



PLTW Engineering

12/Casual Loop Diagrams

April 27, 2020



12/EDD

Lesson: 4/27/2020

Objective/Learning Target: Students will be able to draft a casual loop diagram.



What is a Casual Loop Diagram (CLD)

A casual loop diagram (CLD) is a graphic that aids in visualizing how different variables in a system are interrelated.

The diagram consists of a set of nodes and edges. Nodes represent the variables and edges are the links that represent a connection or a relation between the two variables.



CLDs and Engineering

Causal loop diagrams can be thought of as sentences that are constructed by identifying the key variables in a system (the “nouns”) and indicating the causal relationships between them with links (the “verbs”).

By linking together several loops, you can create a concise story about a particular problem or issue.



CLDs and Engineering

In engineering, we often deal with complex systems with many components.

Causal loop diagrams map out the patterns of relationships within dynamic systems. We can use these diagrams to both understand and predict a system's behaviors.

Understanding and predicting a system's behaviors can help identify potential failure points or areas for improvement.



Drawing a CLD: Step 1

To draw a CLD, we need to follow a specific format.

First, we need to name the important variables. With any system, there are variables that can increase or decrease. Use nouns or noun phrases to name your variables.

If we look at the system of transportation, specifically road construction - we can use the process to create a CLD.



Drawing a CLD: Step 1

If we are part of an engineering team planning to widen a highway from the city to the outlying areas around it - what variables are in play?

How will this effect traffic for commuters?

What is the average commuting time?

Is there demand to widen the roads?

How much construction will be needed?

What is the draw to the outlying areas?

What is the population of the outlying areas?

How many commuters will drive this highway daily?

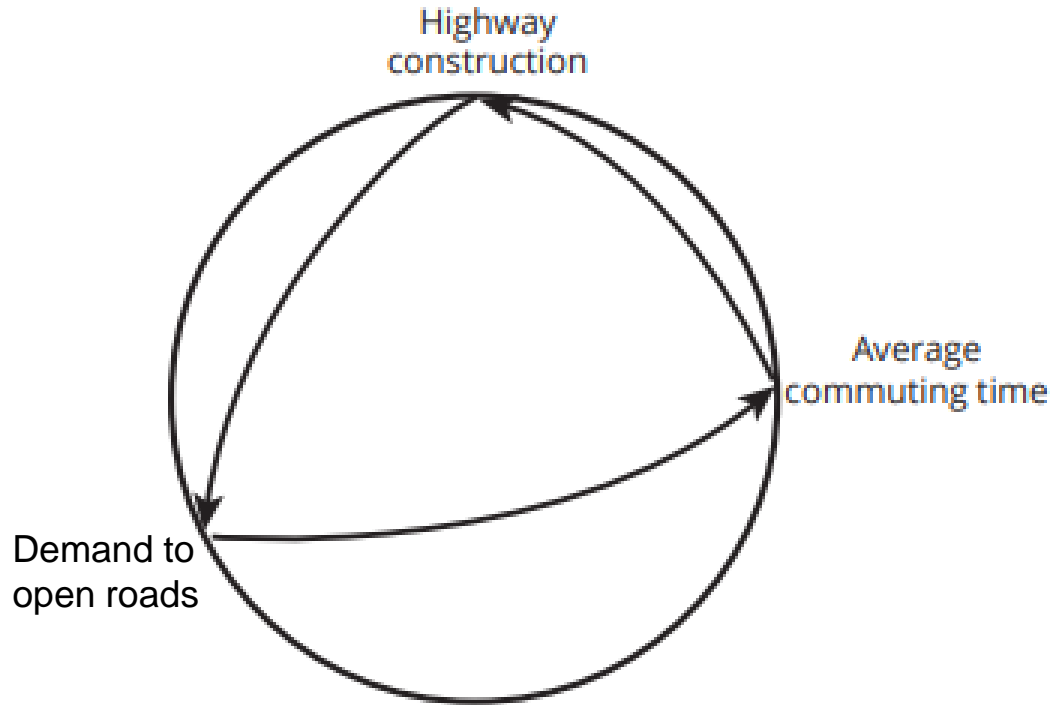


Drawing a CLD: Step 2 - cause and effect

For the second step we need to pick one of the variables from our list and determine how it effects another variable on the list.

Now draw a circle and make points on the circle. Label those points with the variables you have identified. Now draw an arrowed arc that starts with the variable that was the cause, to the variable that was the effect.

Drawing a CLD: Step 2 - cause and effect





Drawing a CLD: Step 2 - cause and effect

Consider the second variable: Does it have a direct effect back on the first variable when it changes?

Does it have an effect on another variable on your list?

Continue to add variable names onto the circle diagram and connect the variables with arrowed arcs.



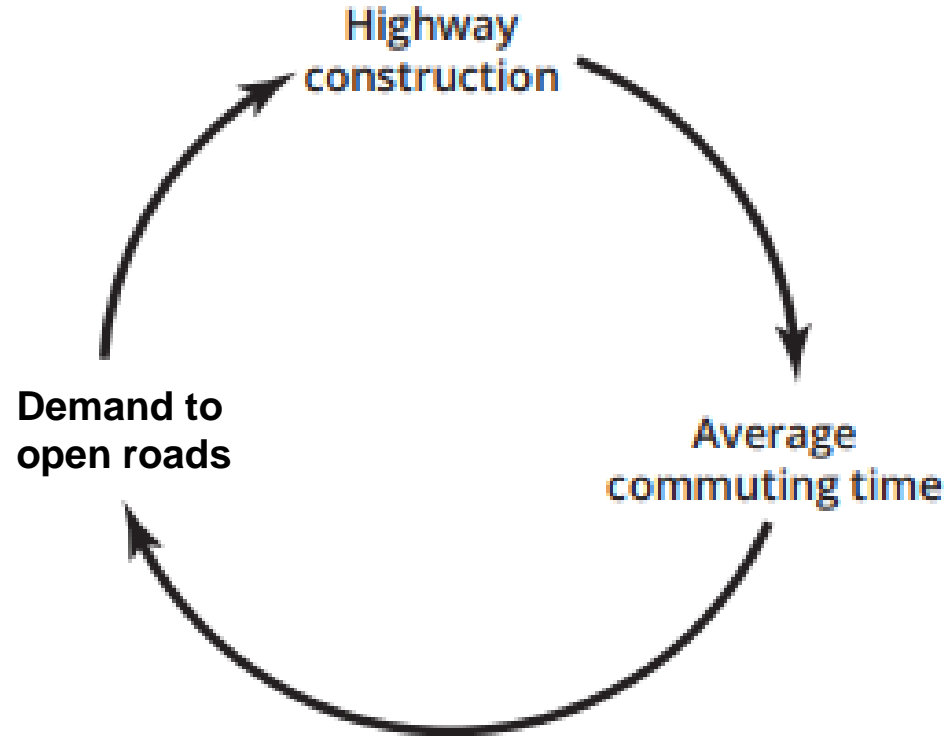
Drawing a CLD: Step 3 - close the loop

At some point, the chain of cause and effect eventually comes back to your beginning variable.

When you determine the sequence of when the loop is complete, move those arrows to the outside and replace the original circle with arrows.

This might happen in just two steps or in several steps. If so, close the loop.

Drawing a CLD: Step 3 - close the loop





Drawing a CLD: Step 4 - Identify direction

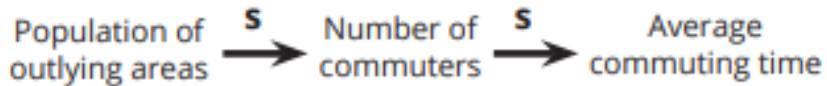
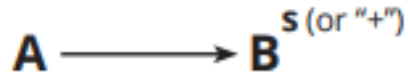
Identify whether the second variable changes in the same direction as the first or in the opposite direction.

For example, if an increase in the first variable causes an increase in the second variable, the change is in the same direction (S).

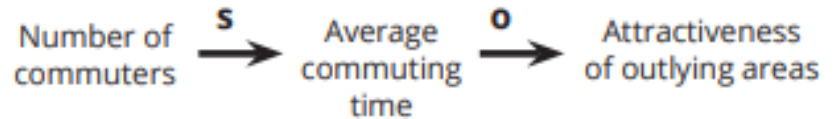
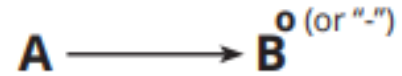
If an increase in the first variable causes a decrease in the second one, the change is in the opposite direction (O).

Drawing a CLD: Step 4 - Identify the direction

Change in the SAME direction



Change in the OPPOSITE direction





Drawing a CLD: Step 5 - Balancing or Reinforcing

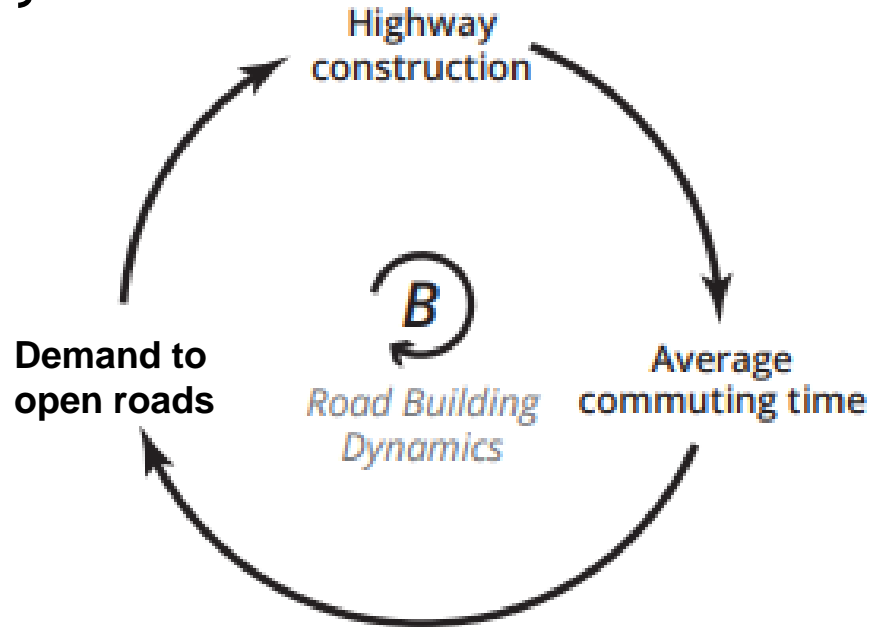
To determine whether a loop is balancing or reinforcing, count the number of Os in the loop.

An odd number of Os indicates a balancing loop, and an even number or zero Os indicates a reinforcing loop.

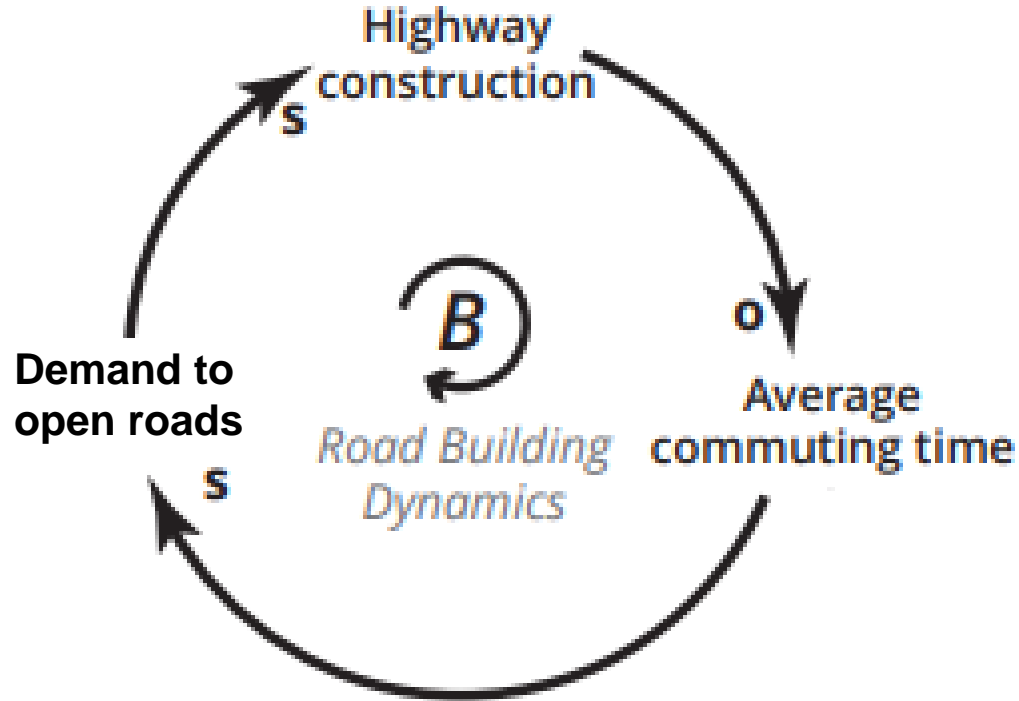
In the middle of the circle, label your loops as Reinforcing (with an R) or Balancing (with a B).

Drawing a CLD: Step 6 - Loop title

Redraw your loop to show balancing or reinforcing and title the loop to explain what it displays.



Drawing a CLD: Step 7 - Test and share your loop





Make a CLD on your own

Choose a topic to make your own CLD and follow the steps from the previous slides to complete the loop.

Here are some suggestions for topics:

- Availability of natural resources for human population
- Electrical power grid reliability
- Healthy diet and eating



Helpful links

[Youtube video - Introduction to basic Casual Loop Diagrams](#)

[Journal article on casual loop diagrams](#)