

CEE 404 Final Examination (2 hours)

- Please write your name on this cover.
- Please write your last name on all other exam pages

- This examination is open-book, open-note.
- There are 6 questions worth a total of 100 points.
- Each question lists the point value for that question.

- Please work quietly and respect other people's space.
- Carefully read each question and ensure that you answer what is asked.
- If you need additional workspace, use the back of the page or the "work space" page provided after some of the problems.

Name (first, last): _____

Question 1: Short Answers (25 points total)

(2 points) In Larry Kyle's SR 520 Bridge Replacement and HOV Program Overview presentation, he mentioned that only one portion of this project is currently funded. Which portion is it? (circle one)

1. West end raised viaduct (I-5 to the floating bridge)
2. Floating bridge across Lake Washington
3. East end highway improvements (floating bridge to Redmond)


(2 points) In Larry Kyle's SR 520 Bridge Replacement and HOV Program Overview presentation, he mentioned that one portion of this project has the most consensus amongst stakeholders. In other words, there is one portion that, at this point, has general public agreement on design. Which portion is it? (circle one)

1. West end raised viaduct (I-5 to the floating bridge)
2. Floating bridge across Lake Washington
3. East end highway improvements (floating bridge to Redmond)

(6 points) In Matt Preedy's Alaskan Way Viaduct & Seawall Replacement Program presentation he mentioned the tunnel is planned for 2 lanes in each direction. If the current Alaskan Way Viaduct is 3 lanes in each direction, why does Matt not foresee a drop in North-South traffic capacity in this corridor? Provide two reasons.

(3 points) In the Flyvbjerg, Holm and Buhl paper, *Underestimating Costs in Public Works Projects: Error or Lie?*, what evidence do the authors cite for their conclusion that "the cost estimates used in public debates, media coverage, and decision making for transportation infrastructure development are highly, systematically, and significantly deceptive"? (they list several, I am only asking for one)

(4 points) A PCC slab is poured in Kennewick, WA at 8 p.m. and sets at 10:00 p.m. when the air temperature is 65°F and the ground temperature underneath the slab is 75°F. Three years later you go back to measure slab curling. At 10 a.m. the air temperature above the slab and the base temperature under the slab are equal; both are 70°F. Which way would you expect the slab to be curling? (Circle one)


Curling up on the edges


Flat


Curling down on the edges

(2 points) According to a number of the CA4PRS-related readings, which of the following has the biggest impact on a contractor's production rate? (circle one)

Concrete cure time

Paver speed and number of pavers

Materials hauling and loading/unloading constraints

(6 points) List 3 benefits associated with full road closures for construction

Extra Credit (1 point each)

1. What was the name of the construction worker in the Village People band?
2. What iconic infrastructure landmark was instrumental in the movie Transformers? (the first movie, not the sequel)
3. What famous singer wrote and recorded the song "Working on the Highway"?

Question 2 (10 points)

The picture below shows your resource use for a CA4PRS PCCP Rehabilitation Deterministic run. Additional information:

- 1 demolition team
- Demolition truck cycle time: 20 minutes
- Concrete delivery truck cycle time: 75 minutes

What are the minimum number of demolition trucks and concrete delivery trucks you would need to hire to meet the requirements pictured below?

Resource	Allocated	Utilized
Demolition Hauling Truck (per hour per team)	10.0	10.0
Base Delivery Truck (per hour)	12.0	12.0
Batch Plant (cu-yd/hour)	150.0	53.3
Concrete Delivery Truck (per hour)	8.0	5.3
Paver Speed (ft/min)	2.0	2.0

Question 3 (10 points)

In order to remove and replace 1 mile of pavement in the carpool lane of I-5 near Edmonds, the WSDOT traffic office proposes only closing the lane that is being repaired. From a constructability standpoint, would you recommend this closure scenario? (Hint: the answer is “no”). Based on your class experience, recommend the number of lanes to close and describe why you need that many lanes for constructability.



Question 4 (15 points)

The following page shows CA4PRS windows captured from a “full depth ACP rehabilitation” analysis. These pictures are: (1) the construction window settings, (2) the output from a probabilistic “comparison” run, and (3) the “production distribution chart” for the continuous closure/continuous operations option. Other relevant information:

- There are exactly 6.00 lane-miles to be paved.
- The pavement is 9 inches of HMA with no base material.
- This is for a “full closure” scenario (one direction of the highway is fully shut down to do the paving).

Answer the following questions:

1. (3 points) On average, how many 55-hour weekend closures will it take to complete this work? Please report in a whole number of weekends (not fractions).
2. (5 points) Report the 87% confidence interval for the 55-hour weekend closure option in terms of the whole number of WEEKENDS (not lane-miles as is reported). Please report these in whole numbers of weekends (not fractions).
3. (3 points) Why does the nighttime closure have a 0.00 in the “closure production” column and “N/A” in the other columns?
4. (4 points) Looking at the 87% confidence interval for the continuous closure/continuous operations scenario, you are clearly not guaranteed to get the job done in 1 week. Are the chances of getting done within one week (7 days of 24 hour operation) greater than 50% or less than 50%?

Construction Window Settings

Weekend Closure

Start Time on Friday: 10:00 PM

End Time on Monday: 05:00 AM

Available Hours: 55.0

Nighttime Closure

Start Time on First Day: 08:00 PM

End Time on Next Day: 06:00 AM

Available Hours per Day: 10.0

Continuous Closure/Continuous Operation

Start Time on First Day: 12:00 AM

No. of Continuous Work Days: 7.0

Available Hours per Day: 24.0

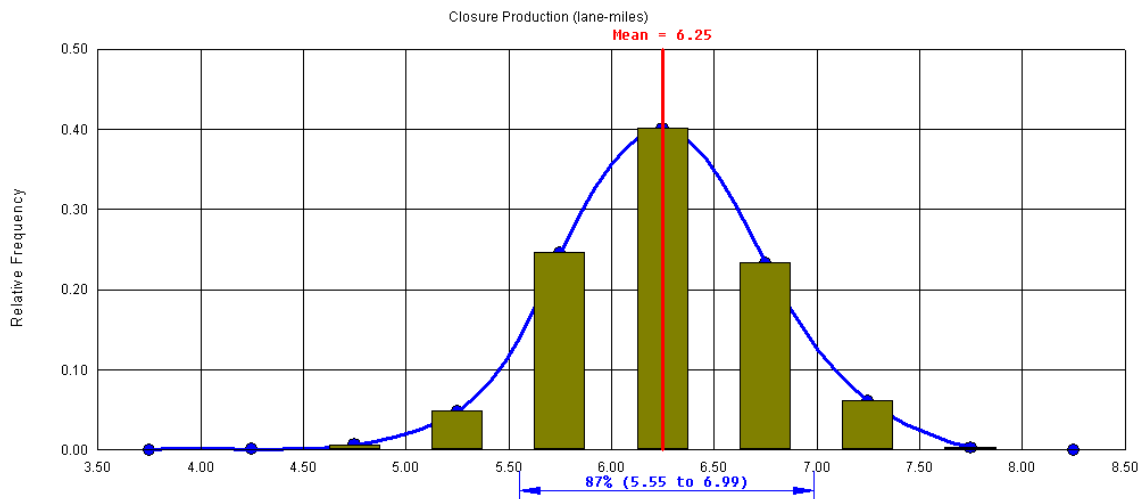
Continuous Closure/Shift Operation

Daily Start Time: 08:00 AM

No. of Continuous Work Days: 6.0

Available Hours per Day: 10.0

Construction Window	Closure Production (lane-miles)	Construction Windows	Standard Deviation	Confidence Interval (87%)
Weekend Closure	1.91	3.14	0.15	(1.69, 2.14)
Nighttime Closure	0.00	N/A	N/A	N/A
Continuous Closure/Continuous	6.25	0.96	0.48	(5.55, 6.99)



Question 5 (20 points)

You are the construction expert at a public hearing to discuss the pavement surface selection for the new SR 520 Bridge. There are two options being considered (listed below). The public likes the OGFC option since it results in less tire-pavement noise and a quieter surface (at least for the first 2 years the surface life each time it is placed).

Surface Course Option	Open-graded friction course (OGFC)	Dense-graded HMA
Cost of initial const:	\$1.6 million	\$2 million
Cost of each mill-and-fill	\$1.2 million	\$1.2 million
Life until mill-and-fill overlay needed:	8 years	16 years
Noise quieting life:	Lasts 2 years then it's as loud as the dense-graded pavement	N/A

There are 3 options being considered:

1. Use OGFC and repave every 2 years.
2. Use OGFC and repave every 8 years
3. Use dense-graded HMA and repave every 16 years.

Knowing what you know about life-cycle cost analysis (LCCA), provide your best advice on which option to choose and why. In your discussion address the following 3 things:

1. (10 points) What costs should be considered when comparing the 3 options?
2. (5 points) How should you value the noise reduction effects of the OGFC?
3. (5 points) What option do you advise the project choose and why?

Question 6 (working space)