

CIVL 3137
Homework 3

1. Below are the gradations of a #78 crushed stone and some #10 limestone screenings:

Sieve Opening	Percent Passing	
	#78 Stone	#10 Screenings
25.0 mm (1")	100.0	100.0
19.0 mm (3/4")	100.0	100.0
12.5 mm (1/2")	93.0	100.0
9.50 mm (3/8")	63.0	100.0
4.75 mm (No. 4)	14.0	90.0
2.36 mm (No. 8)	4.0	57.5
0.600 mm (No. 30)	3.0	26.0
0.300 mm (No. 50)	2.2	15.5
0.150 mm (No. 100)	1.8	9.6
0.075 mm (No. 200)	1.4	6.1

You need to blend these two aggregates together to meet the TDOT 411E specification below:

Sieve Opening	Percent Passing
19.0 mm (3/4")	100
12.5 mm (1/2")	95-100
9.50 mm (3/8")	80-93
4.75 mm (No. 4)	54-76
2.36 mm (No. 8)	35-57
0.600 mm (No. 30)	17-29
0.300 mm (No. 50)	10-18
0.150 mm (No. 100)	3-10
0.075 mm (No. 200)	0-8

To get in the ballpark, aim for 46% passing the No. 8 sieve (the middle of the gradation band). Plot the resulting gradation curve PLUS the upper and lower bounds of the 411E specification on a standard gradation chart downloaded from the course website.

2. You've blended together 45 lb of crushed stone and 75 lb of natural sand in a wheelbarrow. The stone has a bulk relative density of 2.567 and the sand has a bulk relative density of 2.666. When you place as much of the blended aggregate as possible in a 0.5-ft³ bucket, the total weight of aggregate is 52.3 lb. What is the unit weight of the blended aggregate (in lb/ft³) and what is its void content (in % by volume)?
3. The table below shows axle count data obtained from a weigh station during a two-day period in June. A total of 12,197 trucks passed through the weigh station. Each entry in the table shows the number of axles falling within a given 4000-lb axle load interval.

Convert the axle counts into equivalent numbers of 18-kip single-axle loads (ESALs) and determine the total number of ESALs passing through the weigh station during that two-day period. For convenience, you can represent each axle load class by the load at its midpoint (e.g., 10,000 lb for the 8000–11,999 lb class). If you do the calculations in a spreadsheet, please calculate at least one single axle load class and one tandem axle load class by hand and include it in your homework solution.

Single Axles		Tandem Axles	
Axle Load (lb)	Count	Axle Load (lb)	Count
4000–7999	6031	8000–11999	2631
8000–11999	9942	12000–15999	2541
12000–15999	3111	16000–19999	2362
16000–19999	3400	20000–23999	3103
20000–23999	742	24000–27999	1046
24000–27999	12	28000–31999	790
		32000–35999	891

4. The data below were obtained during a CBR test. Plot the data in Excel and determine the CBR for this soil. Report your results to the nearest integer.

Penetration (in)	0.05	0.1	0.15	0.2	0.3	0.4	0.5
Piston Load (lb)	49	158	299	455	760	1025	1162

5. The data below were obtained during a plate load test. The plate had a diameter of 30 in. Plot the data in Excel and determine the k-value for this soil. Report your results to the nearest 10 psi/in.

Deflection (in)	0.04	0.08	0.10	0.13	0.17	0.19	0.23	0.26	0.32	0.39
Plate Load (lb)	1200	2900	3900	5000	6700	7700	9100	10200	11400	13300