HIGHWAY SAFETY AND PROJECT EVALUATION

Dear Consultant:

Traffic safety can be an emotional issue. Identifying hazardous locations and deciding where to apply limited funds must withstand the scrutiny of concerned citizens. In this HW, you will be asked to implement certain elements of the Highway Safety Improvement Program framework (CNotes Figure 6.4). Please complete the exercises below completely and clearly. You may work in a group of CE361 students not to exceed <u>two</u> in size. The <u>signatures</u> of both students must appear on the <u>top</u> page. Remember to label each problem with its "name".

1. **Identify hazardous locations.** (10 points) The City of Mythaca has created a class of intersections called "Class B urban signalized intersections". Eight signalized intersections with "Class B" characteristics had RMEV crash rates 2.1, 9.1, 4.8, 7.3, 2.1, 7.2, 8.3, and 6.9. From these data, determine the Critical Rate to be used to identify hazardous Class B intersections. Use the 95 percent confidence level.

2. **Crashes prevented.** (15 points) A 1-mile section of road has a current ADT of 6614 and a RHMVM crash rate of 68.2. If a countermeasure with a Crash Reduction Factor of 15.6 percent is applied and ADT is expected to be 9330 ten years from now, how many crashes will have been prevented? Assume the ADT will grow at a constant (compounded) rate over the ten years.

3. **Life-cycle analysis.** The County Highway Department has two options for improving the surface of CR550E. Option A is to resurface the road now at a cost of $70,080 per mile, spend $679 per mile per year to seal cracks, then – at Year 25 – begin a new resurface/seal cycle. This strategy will reduce user costs by $5.07 per mile per year for each of the road's 5098 average daily users. Option B is to reconstruct the road for $218,200 per mile now, do routine maintenance at $170 per mile per year for 19 years, then begin a new reconstruct/routine maintenance cycle at Year 20. The reduced user costs will be $7.87 per year per driver.
    A. (10 points) Draw a **cash flow diagram** for each of the options. Treat "reduced user costs" as benefits. Explain the system you used to display and distinguish costs from benefits.
    B. (10 points) Applying the appropriate methods from CNotes Section 5.2 and a discount rate of 5.1 percent, **calculate the Benefits and Costs** for each option, so that the County personnel can choose the better option. Show your work clearly.

4. **Measures of effectiveness.** The County has been offered a federal grant to develop a system of bike trails. The trail system's objectives would be to (a) encourage commuters to ride a bicycle to work or school whenever the weather permits, (b) maximize recreational use by families, and (c) connect existing county parks and recreational facilities. Several system designs have been proposed, none of which achieves all the objectives without exceeding the funding available. You are asked to provide an objective basis for deciding which design to choose.

   A. (15 points) **List 3 MOEs** that you would recommend be used by the county, and justify them.

   B. (5 points) **Suggest weights** to be applied to the MOEs you recommended in Part A, such that the sum of the weights equals 100. Explain briefly.

5. **Ranking alternatives.** Mythaca Airport is becoming an increasingly important part of the regional air transportation system. Several major airlines are interested in offering service to Mythaca, but Mythacans are fussy. They want only the best airlines to be considered. A local consumer protection group has acquired performance data on ten major airlines. Note that a high value for "Percent of on-time flights" is good, but a high value for "Complaints per 100,000 passengers" and "Mishandled baggage per 100,000 passengers" is not. The consumer group hires you to rank the airlines, using the following weights: 0.40 for "Percent of on-time flights"; 0.30 for "Complaints"; 0.30 for "Mishandled luggage".

Percent of on-time flights		Complaints (per 100,000 passengers)		Mishandled baggage (per 100,000 passengers)	
1. TWA	87.9	1. Southwest	0.10	1. America West	3.44
2. Delta	86.5	2. US Airways	0.68	2. US Airways	3.58
3. Northwest	85.9	3. Alaska	0.69	3. TWA	3.58
4. Continental	84.1	4. Delta	0.78	4. Delta	3.72
5. US Airways	83.2	5. United	1.24	5. Continental	4.01
6. Southwest	81.5	6. TWA	1.33	6. Southwest	4.05
7. American	77.4	7. Northwest	1.35	7. American	4.32
8. United	76.9	8. American	1.47	8. Northwest	4.56
9. Alaska	76.5	9. Continental	1.59	9. Alaska	5.54
10. America West	69.4	10. America West	2.50	10. United	6.46
Average	81.7	Average	1.07	Average	4.39

   A. (15 points) Use the **Range Index method** to rank the ten airlines. Explain how you must modify the data for use in this ranking procedure, then use a spreadsheet to implement your modifications.

   B. (15 points) Use the **Percentile method** to rank the ten airlines. Explain how you must modify the data for use in this ranking procedure, then use a spreadsheet to implement your modifications. Note: Excel has a "PERCENTRANK" feature.

C. (5 points) Which **three airlines** (in order of performance) would you recommend Mythaca Airport to invite? Explain your recommendation.