LEAFS Civil Spring 2021

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Ice Breaker

Why would an engineer be needed in the traffic sector?



Imagine a group of people trying to make music together without a conductor.

- 1 person stays on a steady beat, normal volume
- 1 person makes a beep that is off beat, loudly
- I person sings but their volume changes from silent to loud
- 1 person whispers 911 every so often
- What would this situation be like?

Imagine a group of people trying to make music together without a conductor.

Just like a musical group needs its conductor to organize the song, highways and intersections need to be designed carefully by civil engineers.

What Is Traffic Engineering?

Traffic Engineering

- Traffic engineers/transportation planners design and plan road systems
- They ensure the roads are safe and efficient
- They work with:





What Do Traffic Engineers Do?

- Traffic counting surveys
- Determining proper signs and pavement markings
- Investigating transport-related accidents to improve safety
- Analyzing effects of nearby/roadside construction

Adventures of a Traffic Engineer





Congratulations!

You were hired as a civil engineer by the city of Oz! You will be specializing in traffic engineering. Your first task is to drive around the city and make sure everything is up to code.



Safety Edge

You start your drive on a newly paved road.

As the car ahead of you begins to turn, you notice that it drifts to the side and may soon take a steep drop off of the roadway!

Using your quick thinking, you realize a safety edge needs to be put in.

What is a Safety Edge?

A **safety edge** is a design strategy that shapes the edge of the road to prevent drivers from dangerously falling off the roadway.



Safety Edge

What should the angle of the safety edge be?

Click an option to continue.



Safety Edge - Up 30°





Not quite!

An upward angle raises the highway edge and actually *increases* the danger of the car running off the edge. This is the opposite of what we want!

Safety Edge - 90°





Not quite!

When drivers steer off the road, a vertical drop-off can make it difficult for the driver to re-enter the lane. This can lead to the driver losing control and crashing the vehicle.

Safety Edge - Down 30°

30° down

Road

Curb

Click here to continue.



Correct!

The safety edge should be sloped down 30°.

This number was the research tested value to be the best at providing a durable and gradual transition for vehicles, especially when they turn to get back onto the road safely.

Freeway Lanes

You hop on the freeway at a safe 65mph, but soon the surrounding land area narrows down from 4 to 2 lanes.



How was this decided?

Solving Freeway Lanes

You are given a value of **1700 vehicles per hour per lane (vphpl)** as a basis for 2 lanes. If **3,233** vehicles are expected for peak hour traffic, how many freeway lanes are needed?

<u>Given</u>:

- Peak Hour Volume = 3,233
 vehicles/hr
- Vphpl = **1700**



Hairpin Turn in the Mountains



You soon come to a nice highway drive and are enjoying the view. But a sharp turn is coming up! Is it safely made?

A <u>hairpin bend</u> is located on a hill section that has very little slope and maximum stability.

Hairpin Turn in the Mountains

Using your engineering judgement:

- ► Is the safest driving speed 15mph, 20mph, or 25mph?
- The smallest curve radius should be: 10m, 15m, or 20m?
- What should the driving length be to transition from the curve to a straight road: 10m, 15m, or 20m?

15 mph, 15m, 15m



Construction Roadblock

Phew! You finally made it out of the mountains and now find yourself driving along the Yellow Brick Road to the great Emerald City of Oz. But before you can get there, the Good Witch and her munchkins stop you to ask for advice in setting up a construction site to build a fun-house next to the road.



Construction Roadblock



In what order would you suggest the Good Witch's engineers create for safely constructing the road that leads to their Funhouse?

- A. Notify public of construction
- B. Create an emergency traffic plan
- C. Notify city officials of construction
- D. Calculate and enforce the necessary pace setting of traffic using speed message boards and/or police/construction pacers
- E. Meet with construction team, law enforcement, and utilities



Construction Roadblock

Priority Ranking:

- A. Create an emergency traffic plan
- B. Meet with construction team, law enforcement, and utilities
- C. Notify city officials of construction (2wks in advance)
- D. Notify public of construction(1wk in advance)
- E. Calculate and enforce the necessary pace setting of traffic using speed message boards and/or police/construction pacers

Intersections

You have finally arrived at the gates of the city and parked in the lot to check it out. As you walk around, you notice some familiar intersection features from your traffic studies.





Intersection Components: What is it?

What do you think each item is used for?



Intersection Components

A

Which crosswalk curb would you choose to install?



В

Intersection Components: Truncated Domes



- "Warning Dome" to physically warn of entering a roadway
 Aids the visually impaired
- Bright, contrasting color to help those with limited eyesight

Check out the others!

Intersection Components

Which crosswalk curb would you choose to install?



Check out the others!

Intersection Components: Curb Ramps



- For wheelchair and limited-mobility pedestrians
- Must be minimum 3ft wide, no more than 2% slope

Check out the others!

Intersection Components

What are the differences between Side A and Side B?



Intersection Components: Median Refuge Islands

What are the differences between Side A and Side B?



Intersection Components: Median Refuge Islands



- Easier to cross roadways by focusing on one section at a time
- Includes warning domes and widths to have two wheelchairs side by side

Time to Return Home, Engineer!

As you return to your car and travel through to the city limits, the Great and Powerful Oz certifies you as a qualified engineer! You successfully exit the city and return on your way back home.



Great Job!

Inclusive Design

What is it and how do we apply it?

Integrating Inclusive Design

- What do you think inclusive design means?
 - ▷ Think about the who, what, where, and why



Integrating Inclusive Design

The British Standards Institute (2005) defines inclusive design as: 'The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialised design.' (University of Cambridge)



Tenets of Inclusive Design



Intersection Components: Brainstorm Challenge



NORMAL VISION



How would you design a traffic light to help colorblind pedestrians?

Example: Wheelchair Ramps

Do you see any problems with the ramps in the images below? How would you redesign these?





Example: Your Own Life!

- Can you think of an example of encountering non-inclusive design from your own life?
- What was uncomfortable or inconvenient?
- What would you have improved?
- What's an example of inclusive design you have encountered?
 - Physical and and online



Example: Your Own Life!

- What would you improve? How would you redesign it?
- Draw / write your ideas here!



Activity: Design a Street

https://streetmix.net/-/1310519

What does your ideal street look like?

Some things to consider:

- How wide is the sidewalk?
- What type of signs or signals would there be?
- Are there businesses, parks, nature around?
- Who will be using the street?
 - Consider: old people, children, people with physical disabilities, bikers, cars, buses