GIVEN:

U_{ow} @ 7m = 76 mph
t_d = 1 Hr 15 min 75 mins
$T_W = T_A$, so $\Delta T = 0$
d = 40 ft.
F = 45 mi = 237,600 ft.

FIND:
a) H_s
b) T_s
c) Wind Setup
d) H_{rms}

$$H_{rms} = \sqrt{\frac{\Sigma H_i^2}{n}}$$

SOLUTION:

$R_L = 1.0$

$R_T = 1.0$

$76 \frac{m}{Hr}\left(\frac{5280}{3600}\right)$ 111.5 ft/s

75 min = 4500 sec

$$U' = 76\text{ mph} \times \underset{R_L}{1.0} \times \underset{R_T}{1.0} = 76\text{ mph}$$

$$U_A = 0.589(76)^{1.23} = 121.2\text{ mph}\left(\frac{5280}{3600}\right) = 177.8\text{ ft/s}$$

$$f_d = \frac{gd}{U_A^2} = \frac{(32.2)(40)}{(177.8)^2} = 0.0407$$

$$f_F = \frac{gF}{U_A^2} = \frac{(32.2)(237,600)}{(177.8)^2} = 242.0$$

$$f_{td} = \frac{t_d g}{U_A} = \frac{(4500)(32.2)}{177.8} = 814.9$$

Figure 3.21 Page 58 $\Rightarrow \frac{gH_s}{U_A^2} = 0.013 \Rightarrow 0.013 = \frac{(32.2)(H_s)}{(177.8)^2} = \underline{\underline{12.8\text{ ft.} = H_s}}$

Figure 3.22 Page 59 $\Rightarrow \frac{gT_s}{U_A} = 1.18 \Rightarrow 1.18 = \frac{(32.2)(T_s)}{177.8} = \underline{\underline{6.5\text{ s} = T_s}}$

$F' = 45 \times 5280 = 237,600$ ft.

$$Z_{sup} = \frac{F'(RC_F U_{ow}^2)}{2gRd} \Rightarrow \frac{F'(C_F)(U_{ow})^2}{2gd}$$

Setup

$$Z_{sup} = \frac{1}{800}\left[\frac{(237,600)(0.0025)(111.5)^2}{2(32.2)(40)}\right] = 3.58\text{ ft.} \Rightarrow 4\text{ ft.}$$

DURATION

$$T_m = \frac{U_A}{g}\left[\frac{f_{td}}{537}\right]^{3/7} \Rightarrow \underset{5.5217}{\frac{177.8}{32.2}}\left(\frac{814.9}{537}\right)^{.4286} = 6.6\text{ s}$$

$C_F = 0.0025$

$U_{ow} = 76 \frac{m}{Hr}\left(\frac{5280}{3600}\right) = 111.5$ ft/s

$\underset{T_m}{6.6} > \underset{T_s}{6.5}$ = DURATION LIMITED

$FPS(0.3048) = mps$ $FPS(0.6818) = mph$

$1m = 3.281 ft$
$1 ft = 0.3048 m$

1. Given: A lake that is 45 miles long and 40 ft deep. The overwater wind speed at 7-m above the surface is 76 mph. Assume: The air and water temperatures are nearly the same. Td = 1.25 hours.

Circle the closest answer:

Determine:

a) Hs=: [≤8, 11, 12, 13, 15, ≥20] ft 2/3

b) Ts= : [≤2, 3, 4, 5, 7, ≥15] sec 3/3

c) Using a friction coefficient of 0.0025, the wind setup is: [≤1.5, 2, 3, 4, 5, 6, ≥7] ft 2/2

d) The waves are: [Fetch Limited, Duration Limited] 1/1

* e) H_{rms} = [≤5, 7.5, 8.5, 10, 12, ≤13] ft 1

Show your calculations here!

$F = 45 \text{ miles} = 237600 ft = 72420 m$ $d = 40 ft$ $U_{ow} = 76 mph = 111.47 fps = 33.98 mps$ $T_d = 1.25 hr = 4500 s$

$R_L = 1$

$R_T = 1$

$U_A = 0.589(76 mph)^{1.23} = 121.2 mph$

$0.539(111.47)^{1.23} = 177.66 fps$

$\frac{gd}{U_A^2} = 0.0408$ $\frac{gF}{U_A^2} = 242.4$

$\frac{gH}{U_A^2} = 0.011 \rightarrow H_s = 10.78 ft$ $\frac{gT}{U_A} = 1.3 \rightarrow T_s = 7.17 s$

$\frac{gT_m}{U_A} = \left\{\left(\frac{2t_d}{U_A}\right)\frac{1}{537}\right\}^{3/7}$ $T_m = 6.6$ $T_m < T_s$

3

$\frac{gT_m}{U_A} = 1.19$ $\frac{gd}{U_A^2} = .022 \rightarrow \frac{gH}{U_A^2} = 0.0085 \rightarrow H_m = 3.3 ft$

$Z_{sup} = \frac{1}{800}\frac{F(C_f)U_{ow}^2}{2gd} = 3.58$

$Z_{sup} = \frac{C'(F C_f U_{ow}^2)}{2gd}$ $\frac{1}{800}\frac{(237,600)(0.0025)(111.5)^2}{2(32.2)(40)} = 3.58 ft.$

127.8 ft/s

$\frac{gd}{U_A^2} = 0.024$

$\frac{gF}{U_A^2} = 1661.6$

$= 0.009$

$\frac{H}{L} = \frac{s}{2}$

H_{rms}

Given: $\Delta p = 60\,mm \Rightarrow \frac{60}{10} = 6\,cm \Rightarrow 2.36\,in$ or $\frac{60}{25.4} = 2.36\,in$

$R = 18$ nmiles

$V_F = 11\,mph$ = forward speed $= \frac{11\,mph}{1.1518} = 9.55$ knots

$\alpha = 1.2$

Reference Depth = 44 ft.

Latitude = 28°

$a = 0.868$
$b = 73$
$c = 0.57$ "Hg
$W_2 = \frac{2\pi}{24} = 0.26$

Find: H_{os}, T_{os}

Solution

$$U_{max} = a\left(b(\Delta p)^{1/2} - cRf\right) \qquad f = 2\left(\tfrac{2\pi}{24}\right)\sin 28^\circ = 0.2458$$

$$U_{max} = 0.868\left[73(2.36)^{1/2} - (0.57)(18)(0.2458)\right] = 95.15 \text{ knots}$$

112.14 − 2.5219

$$U_R = 0.865(U_{max}) + 0.5V_F$$

$$U_R = 0.865(95.15) + 0.5(9.55) = 87.07 \text{ knots}$$

82.3 + 4.775

$$T_s = A\left[1 + \frac{B\alpha V_F}{\sqrt{U_R}}\right] e^{\frac{R\Delta p}{C}}$$

$\Rightarrow A = 8.6$
$B = 0.104$
$C = 200$
$R = 18$ NMI
$\Delta p = 2.36$ in

$$T_s = 8.6\left[1 + \frac{(0.104)(1.2)(9.55)}{(87.07)^{1/2}}\right] e^{\frac{18(2.36)}{200}}$$

9.6985 1.2366

$\Rightarrow$ **$T_{os} = 11.99$ sec**

$$H_{os} = A_o\left[1 + \frac{B_o\alpha V_F}{\sqrt{U_R}}\right] e^{\frac{R\Delta p}{C_o}}$$

$\Rightarrow A_o = 16.5$
$B_o = 0.208$
$C_o = 100$
$R = 18$ NMI
$\Delta p = 2.36$ in

$$H_{os} = 16.5\left[1 + \frac{(0.208)(1.2)(9.55)}{(87.07)^{1/2}}\right] e^{\frac{18(2.36)}{100}} = 31.68 \text{ ft.}$$

20.715 1.5293

$\Rightarrow$ **$H_{os} = 31.68$ ft.**

$$H_{ss} \approx K_s K_r \left[\Delta p + \frac{C_R C_F R U_R^2 \rho_a}{2 g d_{ref} \rho_w}\right]$$

$\Rightarrow C_R = 1 \to 2 = 2$
$\frac{\rho_a}{\rho_w} = \frac{1}{800}$
$C_F = 0.0026$
$d_{ref} = 44$ ft.
$K_s K_r = 1$

$$H_{ss} \approx K_s K_r \left[2.36 + \frac{(2)(0.0026)(109{,}370)(147\,ft/s)^2}{2(32.2)(44)(800)}\right] = 7.78 \text{ ft.}$$

$\Rightarrow$ **$H_{ss} = 7.78$ ft.**

$87.07 \times 1.1508 = 100.2\left(\frac{5280}{3600}\right) = 147\,ft/s$

$\frac{18\,NMI}{0.86898} = 20.71\,mi \times 5280 =$

$R = 109.369.6$ ft.

2 Given: A hurricane in the northern Gulf of Mexico with:

- $\Delta p = 60$ mm = 2.36"
- R = 18 Nmiles
- $V_F = 11$ mph = 9.559 knots
- $\alpha = 1.2$
- Reference depth 44 ft.
- Latitude 28 degrees

Circle the closest answer:

Determine:

a) H_{os} is: [<20, 30, 35, 38, >40] ft 2

b) T_{os} is: [<12, 13, 14.5, 15, >15] sec 2

c) If CR=2 and Cf=0.0026, the surge height is approximately:
[<1, 2, 4, 6, 8, >10] ft 1/2 / 1

Show your calculations here!

$U_{max} = 0.868 \text{ knots} \{ 73 \text{ miles} (2.36 \text{ in})^{1/2} - 0.57 \text{ inch} (18 \text{ miles}) (\frac{47}{34}) \sin 28° \}$

$= 0.868 (112.145 - 2.52) = 95.15$ knots

$U_R : 0.865 (95.15) + 0.5 (9.559) = 87.08$ knots 3

$T_s = 8.6 \left(1 + \frac{0.104 (1.2)(9.559)}{\sqrt{87.08}}\right) e^{\frac{18(2.36)}{200}} = 11.99$ s

$H_{os} = 16.5 \left(1 + \frac{0.208 (1.2)(9.559)}{\sqrt{87.08}}\right) e^{\frac{18(2.36)}{100}} = 31.68$ ft

ft/sec

$h_{ss} = K_s K_a \left(2.36 + \frac{2(0.0026)(87.08^2)}{2(32.2)(44)(800)}\right) \approx K_s K_a (2.36)$

87.07 knots × 1.1508 = 100.09 mph

$\frac{15}{.8689}$ 20.09 m

$\frac{87.07}{1.1508} = 75.66 \text{ m} \left(\frac{5280}{3600}\right) =$ ~~110.9'~~ 111 ft/s

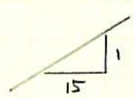
GIVEN: A BEACH WITH A $D_{50} = 0.45\,mm$, WATER TEMP = 20° C

FIND: FALL VELOCITY, BEACH STABILITY

a) $D_{50} = .45\,mm$ @ 20°C

$\Rightarrow$ FIGURE 4-31 $= 7.1\ cm/s = \frac{2.8\ in}{12} = \underline{\underline{0.23\ ft/s}}$

b) $\Rightarrow$ FIGURE 7.20 @ .45 mm & EXPOSED LINE = 1:15



$\tan\frac{1}{15} = 6.67\%$

c) FOR DEEP WATER WAVE $H_0 = 5\ ft$, $T = 10\ sec$

$$L_0 = \frac{g}{2\pi}(T)^2 = \frac{32.2}{2\pi}(10)^2 = 512.5\ ft.$$

$$\frac{H_0}{L_0} = \frac{5}{512.5} = 9.7\times10^{-3} \quad \text{AND} \quad \frac{\pi V}{gT} = \frac{\pi(0.23)}{(32.2)(10)} = 0.002 = 2.24\times10^{-3}$$

$\Rightarrow$ FIGURE 8.14 = OFFSHORE BARS

>1 = OFFSHORE
<1 = ONSHORE

METHOD USED 1984 SPM AND FIGURE 8.14

d) CLOSURE DEPTH

FIGURE 4-22 @ 0.45 mm = 450 microns $V_u = 0.41$

$$0.41 = \left(\frac{H}{2}\right)\left(\frac{gT}{L}\right)\frac{1}{\cosh\left(\frac{2\pi d}{L}\right)}$$

GUESS ON L

Letunr & Pant

1 mm = 0.003281 ft   1 cm/s = 0.03281 ft/s

3. Given: A beach with a D50 = 0.45 mm. Assume water temperature approximately 20 degrees C.

Circle the closest answer:

a) The fall velocity is: [<0.03, 0.15, 0.2, 0.25, 0.3, >0.4] ft/sec

b) The stable beach slope is: [< 1%, 1.5%, 2%, 3%, >4%] "Exposed"

c) For a deep water wave Ho = 5 ft and T = 10 sec, the beach profile tends to: [Berm; Offshore bar(s), Neither] State method 1984 SPM Fig 8.14

d) The closure depth for the wave in (b) is: [<50, 80, 100, 120, 130, >150] ft

Show your calculations here!

D_{50} = 0.45 mm = 0.0014765 ft   Exposed H_o = 5'   T = 10 s

$\frac{H_o}{D_{50} \text{ in ft}} = 3386.5$

1:16 = 0.0625

Dimensionless fall time = $\frac{H_o}{V_f T}$

$L_o = \frac{gT^2}{2\pi} = 51.25$ ft

512.5 ft.

W = 6.5 cm/s = 0.213 ft/s

$F_o = \frac{5}{(.213)(10)} = 2.35$

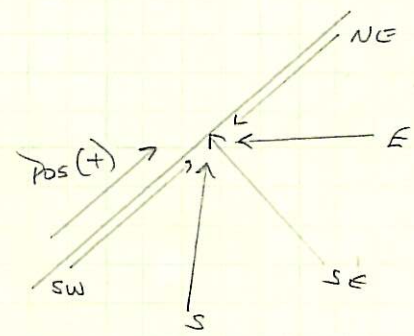
$\frac{\pi(0.213)}{32.2(10)} = 0.0213$

$\frac{H_o}{L_o} = 0.976$

U = 0.5 ft/s = $\frac{5}{2}\left(\frac{32.2(10)}{L}\right)\frac{1}{\cosh(2\pi d/L)}$

D_{50} : 450 micron

GIVEN: BEACH SLOPE = 1.25%
ASSUME SW → NE IS POS (+)



FIND: a) NET LONGSHORE TRANSPORT
b) GROSS LONGSHORE TRANSPORT
c) MAX BREAKER INDUCED CURRENT IS (USE 3ft)

SOLUTION:

H_o ft	SW	S	SE	E	NE
0 - 1	2.5/1.25	4.5	5	2.5	2.5/1.25
1 - 2	1/0.5	2	1	1	0.5/0.25
2 - 3	0.5/0.25	1	0.7	0.7	0.6/0.3

	SW	S	SE	E	NE
H_o	78.75	45°	0	-45°	-78.75
0.5	77.0	999.3	0	-555.3	-77.0
1.5	480.2	6924.7	0	-3462.3	-240.1
2.5	860.1	12,414.6	0	-8690.3	-1033.1
	1417.3	20,338.6		-12,707.9	-1350.2

ASSUME Ky = 137,000

$$Q_{LS\ NET} = Ky\left(\frac{Bin}{100}\right)(H_o)^{2.5}(\cos\theta)^{.25}(\sin 2\theta)$$

$H_{o\,0.5} = 0.1768$
$H_{o\,1.5} = 2.756$
$H_{o\,2.5} = 9.882$

$(\cos -45)^{.25} = 0.917$
$(\sin 2(-45)) = -1.0$ OR 1.0

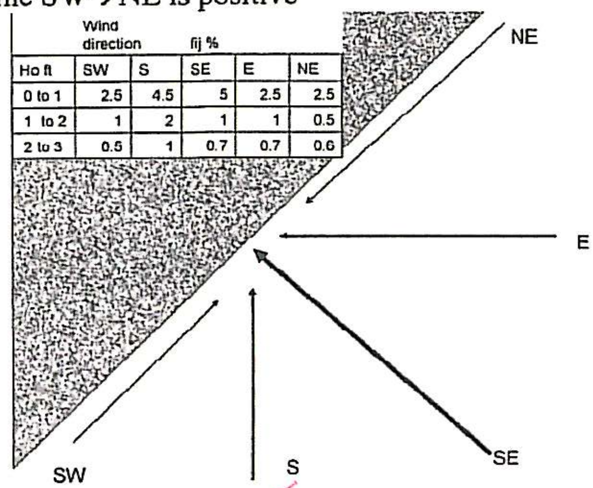
$(\cos 78.75)^{.25} = 0.6646$

$(\sin 2(78.75)) = 0.3827$ OR -0.3827

NET Q_{LS} = 7698 yd^3/yr

GROSS Q_{LS} = 35,814 yd^3/yr

4. Given: Given: the wave frequency table below. The beach slope is 1.25%. Assume SW→NE is positive



Ho ft	SW	S	SE	E	NE
0 to 1	2.5	4.5	5	2.5	2.5
1 to 2	1	2	1	1	0.5
2 to 3	0.5	1	0.7	0.7	0.6

Circle the closest answer:

Estimate:

a) the net longshore transport is:
[≤6500, 7500, 10000, 15000, 30000, ≥360000] yd3/yr

b) the gross longshore transport is:
[≤7000, 7500, 14000, 22000, 36000, ≥50000] yd3/yr

c) the maximum breaker induced current is (use 3 ft wave):
[≤0.5, 1, 1.25, 1.5, 1.75, 2, ≥4] ft/sec

Show your calculations here and in table above!

Wind direction fij %

Ho ft	SW	S	SE	E	NE
0 to 1	1.25 2.5	4.5	5	2.5	1.25 2.5
1 to 2	0.5 1	2	1	1	0.25 0.5
2 to 3	0.25 0.5	1	0.7	0.7	0.3 0.6
H_{oi}	1.37445	0.7854	0	-0.7854	-1.3744
0.5	774.53	29.91000	0	-16.555	-14.777
1.5	48090.5	2076924	0	-1053462	-45240
2.5	162.3 801	12415	0	-2 [illegible] 8690	-1634.8 -1633
	267.3	609	0	-390.1	-254.6
	1418	20339		-12707	-1350

$137000 (H_{oi}^{5/2}) (\cos \alpha_{oj})^{1/4} \sin(2(\alpha_{oj})) (\frac{f}{100})$

SW − NE = ~~475.7~~ 21757 yd³/yr

NE − SW = ~~634.7~~ 14057 yd³/yr

Net Q_L = ~~240.6~~ 7700 SW − NE yd³/yr

Gross = 1510 yd³/yr 35814

2
2
1/2
5/6