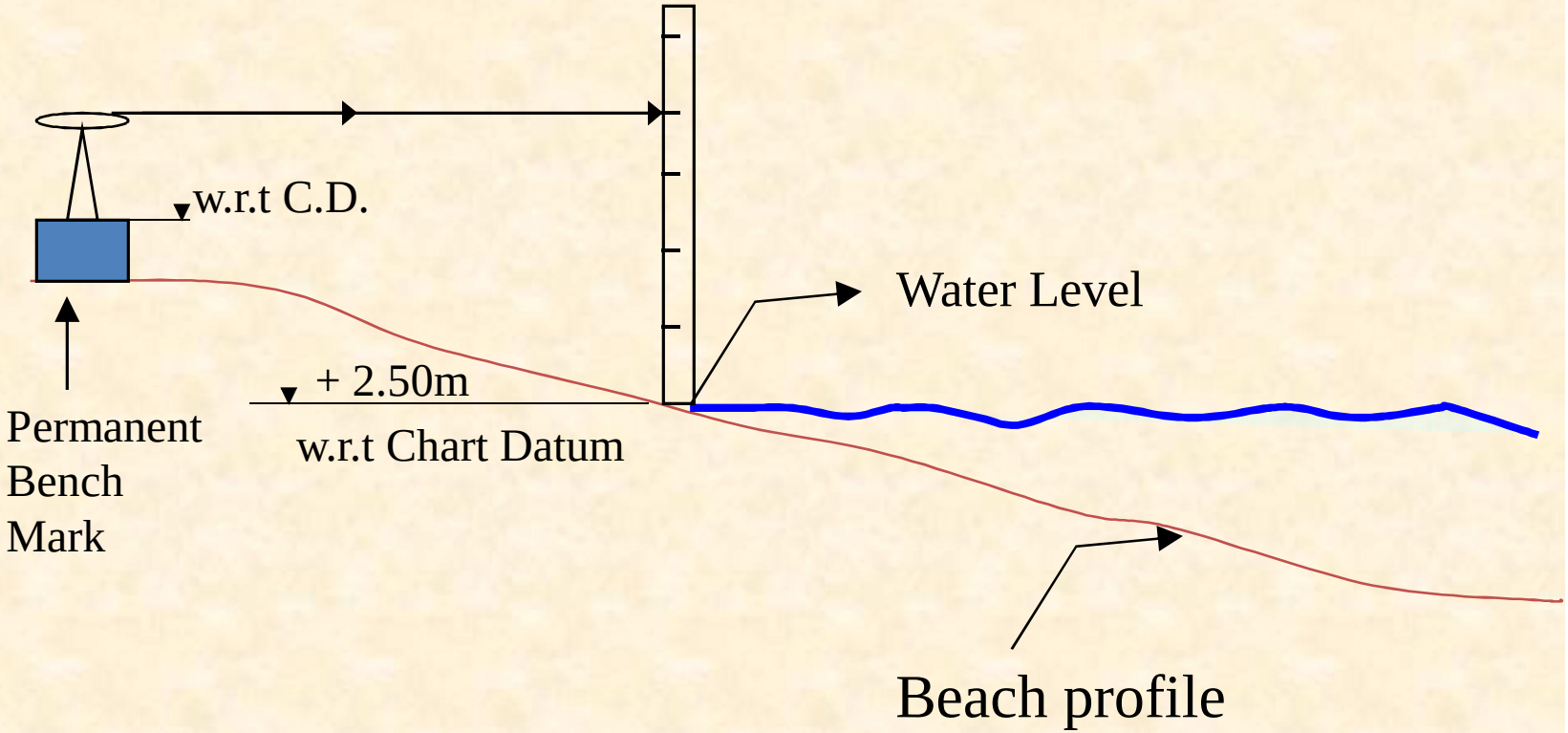
- 0200 --- +0.30 m
- 1100 --- +2.70 m
- 1800 --- +0.40 m
- 2300 --- +2.40 m

At 10.00 Hrs. W.L. = +2.50 m



Connecting Levels w.r.t. Chart Datum

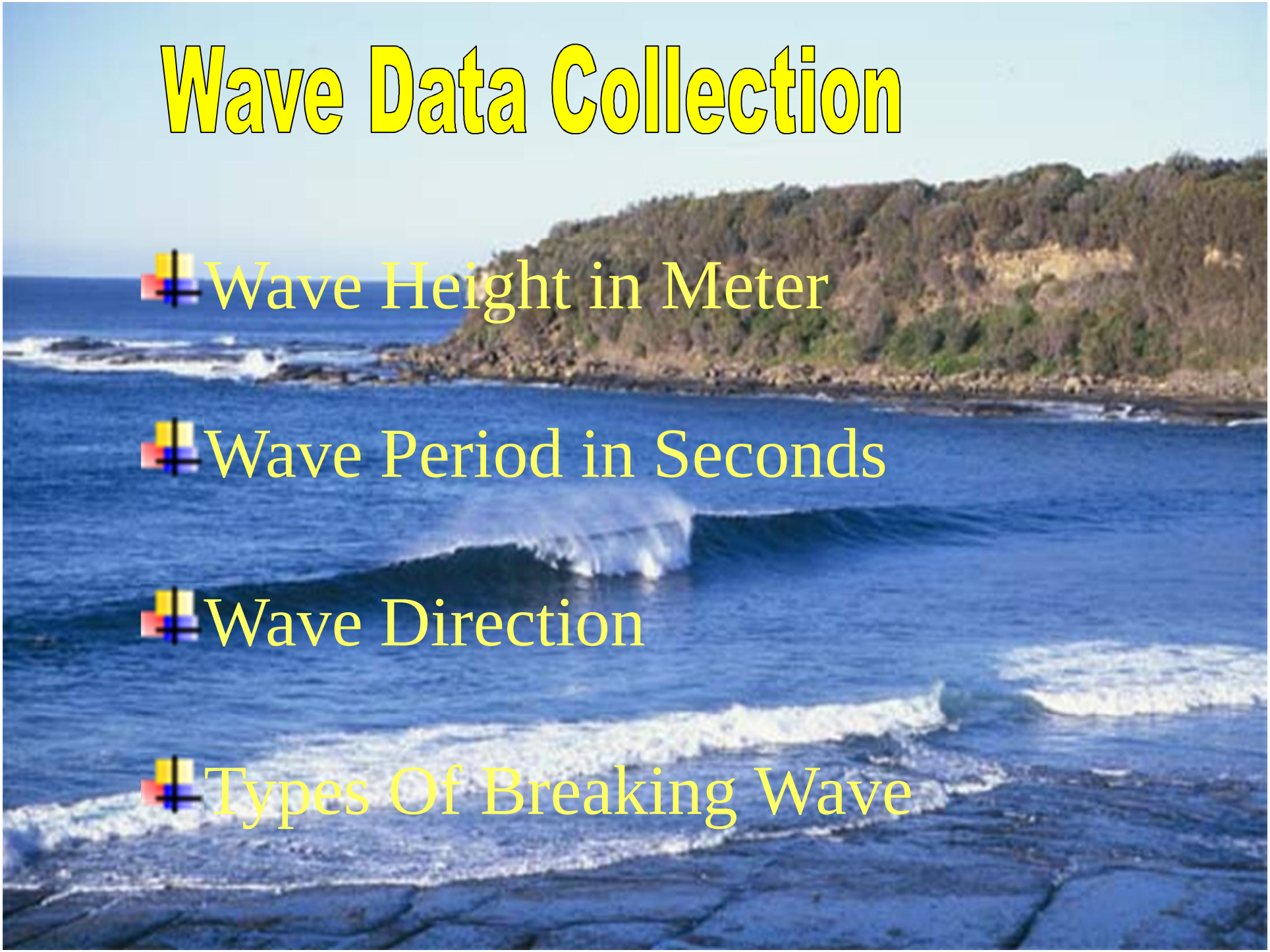
10/03/2007 at 1000 hrs



SYSTEMATIC FIELD DATA COLLECTION AND ANALYSIS

MEASUREMENTS OF:

- **WAVES**
- **TIDES**
- **TIDAL CURRENTS**
- **FLOAT TRACKING**
- **DEPTHS**
- **BED SAMPLING**
- **POSITION FIXING**


Wave Data Collection
Wave Height in Meter
Wave Period in Seconds
Wave Direction
Types Of Breaking Wave

TYPES OF WAVE BREAKING

Spilling Breaker

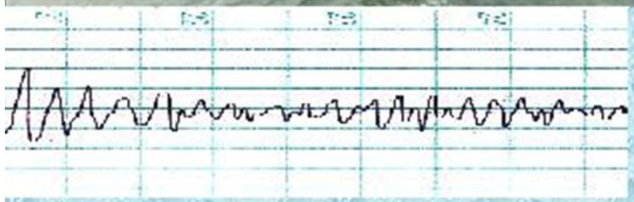
Collapsing Breaker

Plunging Breaker

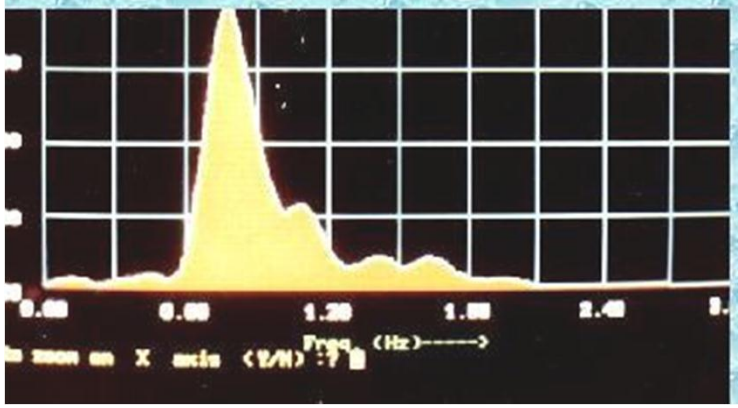
Surging Breaker

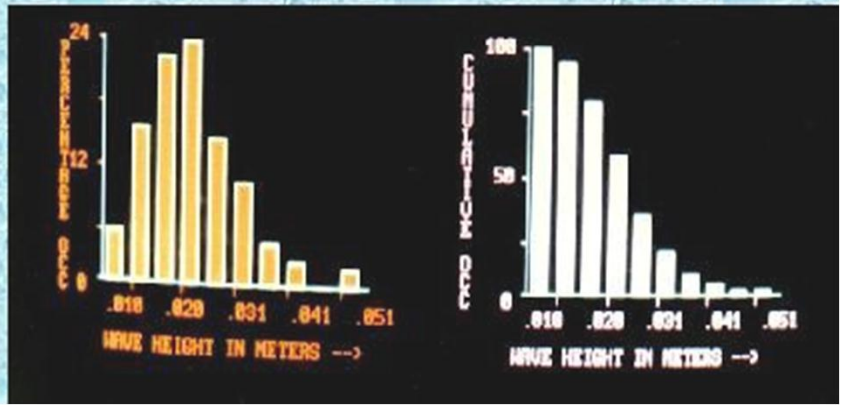
Data Logger with printer and plotter

Main HELP menu



WAVE DATA ANALYSIS





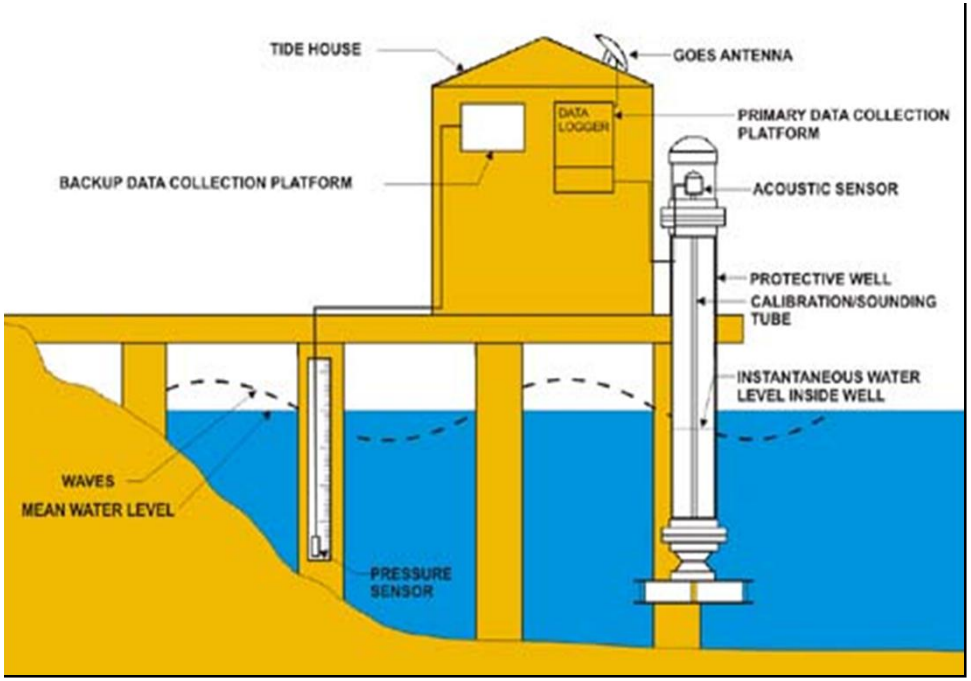
OBSERVATION FOR WAVE HEIGHT

NAME OF STATE:
NAME OF COASTAL DISTRICT:
NAME OF PLACE:
MONTH & YEAR:

DATE	TIME	DIRECTION OF WIND (Degrees)	DIRECTION OF WAVE (Degree)	HEIGHT OF WAVE IN m	PERIOD OF WAVE IN Sec	TYPE OF WAVE BREAKING

TIDE MEASUREMENT


Convetional type tide gauge


TIDE HOUSE
GOES ANTENNA
DATA LOGGER
PRIMARY DATA COLLECTION PLATFORM
BACKUP DATA COLLECTION PLATFORM
ACOUSTIC SENSOR
PROTECTIVE WELL
CALIBRATION/SOUNDING TUBE
INSTANTANEOUS WATER LEVEL INSIDE WELL
WAVES
MEAN WATER LEVEL
PRESSURE SENSOR

TIDE GAUGE

OBSERVATION FOR TIDE LEVELS

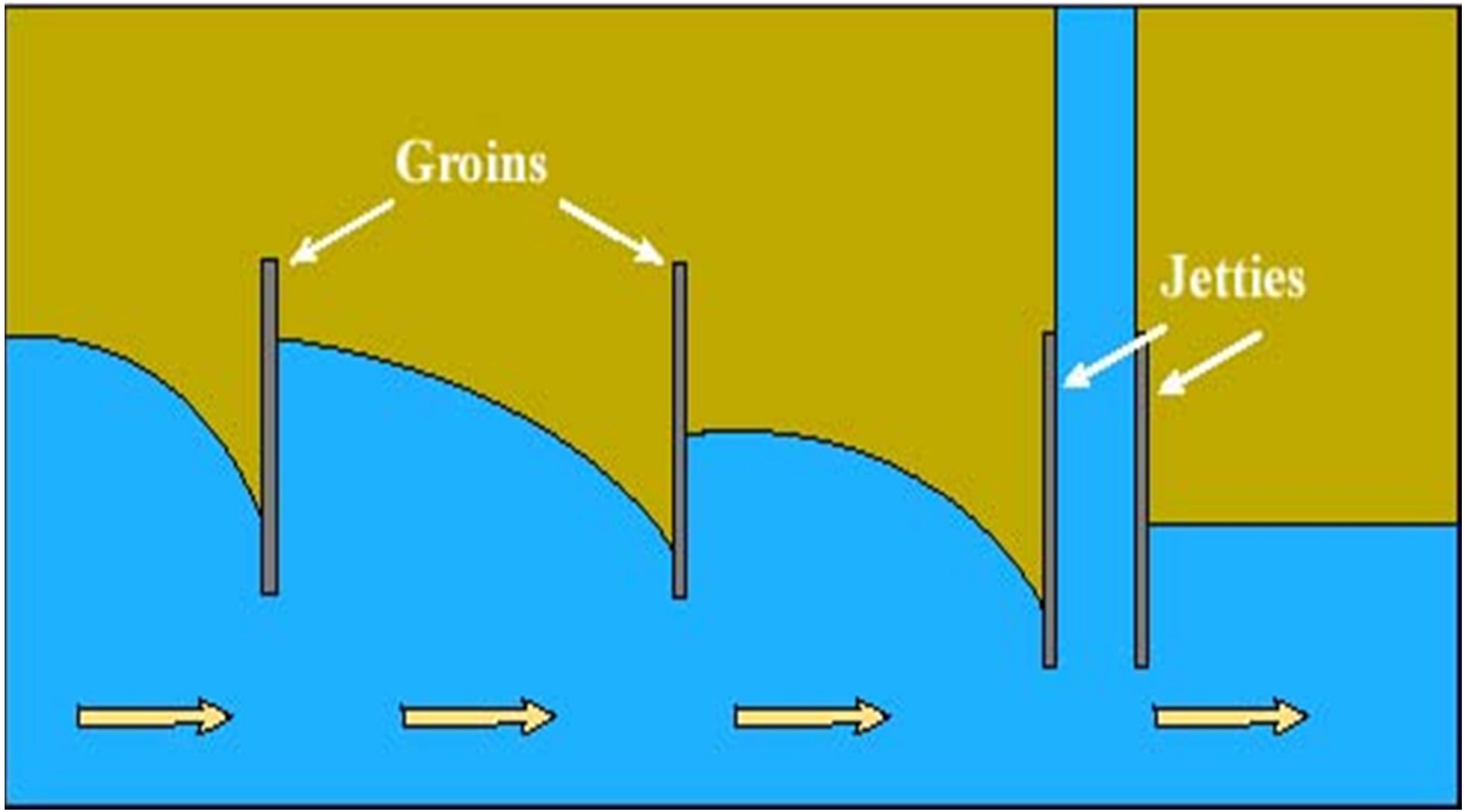
ANNEXURE - V

NAME OF STATE: **DETAILS OF TIDE GAUGE:** **LOCAL DATUM:**
NAME OF COASTAL DISTRICT: **CHART DATUM:**
NAME OF PLACE:
MONTH & YEAR:

DATE/ TIME	0100	0200……..	1000……..	1500……..	2000……..	High Water		Low water		Daily
						TIME	LeVEl	Time	LEvel	M.S.L
1										
2										
. . . 10										
. . .										
31										


CURRENT MEASUREMENT

Structures to reduce longshore sediment transport

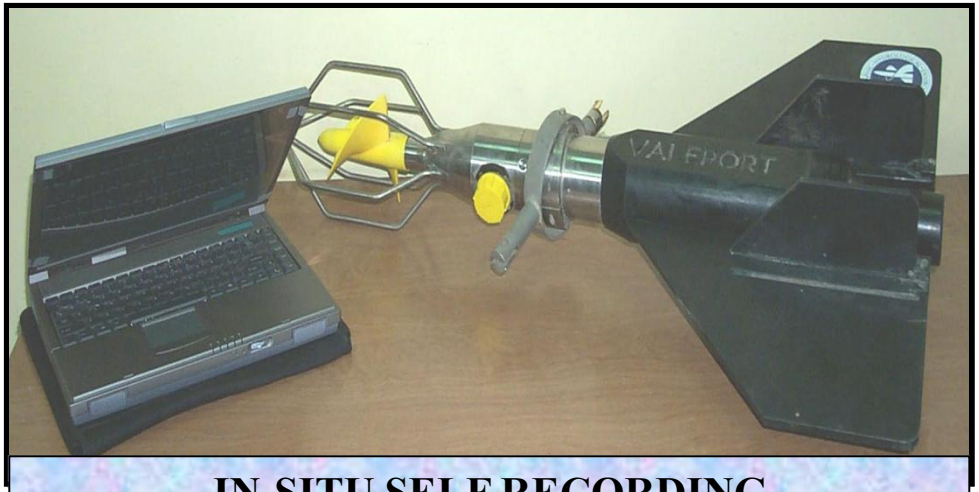


DEPTH AND CURRENT MEASUREMENT

DIGITAL ECHO SOUNDER
WITH POSITION FIXING

DIRECT READING CURRENTMETER

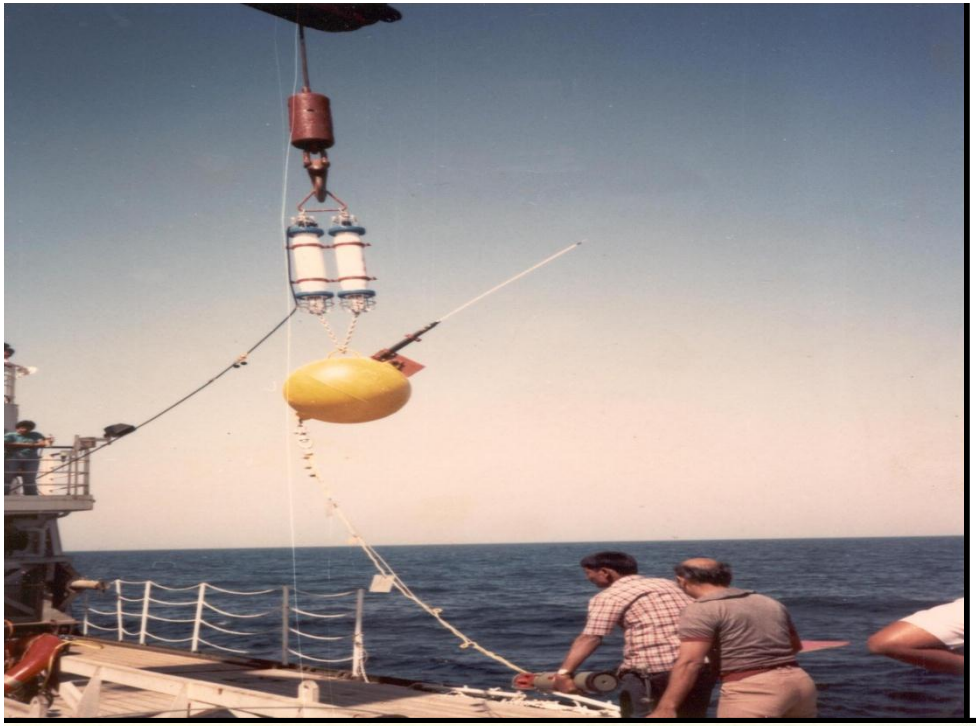
DIGITAL ECHO SOUNDER



IN-SITU SELF RECORDING
CURRENTMETER

CURRENT MEASUREMENT FROM BOAT

CURRENT MEASUREMENT FROM JETTY



FLOAT TRACK OBSEVATION

OBSERVATION FOR CURRENTS

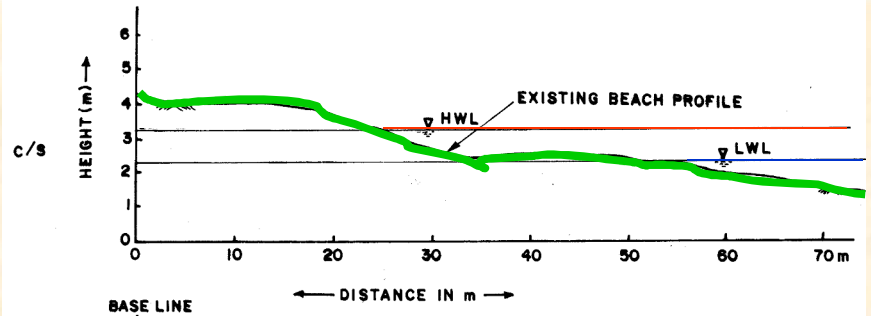
ANNEXURE - IV

NAME OF STATE:
NAME OF COASTAL DISTRICT:
NAME OF PLACE:
MONTH & YEAR:

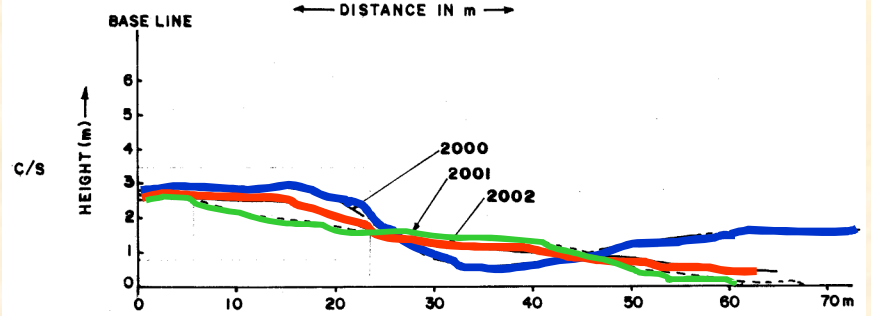
DETAILS OF CURRENT METER:
DETAILS OF TRACK :

SR. NO	DATE	TIME	TIDE LEVEL IN m	DEPTH IN m	FLOAT TRACK OBSERVATIONS						CURRENT OBSERVATIONS	
					PLACE OF RELEASE OF FLOAT	TIME OF OBSR.	DIST. TRAVEL	AV. VEL. IN m/sec	WIND DIRCT	WIND VEL IN m/sec	SPEED IN M/SEC	DIRECTN (DEG. North)
1												
2												
3												

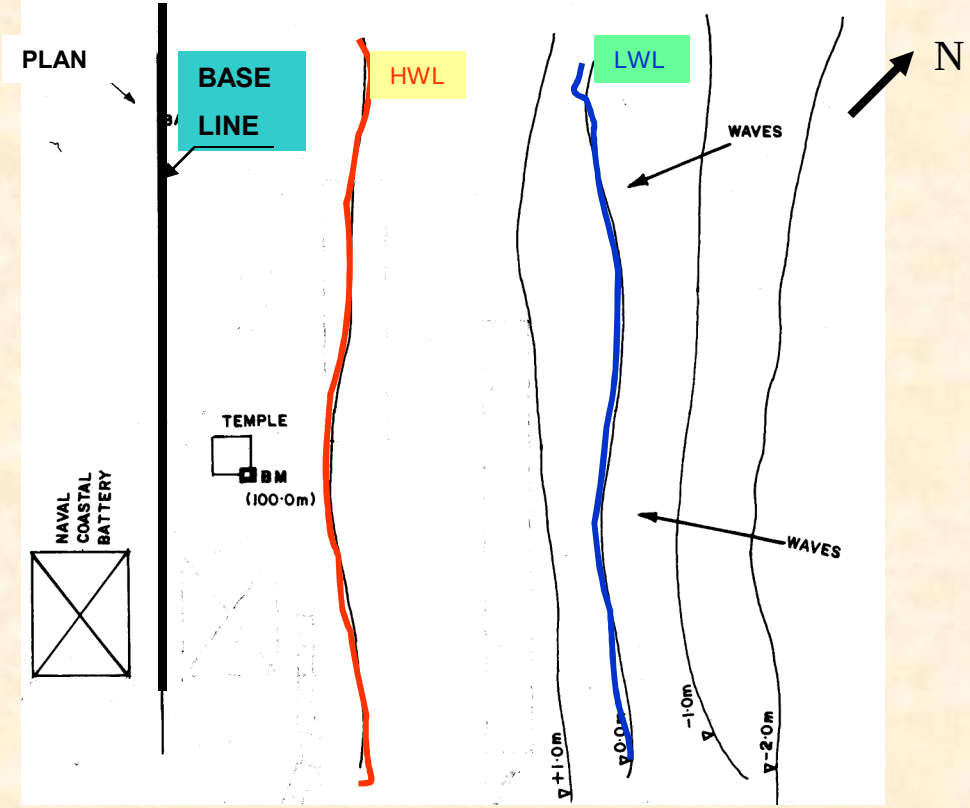
BEACH PROFILE



TYPICAL BEACH PROFILE



YEARWISE CHANGE IN BEACH PROFILE



TYPICAL PLAN OF BEACH SHOWING

(HWL,LWL lines & WAVE DIRECTIONS)

INFORMATION REGARDING PROTECTIVE STRUCTURES

Protective Structures or Structures Already existing	**Levels W.R.T Bench mark in m**			**Plantation** **Per year**	**Wave height /** Period	**Wave** Direction	**Cost /m**	Remarks
	BED	**TOE**	**CREST**					
Breakwater/ Groyne/ Seawall	+0.5	+2.5	+4.5	Nil or 100 m Along the length of beach Planted (Casurina or Mylly trees)	About 1 m wave during Non- monsoon Or 2-3m waves during monsoon or Less than 1m waves during calm weather Wave period ï 8 to 10 Sec Type of breaking ï Plunging/ Collapsing/ surging	North-East in Nov And December, while South-west in remaining months	Rs. 20,000 Per m	1) Section of Tetrapods or Stones required 2) Toe stones damaged or settled etc. 3) Stones up to 3t are available. Cranes are also available for lifting the stones etc.

CONCLUSIONS

- COLLECTION OF DATA IN SYSTEMATIC FORMAT FOR VARIOUS PARAMETERS SUCH AS WAVES, TIDES, DEPTH CURRENTS AND BEACH PROFILES IS ESSENTIAL IN DESIGN OF COASTAL PROTECTION WORKS.
- LEVELS OF TIDE AND BEACH PROFILE MUST BE RELATED WITH STANDARD CHART DATUM.
- INFORMATION ABOUT EROSION SITE IS TO BE COLLECTED FROM WHOLE TO PART.
- COLLECTION OF DATA OF BEACH SAMPLES IN THE FORM OF EFFECTIVE GRAIN SIZE (D_{50}) ETC. IS ESSENTIAL FOR DESIGN OF FILTER LAYER.


Thank you