Transport Infrastructure LCA

Prof. Shoshanna Saxe
Department of Civil and Mineral Engineering
University of Toronto

Presentation at workshop of the International Transport Forum:
Life Cycle Assessment Methods to Support India’s Efforts to Decarbonise Transport
13 April 2021
Infrastructure is the skeletal structure of civil society.

What is the relationship between infrastructure provision and the society we create? Where are the levers for improvement?
Transport is a large driver of GHG emissions

Source: Greenhouse gas emissions on Climate Watch. Available at: https://www.climatewatchdata.org

Life Cycle Assessment

“A process to evaluate the environmental burdens associated with product, processes or activity by identifying and quantifying energy and materials used and wastes released to the environment; to assess the impact of those energy and materials used and released to the environment; and to identify and evaluate opportunities to affect environmental improvements. The assessment include the entire lifecycle of the product, process or activity, encompassing extracting and processing raw materials; manufacturing, transportation and distribution; use, reuse, maintenance; recycling and final disposal”

(Consoli et al., 1993)
What to build?                How to build?

Construction LCA

LCA and transportation infrastructure...
Construction impacts

Material use

Energy use

Impact factors

\( \times \)
Construction

Division of responsibilities/Data

Energy needs for mobility

### Generation - Fuel Type

- **nuclear**: 44.1% (6,978 MW)
- **hydro**: 27.9% (4,413 MW)
- **wind**: 22.8% (3,604 MW)
- **gas**: 3.4% (531 MW)
- **solar**: 1.7% (272 MW)
- **biofuel**: 0.2% (39 MW)
- **import export net**: 164 MW, 1,491 MW, 1,327 MW

### CO2e Intensity

17 g/kWh

"any policy that reduces congestion without otherwise making driving more expensive ... will tend to attract new traffic that at least partially offsets the policy’s effect on congestion"

-Hymel et al 2010


http://www.vtpi.org/gentraf.pdf
Induced Demand

When the infrastructure is only comfortable for a small group of people...

This isn't so bad.

Nope. Not a chance!

Only a few will use it.

With infrastructure that is comfortable and safe for most people...

Ahh, much better...

Fewer people are excluded from using it.

Hmm, this isn't so bad, either.

Credit: Ryan Martinson
Land use, land use change, and forestry (LULUCF)

City of Toronto, 2013
The impact of urban proximity, transport accessibility and policy on urban growth: A longitudinal analysis over five decades

Dena Kasraian
Delft University of Technology, The Netherlands; University of Toronto, Canada

Kees Maat and Bert van Wee
Delft University of Technology, The Netherlands

Roman Roads to Prosperity: Persistence and Non-Persistence of Public Goods Provision*

CARL-JOHAN DALGAARD
NICOLAI KAARSEN
OLA OLSSON
PABLO SELAYA

July 9, 2018
End of life?

London Underground, 1863

Pons Fabricius, Rome, 62 BCE

https://www.bbc.co.uk/newsround/20953143

https://www.shutterstock.com/video/clip-11850530-bridge-pons-fabricius-over-tiber-river-rome
Persistent and hysteretic

Network Effects


Cycling Network Toronto
So what?

• Transport infrastructure’s boundaries are wide and long

• Infrastructure comes first

• Huge knock on (indirect) impacts

• Infrastructure choice nearly impossible to undo (need to stop digging)
Thank you!

Prof. Shoshanna Saxe
http://civil.engineering.utoronto.ca/staff/professors/shoshanna-saxe/

Twitter: @shoshannasaxe