

CEEN 3320 - Behavior & Properties of Engineering Materials

Laboratory Experiment No. 2 - Statistical Analysis

OBJECTIVES: To utilize statistical principles as applied to acceptance testing to develop confidence intervals for a population mean and to develop and execute a sampling and testing plan for determining the average compressive strength of in-place PCC slabs.

EQUIPMENT: Schmidt hammer, colored die

TEXT REF: Chapter 1, Appendix Experiment 18, Statistics Review Handout

PROCEDURES:

Part A – Confidence Intervals

Figure 1 provides a population of 216 strength measures, separated into 6 tables of 36 values each. Each table is represented by a unique value for die color 1. Each cell of every table is represented by a unique combination of die colors 2 and 3 values ranging from 1 to 6. By rolling the three colored die, you will be able to randomly select a value from these tables which can be considered as a random test result for the population of 216 values. For example, a roll of: Color 1 = 4, Color 2 = 3, and Color 3 = 5 would yield a random test strength of 4271.

For this portion of the lab, you will be developing confidence intervals for the population mean based on sample sizes of 1 and 5, assuming the population has a known standard deviation of 400. Select 3 colored die and assign a number to each color. Roll the colored die 5 times and record the value of each dice into Table 1. Based on the die values, select the appropriate test strength value from Figure 1 and enter this value into Table 1. Using the result for Roll 1, compute the 90% confidence interval for the population mean ($n=1$). Using the results for all 5 Rolls, compute the 90% confidence interval on the mean ($n=5$).

Part B - Sampling & Testing Plan

A rehabilitation project is being planned for the Portland cement concrete (PCC) pavement slabs immediately beneath the Olin Engineering Center. Currently, the area is paved with 5 ft x 5 ft PCC slabs in a grid pattern of 8 slab rows (E-W) by 26 slab columns (N-S), as shown in Figure 2. Excluding the areas paved with bricks, there are a total of 200 PCC slabs. As part of this rehabilitation project, there is a need to determine the average compressive strength of the PCC slabs to a 95% confidence level with a maximum allowable error of 250 psi. The compressive strength of the in-place concrete slabs will be estimated based on Schmidt hammer readings. Previous repeated testing indicates a standard deviation of 500 psi for individual concrete strength measures.

Given this information, develop and execute a sampling and testing plan to determine the average in-place PCC compressive strength to the desired level of confidence. For each selected test slab, obtain three readings near the central portion of the slab using a triangular spacing of approximately 12 inches between tests. Enter the average of the three readings into Table 2 as the compressive strength for the test slab.

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 Laboratory 2 - Part A - Figure 1

Color 1 = 1		Color 2					
		1	2	3	4	5	6
Color 3	1	4801	5287	5794	4763	5321	4976
	2	4804	4334	5579	4887	4515	4926
	3	4506	4496	4785	4536	4617	4779
	4	4789	4134	5181	5658	4542	4807
	5	4550	4267	5313	4806	5525	5006
	6	4980	4312	5250	5376	4291	5106

Color 1 = 4		Color 2					
		1	2	3	4	5	6
Color 3	1	4726	3877	4673	5510	4432	5012
	2	4238	4322	4298	4678	5317	4021
	3	4814	4363	4210	4829	5060	4668
	4	5268	4721	4759	4844	5333	5460
	5	5179	5312	4271	4081	3838	5358
	6	4485	5184	4331	5183	4742	3842

Color 1 = 2		Color 2					
		1	2	3	4	5	6
Color 3	1	4467	5381	5324	4964	4538	5189
	2	4689	4503	4648	4935	5578	4017
	3	4637	4831	4606	4392	4002	4426
	4	4640	4938	5081	4856	5182	4158
	5	5167	4807	4989	4982	4864	4645
	6	4999	4466	4370	5235	4906	5123

Color 1 = 5		Color 2					
		1	2	3	4	5	6
Color 3	1	5702	5137	4370	4489	4469	4979
	2	4158	5172	4898	4730	4758	5049
	3	5279	4425	4862	5886	4954	4403
	4	5021	4389	5033	4704	5417	5466
	5	4872	4564	4028	5212	5261	5176
	6	4907	4718	4459	5584	4569	4798

Color 1 = 3		Color 2					
		1	2	3	4	5	6
Color 3	1	4813	4288	4656	4559	5062	4403
	2	4658	4340	5393	4041	4635	4882
	3	4936	4735	4831	5003	4548	5124
	4	4407	3807	5001	4730	5535	4859
	5	5089	4415	5339	4744	4628	4606
	6	4528	4414	5519	4826	4883	5156

Color 1 = 6		Color 2					
		1	2	3	4	5	6
Color 3	1	5298	5743	5044	5021	4657	4655
	2	4503	4992	5070	4404	4799	5000
	3	4582	5122	4086	4950	4339	5134
	4	4736	4378	5041	5324	4814	4990
	5	3763	4438	4745	4443	4651	4350
	6	4993	4610	4696	4659	4799	5185

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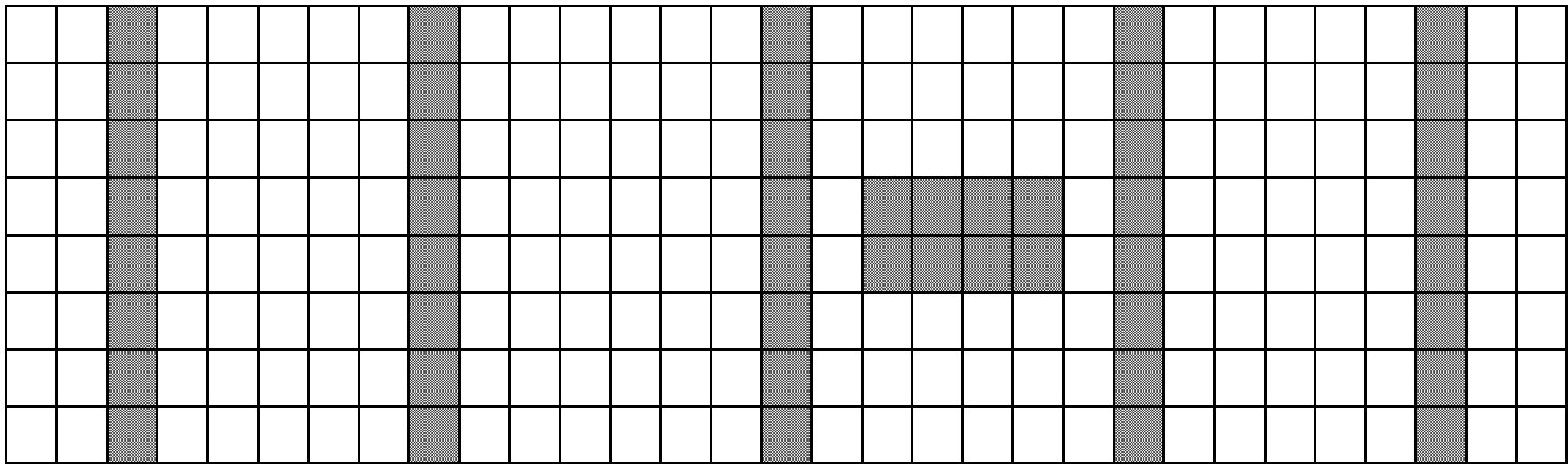


Figure 2: PCC Slab Grid Under Olin Engineering Building

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Part A - Table 1

Reading	Color 1 Dice	Color 2 Dice	Color 3 Dice	Strength*
Example	4	3	5	4271
Colors	1 =	2 =	3 =	
Roll 1				
Roll 2				
Roll 3				
Roll 4				
Roll 5				

* Strength values obtained from Figure 1

Part B - Table 2

Reading	Slab Row (E-W)	Slab Column (N-S)	Strength, psi
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
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