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JUN 17 REC'D

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322
COLLEGE OF ENGINEERING

DEPARTMENT OF
CIVIL AND ENVIRONMENTAL
ENGINEERING

June 16, 1980

Mr. Glenwood Richardson
County Engineer
179 North Main St.
Logan, Utah 84321

Dear Mr. Richardson:

At the request of the Parson Ready Mix Company of Smithfield, Utah, I measured the unit weight of fill material from their plant. The test was made in accordance with ASTM C-29. The test results show that the uncompacted fill material has a unit weight of 106.4 lb/ft^3. This compares with about 100 lb/ft^3 for sand and about 108 lb/ft^3 for gravel.

The uncompacted fill weighs 1.44 tons per cubic yard. Mr. Jay Parson suggested I send you this letter for your information.

Sincerely yours,

William A. Cordon

William A. Cordon, Prof. Emeritus
Civil & Environmental Engineering

WAC:gf

cc: Jay Parson

RIBS = 3.92 CU.FT

FILLETS = 9.38 CU.FT.

FRONT BOX = 4.88 CU FT

343.88

1' - = 3.56

3' - = 3.88

5' - = 2.78

7' = 2.59

9' = 2.28

11½ = 2.81

14' = 4.31

① 1' = 47.5" - 3.56" = 43.94" = 3.66'

② 3' = 46.5" - 3.88 = 42.62" = 3.55'

③ 5' = 45.5" - 2.78 = 42.72" = 3.56'

④ 7' = 44.5" - 2.59 = 41.91" = 3.49'

⑤ 9' = 43.5" - 2.28 = 41.22" = 3.44'

⑥ 11.5' = 42.25" - 2.81 = 39.44" = 3.29'

⑦ 14' = 41.00" - 4.31 = 36.69 = 3.06'

AREA. #1 $3.66' \times 1^{\circ} \times 7.25 = 26.54$

#2 $\frac{3.66 + 3.55}{2} \times 2 \times 7.25 = 52.27$

#3 $\frac{3.55 + 3.56}{2} \times 2 \times 7.25 = 51.55$

#4 $\frac{3.56 + 3.49}{2} \times 2 \times 7.25 = 51.11$

#5 $\frac{3.49 + 3.44}{2} \times 2 \times 7.25 = 50.24$

#6 $\frac{3.44 + 3.29}{2} \times 2.5 \times 7.25 = 60.99$

7' $\frac{3.29 + 3.06}{2} \times 2.5 \times 7.25 = 57.55$

350.25

BACK OF GATE 11.81

362.06

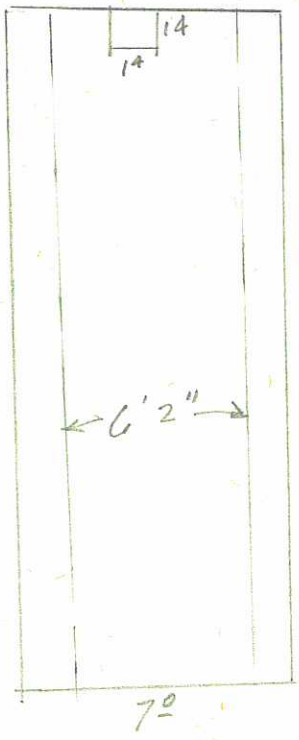
$\frac{43380.00}{343.88} = 126.15$ CU.FT.

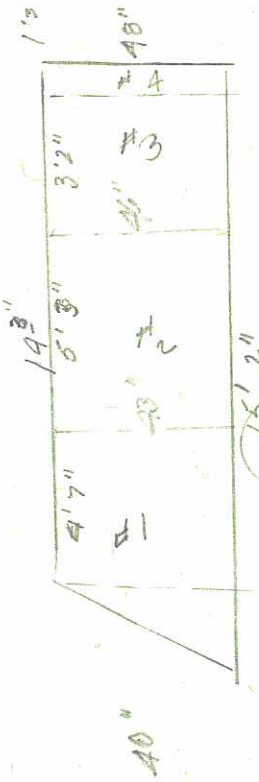
126.05

126.10

8/12. 99 ÷ 3403.37

10.4



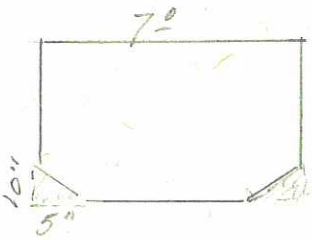


$\frac{48" - (11\frac{1}{4}+10) + 8\frac{1}{2} + 8 + 8\frac{1}{2}}{4} = 8.91$

$\frac{46" - (9\frac{3}{4}+8\frac{1}{2}) + 9\frac{3}{4} + 8\frac{1}{2} + 8 + 8\frac{1}{2}}{4} = 8.47$

$\frac{43 - 9\frac{3}{4} + 8\frac{1}{2} + 9\frac{3}{4} + 8\frac{1}{2} + 8\frac{1}{2}}{4} = 8.97$

$\frac{40 - 10 + 9\frac{1}{4} + 10\frac{1}{4} + 9.5 + 10}{2} = 9.84$



Aver Depth = 48 - 8.91 = 39.09" = 3.25'

46 - 8.47 = 37.53 = 3.04'

43 - 8.97 = 34.03 = 2.84'

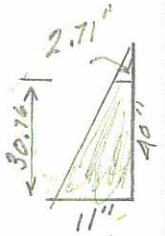
40 - 9.84 = 30.16 = 2.51'

35.34

Deduct for fillet: $2\left(\frac{15'2" \times 10" \times 5"}{2}\right) = 5.26$ Cu. ft. Minus

$\frac{}{1728}$

11 front box $\frac{14 \times 14 \times 39.09}{1728} = 4.43$ Cu ft Minus



Vol. of back = $\frac{\frac{11 + 2.71}{2} \times 30.16}{144} \times 7 = 10.05$ Cu. ft.

#1 $\left(\frac{2.51 + 2.84}{2}\right) 4.58 \times 7 = 85.75$ C.F.

#2 $\left(\frac{2.84 + 3.24}{2}\right) 5.25 \times 7 = 108.96$ ~~109.70~~

#3 $\left(\frac{3.24 + 3.25}{2}\right) 3.17 \times 7 = 70.34$ ~~70.79~~

#4 $3.25 \times 1.25 \times 7 = 28.44$

~~295.04~~ 295.50 + 10.5

$\frac{37190}{283.50} = 131.27$ C.F.

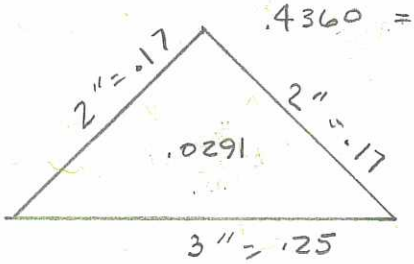
126.05 + 5.22 = 131.27

3529.46 + 474.28 = 4003.74 Cu. Yds.

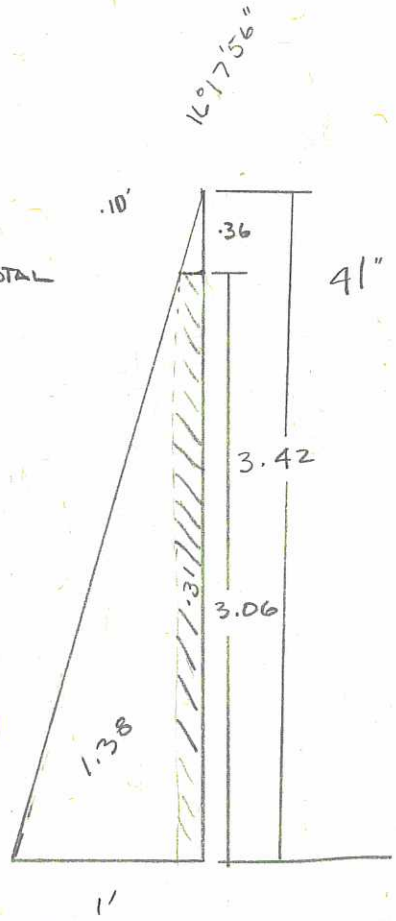
4003.37

132.8L

3586.15
3403.37 344.76



.4360 = 3.92 TOTAL



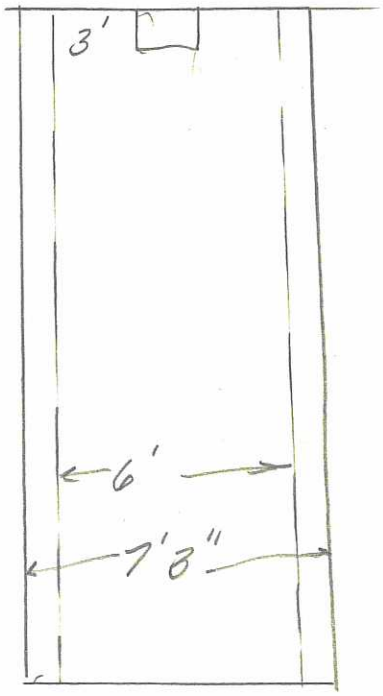
AREA = $S = \frac{a+b+c}{2}$ $\sqrt{(s-a)(s-b)(s-c)s}$

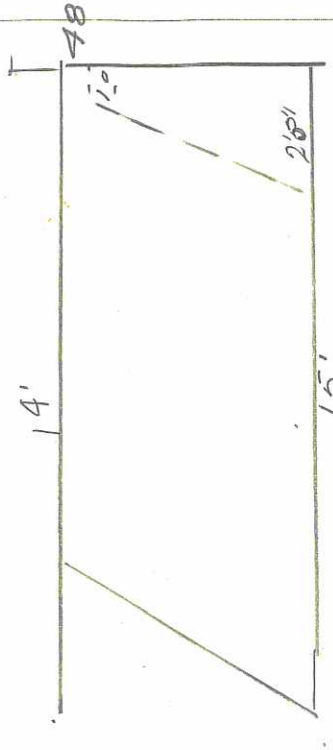
$S = .30$

$$\sqrt{.30(.30-.17)(.30-.17)(.30-.125)}$$

$$\frac{.0291}{.13 \quad .13 \quad .05}$$

11.81 CUFT

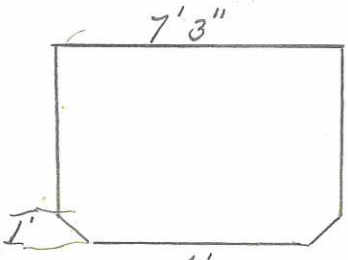




Ribs
2x2x3 - 5" apart
△ - 9 total

Aver Depth

	Front					Aver
1'	1-4	$3\frac{3}{4}$	$2\frac{3}{4}$	$8\frac{1}{4}$	6"	3.56" ✓
3'	3	$3\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{4}$	$4\frac{3}{4}$ $4\frac{1}{2}$	3.88 ✓
5		$2\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$8\frac{1}{4}$	3.50 (2.78)
7		$2\frac{1}{2}$	$2\frac{1}{4}$	2	$2\frac{3}{4}$ $4\frac{1}{4}$	3.44 (2.59)
9		$2\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2}$	2 $3\frac{3}{4}$	2.28 ✓
$11\frac{1}{2}$		$3\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{2}$ $4\frac{1}{2}$	2.81 ✓



Aver. Depth =

1' = 41" - 3.56" = 37.44" = 3.12'

3 = 41 - 3.88 = 37.12 = 3.09'

5 = 41 - ~~3.50~~ 2.78 = ~~37.50~~ 3 = 3.13'

7 = 41 - 3.44 = 37.56 = 3.13

$11\frac{1}{2}$ = 41 - 2.81 = 38.19 = 3.18 ($4\frac{1}{2}$)

Area #1 - 3.12 x 1⁰ x 7.25 = 22.62 Cu.Ft.

#2 - $\frac{3.12+3.09}{2}$ x 2 x 7.25 = 45.02

#3 - $\frac{3.09+3.13}{2}$ x 2 x 7.25 = 45.10

#4 - $\frac{3.13+3.13}{2}$ x 2 x 7.25 = 45.39

#5 - $\frac{3.13+3.18}{2}$ x 4½ x 7.25 = 102.93

#6 - 3.18 x 2.5 x 7.25 = 57.64 Cu. Ft.

#7 - $\frac{10+07}{2}$ x 3.18 x 7.25 = 12.33 Cu. Ft.

Tot 331.03

Deductions

Ribs - $9 \times \frac{1}{2} \frac{(3 \times 2.5)}{144} \times 15$ = 3.52 ✓ Cu.Ft.

Fillets - $2 \times \frac{1}{2} \frac{(12 \times 7.5)}{144} \times 15$ = 9.48

Front Box = $\frac{2.25+1}{2} \times 3 \times 1$ = 4.88 ✓

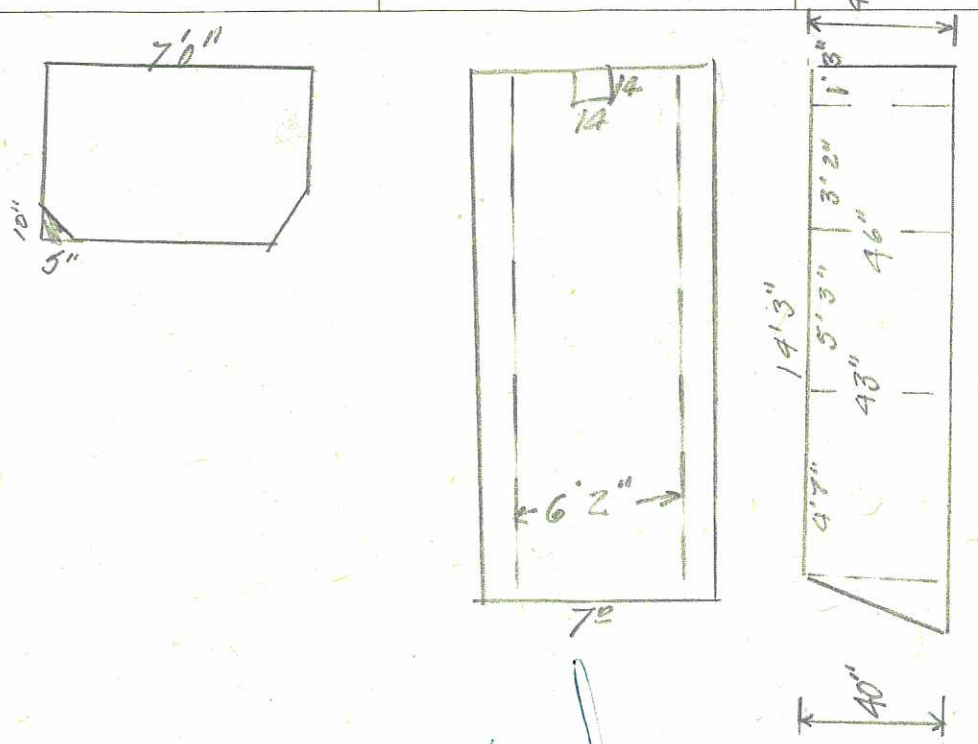
- 17.88

+ 331.03

313.15 CF

$\frac{43380\#}{313.15}$ = 138.53

37190



48" = 11" = 37" = 3.08'

40" = 10.4 = 35.6 = 2.97'

43" = 9.8 = 33.2 = 2.77'

40 = 10.7 = 29.3 = 2.44'

51250
22700
28550

Too Sandy

#1 $\frac{2.44+2.77}{2}$ 4.58 x 7 = 83.62

#2 $\frac{2.77+2.97}{2}$ 5.25 x 7 = 105.47

#3 $\frac{2.97+3.08}{2}$ 3.17 x 7 = 67.12

#4 3.25 x 1.25 x 7 = 28.44

284.81

100.29 #/sq. ft.

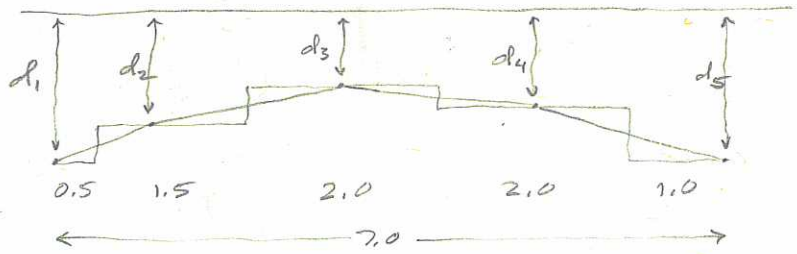
SOLUTION

① SOLVE USING "MEAN END AREA" PROCEDURE WITH THE FOUR CROSS SECTIONS.

a) ASSUME FRONT AND REAR CROSS-SECTIONS EXTEND AS IS TO INTERSECTION WITH HEAD BOARD AND TAILGATE, RESPECTIVELY

b) FIGURE LOSSES DUE TO FLOOR FILLETS AND THE EXTRA AREA DUE TO THE SLANTED TAILGATE LATER

② FIRURE AVE DEPTH AT EACH CROSS SECTION AS FOLLOWS:

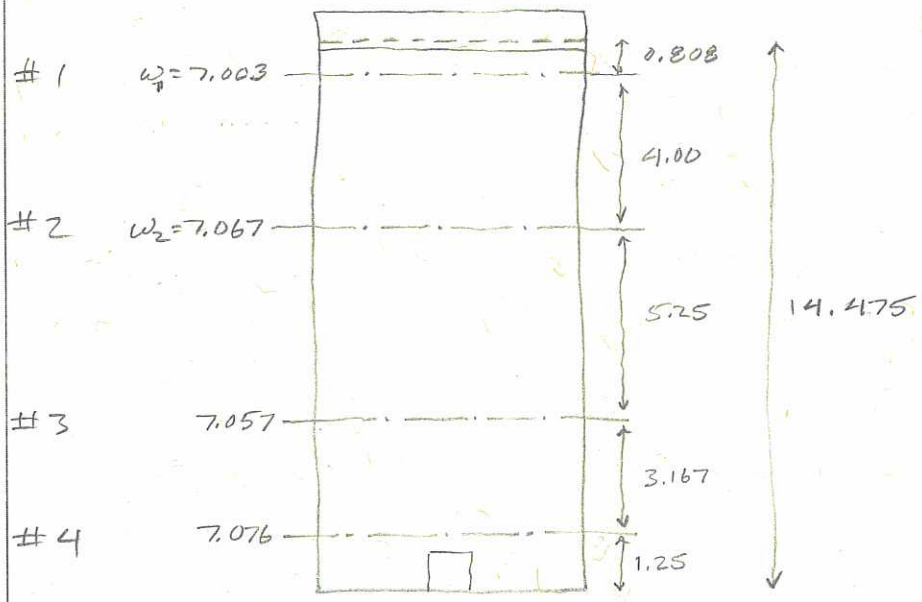


$$d_{ave} = \frac{(0.5d_1 + 1.5d_2 + 2.0d_3 + 2.0d_4 + 1.0d_5)}{7.0}$$

THE SIDES OF THE BED ARE NOT EXACTLY PARALLEL; THERE IS A 1" INCREASE IN WIDTH FROM FRONT TO BACK. THIS HAS LITTLE EFFECT ON THE AVE DEPTH. IT IS INCLUDED IN THE WIDTH WHEN COMPUTING EACH CROSS SECTION AREA.

CROSS SECTION #1 (BACK)	40" − 9.804"	= 30.196"
#2	43 − 8.857	= 34.143
#3	46 − 8.518	= 37.482
#4 (FRONT)	48 − 8.750	= 39.250

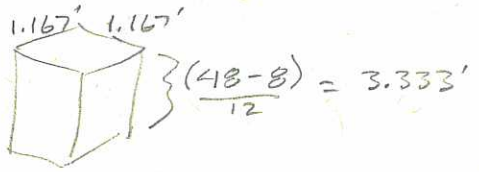
③ FIGURE EACH CROSS SECTIONAL AREA AND THE ENCLOSED VOLUMES:



$A_1 = 7.003\,(30.196)\,1/2 = 17.622\ ft^2$
$A_2 = 7.067\,(34.143)\,1/2 = 20.107$
$A_3 = 7.057\,(37.482)\,1/2 = 22.043$
$A_4 = 7.076\,(39.250)\,1/2 = 23.144$

$V_1 = 17.622\,(0.808) = 14.239\ ft^3$
$V_2 = (17.622 + 20.107)\,1/2\,(4) = 75.458$
$V_3 = (20.107 + 22.043)\,1/2\,(5.25) = 110.644$
$V_4 = (23.144 + 22.043)\,1/2\,(3.167) = 71.554$
$V_5 = 23.144\,(1.25) = 28.930$
$\Sigma = 300.824\ ft^3$ + 300.824

④ LESS VOL OF HEAD BOARD COLUMN:



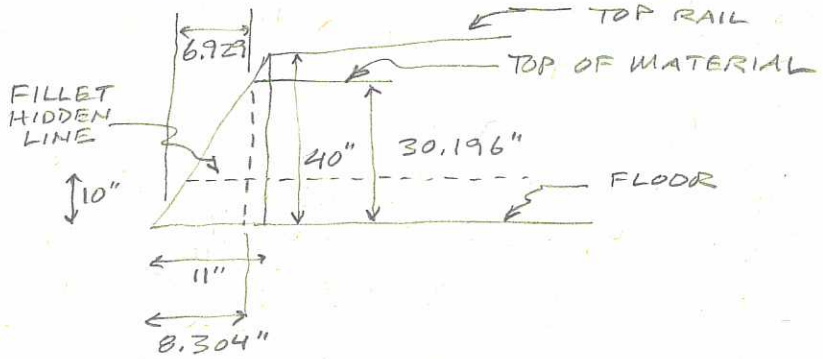
$V = 1.167^2\,(3.333) = 4.540$ − 4.540

⑤ LESS VOL OF FILETS:

OR, 0.347 ft^3 / LINEAR FOOT

$V = 0.347\,(14.475) = 5.023$ − 5.023

⑥ ADDING VOL OF TAILGATE AREA:



ⓐ VOL OF TAILGATE AREA =

$$\frac{(8.304)(30.196)}{144}\left(\frac{1}{2}\right)(7.000) = 6.095\ ft^3 \qquad +6.095$$

ⓑ COMPUTE FILLET VOL. BASED ON AVE LENGTH OF FILLET AS SHOWN:

$$\frac{6.929}{12}(0.347) = 0.200 \qquad -0.200$$

⑦ TOTAL VOLUME $297.156\ ft^3$ 297.156

⑧ DENSITY:

$$\frac{37190\ \#}{297.156\ ft^3} = 125.2\ \#/ft^3$$

$$= 3,379\ \#/yd^3$$