BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water Resources, and Coastal Engineering
Student Group: Earned Credit Hour >108, Final Examination (Spring) : Feb 2021

Subject: EWC-471, Basic Coastal Engineering

Total: 2.00 hours **Full Marks: 180**
Section A: 1.00 hour **Section A: 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 1 and Question – 4 (Viva Voce)** in **Section A** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 2 & Q - 3)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-A

Question – 1 (Compulsory)

a. With neat sketches show the following coastal features: Coastline, Tombolo, Barrier Spit, Headland and Dune **10**

b. A wave with a period of 7.0 sec is propagating from a depth of 500 m towards the shore over a uniformly sloping shelf (1:15). At a depth of 8m, Calculate the followings using small amplitude wave theory. **20**

i) wave celerity and wave length,
ii) Local horizontal and vertical velocities at a point 2 m below the still water level, when $Kx-\sigma t = \pi/6$ and H=2.5 m
iii) Energy and Power of wave, when H= 2.5 m.

Question – 2

a. "It is a good idea to consider wave refraction effects when looking for a location of a structure to be built into the sea." Explain the statement based on the concept of wave refraction. **10**

b. A wave with height 2.3 m and period 6.0 sec at a depth of 12m shoaling on a 1:5 slope towards the shore. Calculate: **20**
i) Breaking wave height
ii) Water depth at wave breaking
iii) Type of wave breaking

Question – 3

a. Briefly explain how the coastal zone of Bangladesh is managed against cyclone and storm surges. **10**

b. A vertical emerged breakwater is located at a depth of 15m at a sea. Waves of 3.5 m height and 180 m wave length are propagating towards the breakwater. Assuming γ=10.2 KN/m^3, Calculate the magnitude and location of non-breaking wave force on the breakwater, when
i) Wave crest hits the breakwater
ii) Wave trough hits the breakwater

Question – 4 Viva Voce (Compulsory) **30**

Useful Equations

$$u=\frac{\pi H \cosh k(z+h)}{\sinh kh}.\cos(wt-kx)$$

$$w=-\frac{\pi H \sinh k(z+h)}{\sinh kh}.\sin(wt-kx)$$

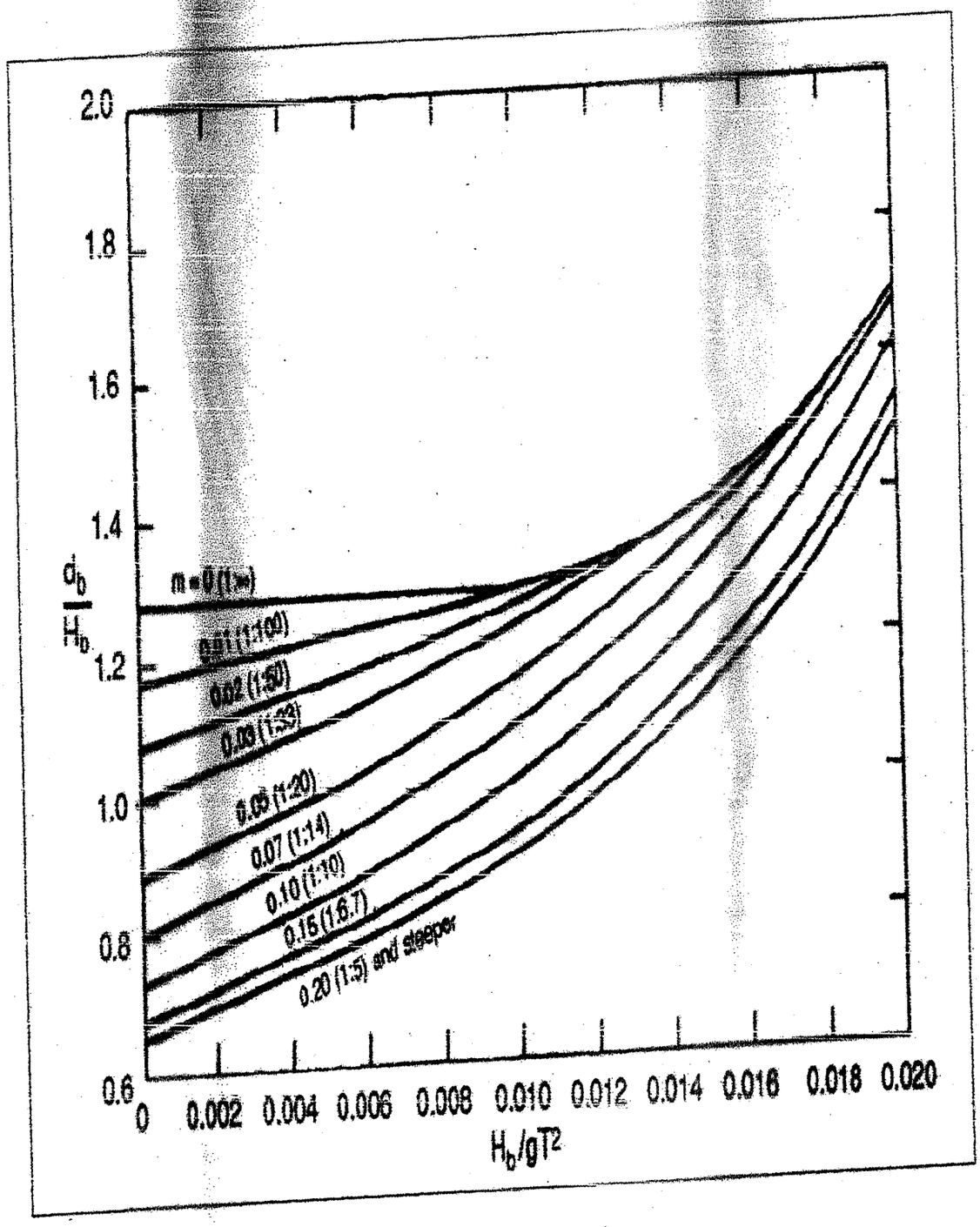
$$L=\frac{gT^2}{2\pi}.\tanh\frac{2\pi h}{L}$$

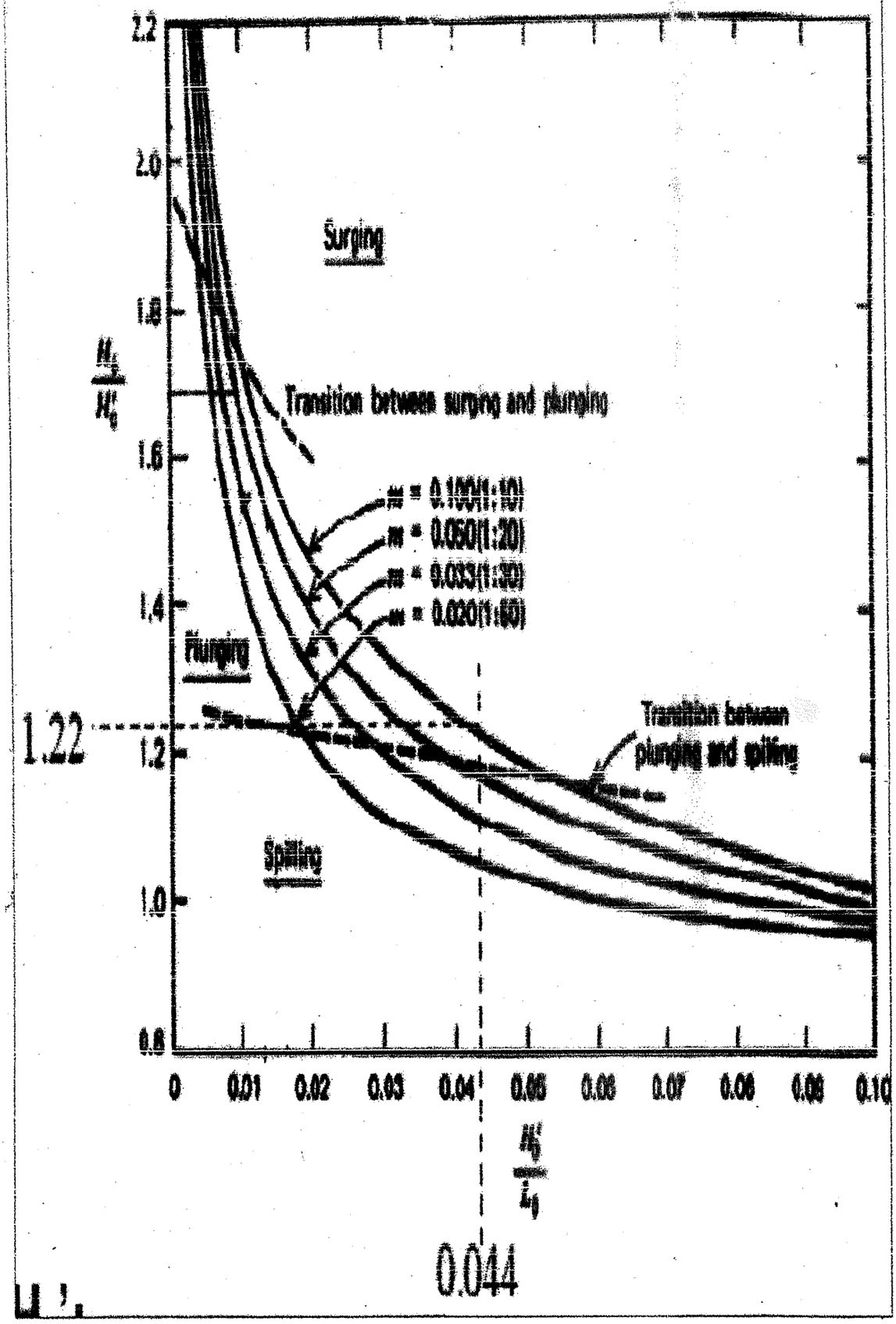
$$P_c=\frac{\gamma H}{\cosh kd}+\gamma d$$

$$P_t=-\frac{\gamma H}{\cosh kd}+\gamma d$$

$$H_o'=H\sqrt{\left(\frac{2\pi L}{L_o}\right)}$$

$$n=\frac{1}{2}\left(1+\frac{4\pi d/L}{\sinh 4\pi d/L}\right)$$


2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
$\frac{d_b}{H_b}$
m = 0 (1:∞)
0.01 (1:100)
0.02 (1:50)
0.03 (1:33)
0.05 (1:20)
0.07 (1:14)
0.10 (1:10)
0.15 (1:6.7)
0.20 (1:5) and steeper
0
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
0.018
0.020
H_b/gT^2


2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
Surging
Transition between surging and plunging
m = 0.100(1:10)
m = 0.050(1:20)
m = 0.033(1:30)
m = 0.020(1:50)
Plunging
Transition between plunging and spilling
Spilling
1.22
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.044

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Total: 2.00 hours **Full Marks: 180**
Section B: 1.00 hour **Section B: 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 5 and Question – 8 (Viva Voce)** in **Section B** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 6 & Q - 7)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-B

Question – 5 (Compulsory)

a. Illustrate with neat sketches, **10**
i) Failure modes of rubble-mound breakwater
ii) typical beach configurations with detached nearshore breakwater
iii) pressure blow out of slab elements

b. The site and wave conditions along a shoreline are as below: **20**
Road level= 115 ft MLLW
Storm Surge height = 8 ft
50 year high water level= 112 ft MLLW
MHHW= 110 ft MLLW
Bed level at the end of the bank slope= 105 ft MLLW
RL of MLLW= 100 ft
Bottom slope of sea bed= 1:50
Design wave height= 8 ft
Design wave period= $4+\frac{last\ two\ digit\ of\ your\ student\ ID}{30}$

Design a revetment type shore protection structure with quarry stone armor unit including the filter and toe protection. Also show the design section with neat sketch. Use the attached tables and graph.

Question – 6

a. Write short notes on the following: **15**
i) Mixed tidal cycles
ii) Tide dominated deltas
iii) Chart datum
iv) Locked basins
v) Tidal constituents

b. With neat sketches draw a harbor with outer dock and show its various components. **15**

Question – 7

a. List down the prevailing issues and challenges in the coastal zone of Bangladesh according to BDP 2100. What strategies should be taken to reduce these problems? **10**

b. What natural processes are taking place at a coast? How do these **10**

processes effect human living nearby the coast?

c. Discuss the geometry of different types of delta with relevant figures and examples. **10**

Question – 8 Viva Voce (Compulsory) **30**

Graph for question no. 5(b)

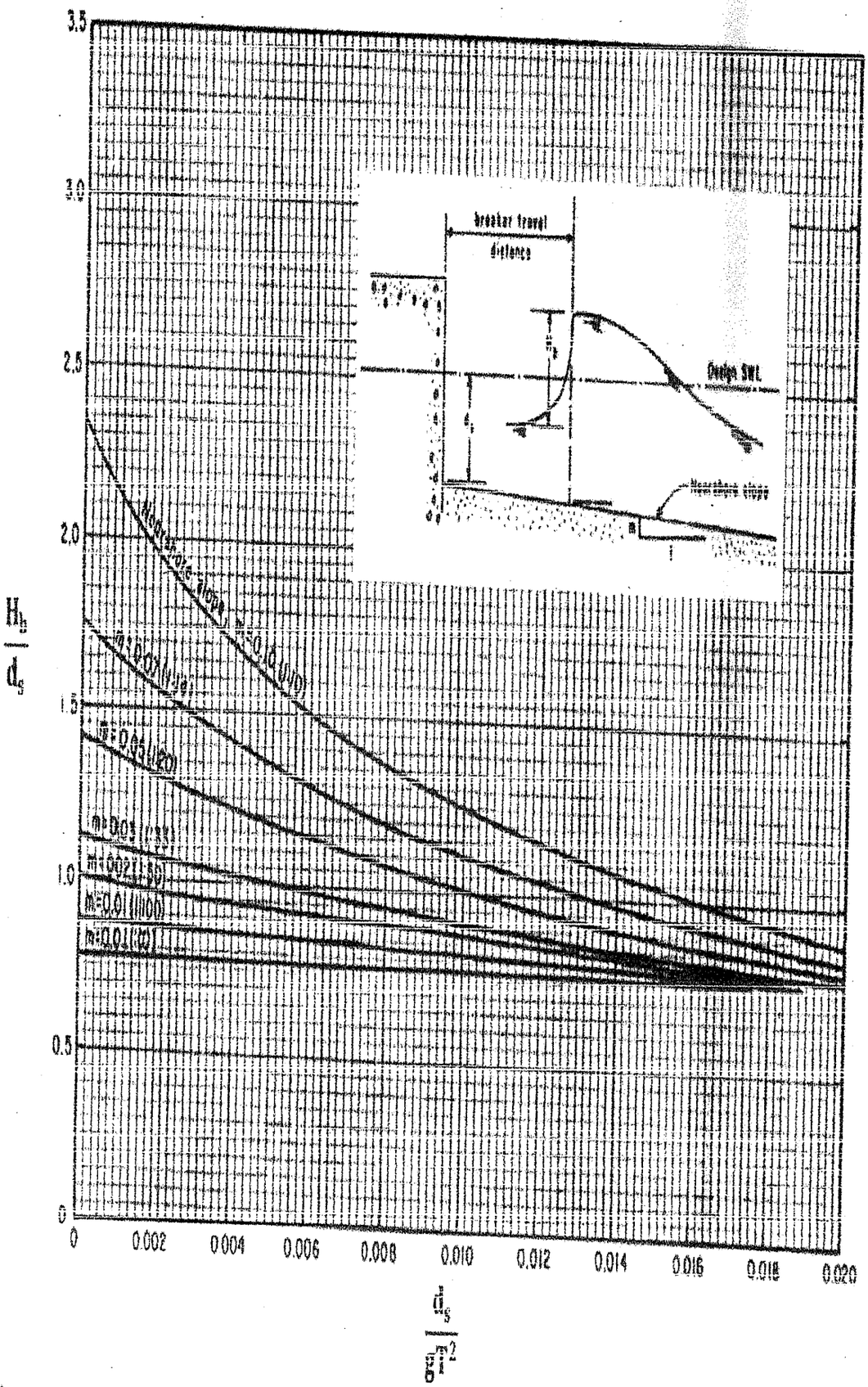


Figure 18 Dimensionless Design Breaker Height Versus Relative Depth at Structure [Weggel (1972)]

Tables for question no 5 (b)

Table 1

Table 2-2
Rough Slope Runup Correction Factors (Carstea et al. 1975b)

Armor Type	Slope (cot θ)	Relative Size H / K_r[a,b]	Correction Factor r
Quarrystone	1.5	3 to 4	0.60
Quarrystone	2.5	3 to 4	0.63
Quarrystone	3.5	3 to 4	0.60
Quarrystone	5	3	0.60
Quarrystone	5	4	0.69
Quarrystone	5	5	0.72
Concrete Blocks[c]	Any	6[d]	0.93
Stepped slope with vertical risers	1.5	$1 \le H_o'/K_r$[d]	0.75
Stepped slope with vertical risers	2.0	$1 \le H_o'/K_r$[d]	0.75
Stepped slope with vertical risers	3.0	$1 \le H_o'/K_r$[d]	0.70
Stepped slope with rounded edges	3.0	$1 \le H_o'/K_r$[d]	0.86
Concrete Armor Units			
Tetrapods random two layers	1.3 to 3.0	-	0.45
Tetrapods uniform two layers	1.3 to 3.0	-	0.51
Tribars random two layers	1.3 to 3.0	-	0.45
Tribars uniform one layer	1.3 to 3.0	-	0.50

[a] K_r is the characteristic height of the armor unit perpendicular to the slope. For quarrystone, it is the nominal diameter; for armor units, the height above the slope.
[b] Use H_o' for $d_j/H_o' > 3$; and the local wave height, H_s for $d_j/H_o' \le 3$.
[c] Perforated surfaces of Gobi Blocks, Monoslabs, and concrete masonry units placed hollows up.
[d] K_r is the riser height.

Table 2

Table 2-3
Suggested Values for Use in Determining Armor Weight (Breaking Wave Conditions)

Armor Unit	n[a]	Placement	Slope (cot θ)	K_D
Quarrystone				
Smooth rounded	2	Random	1.5 to 3.0	1.2
Smooth rounded	>3	Random	1.5 to 3.0	1.6
Rough angular	1	Random	1.5 to 3.0	Do Not Use
Rough angular	2	Random	1.5 to 3.0	2.0
Rough angular	>3	Random	1.5 to 3.0	2.2
Rough angular	2	Special[b]	1.5 to 3.0	7.0 to 20.0
Graded riprap[c]	2[d]	Random	2.0 to 6.0	2.2
Concrete Armor Units				
Tetrapod	2	Random	1.5 to 3.0	7.0
Tripod	2	Random	1.5 to 3.0	9.0
Tripod	1	Uniform	1.5 to 3.0	12.0
Dolos	2	Random	2.0 to 3.0[e]	15.0[e]

[a] n equals the number of equivalent spherical diameters corresponding to the median stone weight that would fit within the layer thickness.
[b] Special placement with long axes of stone placed perpendicular to the slope face. Model tests are described in Markle and Davidson (1979).
[c] Graded riprap is not recommended where wave heights exceed 5 ft.
[d] By definition, graded riprap thickness is two times the diameter of the minimum W_{50} size.
[e] Stability of armour on slope steeper than 1 on 2 should be [illegible]

Table 3

Table 2-4
Layer Coefficients and Porosity for Various Armor Units

Armor Unit	n	Placement	K_Δ	P (%)
Quarrystone (smooth)	2	Random	1.00	38
Quarrystone (rough)	2	Random	1.00	37
Quarrystone (rough)	≥3	Random	1.00	40
Graded riprap	2*	Random	N/A	37
Tetrapod	2	Random	1.04	50
Tribar	2	Random	1.02	54
Tribar	1	Uniform	1.13	47
Dolos	2	Random	0.94	56

* By definition, riprap thickness equals two cubic lengths of W_{50} or 1.25 W_{100}.

Table 4

Table 2-5
$H/H_{0\%}$ for Cover Layer Damage Levels for Various Armor Types ($H/H_{0\%}$ for Damage Level in Percent)

Unit	$0 \le \%_D < 5$	$5 \le \%_D < 10$	$10 \le \%_D < 15$	$15 \le \%_D < 20$	$20 \le \%_D \le 30$
Quarrystone (smooth)	1.00	1.08	1.14	1.20	1.29
Quarrystone (angular)	1.00	1.08	1.19	1.27	1.37
Tetrapods	1.00	1.09	1.17	1.24	1.32
Tribars	1.00	1.11	1.25	1.36	1.50
Dolos	1.00	1.10	1.14	1.17	1.20