University Of Technology

Building and Construction Eng. Dept.

Exam – Final- – 2012/2013

Subject : Construction Methods&Equipement **Class:3**

Branch : Construction& Building **Time : 3 Hours**

Examiner :D.Raid AL-Lamy **Date : / / 2013**

NOTE: Answer (5) Questions ONLY

Q1-(A) Depending on the following information Find the size of power shovel YOU can using it :

- Hard clay soil
- Depth of cut 2.25
- Percent of optimum depth is 83.3%
- The depth-swing factor is 1.04
- The job-management factor is 0.69
- The probable output 79.7 m^3/hr.

Q1-(B)- If a crawler tractor has effective drawbar pull 1520 kg and the drawbar pull used to overcome the rolling resistance is 480 kg, find the drawbar pull in sixth gear when operated on a level road?

Q2 - Determine the probable fixed annual cost for owning and operating a (1.5 m^3) diesel engine crawler power shovel, the following information will apply:

cost per hour for owning and operating	$/hr 22.16
Engine	160 hp
Crankcase capacity	22.71 liter
Hours between oil changes	100 hr
Operating factor	0.6
Useful life, with no salvage value	6 years
Hours operated per year	2000
Cost of fuel per liter	0.33 $/liter
Cost of oil per liter	0.53 $/liter

Q3-(A) You have the additional attractive effort resulting from the slope equal to 1200 kg of a truck is moving up a road whose slope is (3%).find the probable gross weight of this truck?

Q3-(B) Determine the Maximum size batch of paving mixer which Maximum output per hour is 83.5 m3 and it is possible to produce a batch of concrete in 50 sec.

Q4 (A)– Check the load on the tie bar for the concrete wall form and CALCULATE THE PRESSURE ON CONTACT AREA if the tie bar capacity is 20 KN when the (L Wales) (spacing between Tie bars) is 1.5 m and (L Sheathing) (spacing between Studs)is 0.7 m and (L stud is 0.35 m)

- and rated of filling is 1.2 m/hr , concrete Temperature is 35c , double Wales 5×10cm , sheathing 2.5× 10cm . Type of lumber used: Douglas fir.

Q4-(B) Determine the number of strokes per min (n) for a duplex double-acting size (150mm × 300mm) if the total pumping head including friction loss in pipe is (48) m and the efficiency of pump is 60% and the minimum horsepower is 32 hp , the weight of 1 liter of water is 1 kg. Assume a water slippage of 4%.?

Q5 (A)- You have the following information about a construction mixer 16s?

- Output per hour is 15.37m3
- Volume per batch is 0.41m3
- Quantity of material per cubic meter are (cement 7.32 page ,sand 853kg ,gravel 1095kg, Water 193 lt

1- . Determine the number of batches per hr?

2- The time per cycle?

3- The quantity of material per batch?

Q5(B) A contractor who employs an average of 200 men 40 hours per week for 50 weeks has six disabling injuries. ,the six disabling injuries resulted in a total of 86 days lost from work , if one of the six disabling injuries, involving a time loss of 16 days, resulted in a loss of an arm below the elbow. What is his Injury-Frequency rate AND the Injury-Severity rate AND the Injury Index? Using information from Table (11-1)

Q6 (A) Estimate the approximate output of a bulldozer for the following conditions?

- Swell, 25%.
- Haul distance, 30m.
- Moldboard size, 2.9m long, 0.9m high.
- Rated moldboard capacity, 2.5m3 loose volume.
- Operating factor, 50min/hr.
- Pushing speed, 2.4 km/hr.
- Returning speed, 5.6 km/hr.
- Fixed time, loading and shifting gears, 0.32 min.

Q6 (B)-Select the smallest power shovel required to excavate (54000 m^3 bank measure) of hard, tough clay earth in 100 working days of 8hrs each. The average depth of cut will be (2.7m) and the average angle of swing will be (90°), noting that the job conditions are excellent, the management conditions are good and the working hour is 50 min.?

Table (8-2) - Ideal Output of Power Shovel, in Cubic Meter Per 60-Min Hour, Bank Measure.

Class of material	Size shovel, cubic meter								
	0.3	0.4	0.6	0.8	1	1.2	1.4	1.6	2
Moist loam or high sand clay	1.1 65	1.4 88	1.6 126	1.8 157	2.0 190	2.1 218	2.2 245	2.4 271	2.6 310
Sand and gravel	1.1 61	1.4 84	1.6 118	1.8 153	2.0 178	2.1 206	2.2 229	2.4 252	2.6 298
Good common earth	1.4 54	1.7 73	2.1 103	2.4 134	2.6 160	2.8 183	2.9 206	3.1 229	3.4 268
Hard, tough clay	1.8 38	2.1 57	2.4 84	2.7 111	3.0 137	3.3 156	3.5 18.	3.7 202	4.1 236
Well-blasted rock	— 30	— 46	— 72	— 95	— 118	— 137	— 156	— 175	— 210
Wet, sticky clay	1.8 19	2.1 30	2.4 53	2.7 73	3.0 91	3.3 110	3.5 125	3.7 141	4.0 175
Poorly blasted rock	— 11	— 19	— 38	— 57	— 73	— 88	— 107	— 122	— 149

Table (8-3) Conversion Factor for Depth of Cut and Angle of Swing

Angle of swing, deg.							Percent of Optimum Depth
180	150	120	90	75	60	45	
0.59	0.65	0.72	0.8	0.85	0.89	0.93	40
0.66	0.73	0.81	0.91	0.96	1.03	1.1	60
0.69	0.77	0.86	0.98	1.04	1.12	1.22	80
0.71	0.79	0.88	1.00	1.07	1.16	1.26	100
0.7	0.77	0.86	0.97	1.03	1.11	1.20	120
0.66	0.73	0.81	0.91	0.97	1.04	1.12	140
0.62	0.67	0.75	0.85	0.90	0.96	1.03	160

Table (8-4) Coefficient Related to Management and Job Conditions*

Job Conditions	Management Conditions			
	Excellent	Good	Fair	Poor
Excellent	0.84	0.81	0.76	0.70
Good	0.78	0.75	0.71	0.65
Fair	0.72	0.69	0.65	0.60
Poor	0.63	0.61	0.57	0.52

Table (7-1) – Properties of Various Kinds of Lumber Used in Form Construction*

Kind of Lumber	Safe working stresses, (kN/m^2) ×1000				
	Extreme Fiber in Bending (f)	Compress-ion Perpend-icular to Grain	Compression Parallel to Grain	Horizontal Shear (v)	Modulus of Elasticity (E)
Douglas Fir, Coast Region** No.1 Grade	12.4	3.4	10.3	1.0	11034.5
Hemlock, West Coast** No.1 Grade	12.4	3.1	9.2	0.9	9655.2
Larch,Common Structural Grade	12.4	3.4	11.4	1.0	10344.8

Table (11-1) - The American Standard Scale for Lost Time Resulting from Death or Permanent Disability

Nature of Injury	Time Charge, Days
Death	6000
Permanent total disability	6000
Loss of member or function:	
Arm, at or above elbow	4500
Arm, below elbow	3600
Hand	3000
Thumb	600
Any 1 finger	300
2 fingers on same hand	750
3 fingers on same hand	1200
4 fingers on same hand	1800
Thumb and 1 finger on same hand	1200
Thumb and 2 finger on same hand	1500
Thumb and 3 finger on same hand	2000
Thumb and 4 finger on same hand	2400
Leg, at or above knee	4500
Leg, below knee	3000
Foot, at ankle	2400
Great toe	300
2 great toes	600
1 eye, loss of sight	1800
Both eyes, loss of sight	6000
1 ear, loss of hearing	600
Both ears, loss of hearing	3000

اجابات ادارة معدات وطرق انشاء

Solution:Q1 A

Ideal output will be:

$79.7 \div (1.04 \times 0.69) = 111\ m^3/hr.$

the optimum depth is

$$\frac{2.25}{x} \times 100 = 83.3\%$$

$$x = 2.7m$$

From table (8-2) the ideal output will be $111m^3/hr.$, the optimum depth is 2.7m. YOU can use 0.8 cubic meter shovel,

Table (8-2) - Ideal Output of Power Shovel, in Cubic Meter Per 60-Min Hour, Bank Measure.

Class of material	Size shovel, cubic meter								
	0.3	0.4	0.6	0.8 x	1	1.2	1.4	1.6	2
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SOLUTIONQ1B

Effective Drawbar Pull $= x - 480 = 1520kg$

the drawbar pull in sixth gear
$= 1520 + 480 = 2000kg$

Solution:Q2

Fuel consumed per hour = operating factor × hp × engine consumption
Fuel consumed per hour = $0.6 \times 160 \times 0.15 = 14.4$ liter

$$q = \frac{hp \times f \times 0.0027(kg/hp-hr)}{0.89(kg/l)} + \frac{C}{t}$$

$$q = \frac{160 \times 0.6 \times 0.0027}{0.89} + \frac{22.71}{100} = 0.52 \ liter$$

Hourly Costs:	
Total Cost per hour, excluding labor	$22.16
Fuel: $14.4(0.33)$ (_)	$4.75
Lubrication Oil: $0.52(0.53)$ (_)	$0.28
=	$17.13
Total Annual Fixed Cost	
17.13 × 2000=34255	$34255

(3) اجابات ادارة معدات وطرق انشاء

Solution:Q3 A

$$P = X \times 10 \times 3 = 1200 \ kg$$

X=1200 ÷(3 × 10) = 40 T

Solution:Q3 B

No. batches per hr = 60 × 60 sec ÷ 50 sec = 72
Maximum size batch=83.5 ÷ 72 = 1.16m^3

Solution:Q4 A

Lateral Pressure:

$1.2 \ m/hr < 2.1 \ m/hr$

$\therefore$ *use the least value of* :

$$P_m = 7 + \frac{1414R}{1.8T + 32} = 7 + \frac{1414(1.2)}{1.8(35) + 32} = 24.86 \ kN/m^2$$

$$P_m = \gamma_c \times h = 24 \times 3.5 = 84 \ kN/m^2$$

Then use P_m=24.86 kN/m^2

Check Load on tie bar:

Tie bar used capacity=20kN

Load on Tie Bar = $P_m \times L_{(Stud)} \times L_{(Wale)}$

Load on Tie Bar = $24.86 \times 0.35 \times 1.5 = 13.05kN$

$13.05kN < 20kN$

$\therefore$ OK

Bearing of studs on wales:

$$\text{Contact Area}(C.A,) = b_{(Stud)} \times b_{(Wale)} = 0.05 \times (2 \times 0.05) = 0.005m^2$$

Load on contact Area = $W_{stud} \times L_{stud}$ = 17.4 × 0.35 = 6.09 kN

stress on contact area = $\frac{P}{C.A} = \frac{6.09}{0.005} = 1218 \ kN/m^2$

1218 kN/m^2 < 34001 kN/m^2

∴ OK

Solution:Q4 B

From eq. (5-4):

$$32.14 = \frac{W}{4560} = \frac{w\,Q\,h}{4560\,e} = \frac{1 \times X \times 48}{4560 \times 0.6} = 1832 L/\min$$

$$1832.2 = 2\ (1 - 0.04) \times \frac{\pi\ (150)^2\ (300)\ (n)}{4} \times 10^{-6}$$

n=180 rpm

Solution:Q5 A

No. batches per hr

15.37 m^3 ÷ 0.41 m^3 = 37.5 batches

The time per cycle :

60 ÷ 37.5= 1.6 min

The quantity of material per batch will be

7.32 × 0.41 = 3.0 bags OF Cement

Sand, 853 × 0.41 = 349.7 kg

Gravel, 1095 × 0.41 = 499.0 kg

Water, 193 × 041= 79.1 lt

(5) اجابات ادارة معدات وطرق انشاء

Solution:Q5 B

The total equivalent time lost for the six accidents will be:
$86-16+3600=3670$ days

$$\text{Injury-FrequencyRate}=\frac{\text{No.DisablingInjuries}\times 10^6}{\text{No.Man-Hr Worked}}$$

$$\text{Injury-FrequencyRate}=\frac{6\times 10^6}{200\times 40\times 50}=15$$

$$\text{Injury-SeverityRate}=\frac{\text{No.DaysLost}\times 1000}{\text{No.Man-Hr Worked}}$$

$$\text{Injury-SeverityRate}=\frac{3670\times 1000}{200\times 40\times 50}=9.175$$

$$\text{Injury-Index}=\frac{\text{FrequencyRate}\times\text{SeverityRate}}{1000}$$

$$\text{Injury-Index}=\frac{15\times 9.175}{1000}=0.138$$

(6) اجابات ادارة معدات وطرق انشاء

Solution:Q6A

Net moldboard capacity= $2.5 \div 1.25 = 2m^3$

Probable round-trip time:

Pushing, 45m, @ 3 km/hr, $\frac{\frac{45}{1000} \times 60}{3} = 0.9$ min

Returning, 45m, @ 6 km/hr, $\frac{\frac{45}{1000} \times 60}{6} = 0.45$ min

Fixed time, 0.4 min

Total time= 0.9+0.45+0.4= 1.75 min

Trip per hour, $50 \div 1.75 = 28.57$

Output per hour, $28.57 \times 2 = 57.14\ m^3/hr$

Solution:Q6B

$$Actual\ Output = \frac{54000}{(100)\times(8)} = 67.5\ m^3/hr$$

$$Actual\ Output = Ideal\ Output \times (D_{cut}\ \&\ A_{swing})_F \times (J\ \&\ M)_F \times (Time)_F$$

Assume that the optimum depth is equal to the actual depth

Then the % of optimum depth =100%, Angle of swing=90°

From table (8-3), $(D_{cut}\ \&\ A_{swing})_F = 1$

From table (8-4), $(J\ \&\ M)_F = 0.81$

Time factor $= \frac{50}{60}$

$$67.5 = Ideal\ Output \times 1 \times 0.81 \times \frac{50}{60}$$

$$Ideal\ Outpu = 100\ m^3/hr$$

Use (0.8 m^3) power shovel

From table (8-2), for (0.8m^3) power shovel and hard, tough clay earth

Ideal output= 111 m^3/hr, Optimum depth= 2.7 m

(7) اجابات ادارة معدات وطرق انشاء

$$\%\ of\ optimum\ cut = \frac{2.7}{2.7} \times 100 = 100\%$$

From table (8-3), for 100% of optimum height and 90° angle of swing:

$$\left(D_{cut}\ \&\ A_{swing}\right)_F = 1$$

From table (8-4), $\left(J\ \&\ M\right)_F = 0.81$, Time factor $= \frac{50}{60}$

$$Actual\ Output = Ideal\ Output \times \left(D_{cut}\ \&\ A_{swing}\right)_F \times \left(J\ \&\ M\right)_F \times \left(Time\right)_F$$

$$Actual\ Output = 111 \times 1 \times 0.81 \times \frac{50}{60} = 74.93\ m^3 / hr$$

$$74.93\ m^3 / hr > 67.5\ m^3 / hr \Rightarrow \therefore OK$$