TRB 2010 Joint Summer Meeting, Minneapolis MN

The Global Supply Chain and Greenhouse Gases: a North American Perspective

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Summary

- Background
- Foundation Paper
- Greening North American Transportation Corridors

Background

- TTI conducted two projects for the tri-national Commission for Environmental Cooperation (CEC)
- *Foundation Paper*

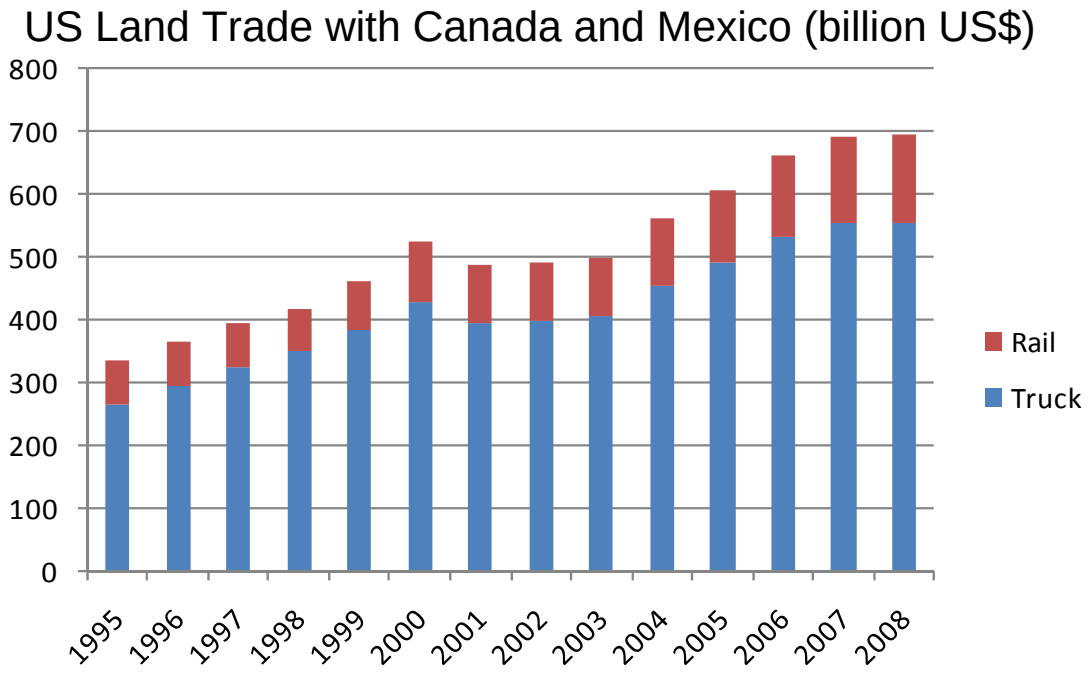
  Part of larger CEC report under Article 13 "Towards Sustainable Freight Transportation in North America"
  - freight transportation system in North America as it relates to greenhouse gas (GHG) emissions
  - state-of-the-practice in measurement/estimation of GHGs
  - available GHG mitigation strategies
  - opportunities for GHG mitigation on a NA front
- *Greening North American Transportation Corridors*
  - developed methodology to measure corridor level emissions
  - issues and opportunities to improve air quality
  - case study determined the air quality impact of truck and rail freight movement along the Mexico City to Montreal corridor

Foundation Paper

Overview

- Transportation is one of the major contributors to the release of GHGs in the atmosphere, producing more than 1/3 of the total GHGs released in North America

- Canada is #1 US trading partner and Mexico is #3 US trading partner
- Truck is the dominant mode for goods movement between the three countries

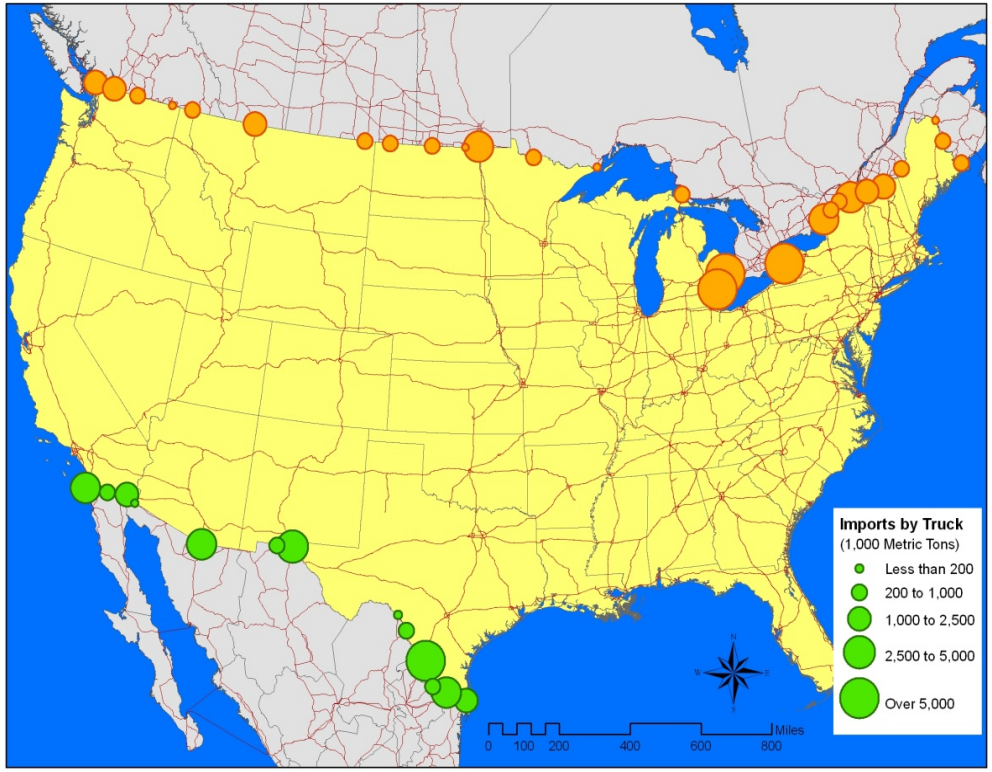


Foundation Paper

Cross-Border Trade

- Approximately 50% of the total truck and rail traffic by value in North America was handled by 3 land ports of entry
- At the US-Canadian border, more than 75% of the surface trade was handled by 5 land ports of entry
- At the US-Mexican border, 75% of the total trade was handled by 4 ports of entry

2008 US-Canada and US-Mexico Major Ports of Entry



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Correlation between Freight Transportation and GHGs

- The primary fuel of freight truck and rail is diesel—a petroleum product i.e. a fossil fuel
- GHGs are byproducts of combustion of fossil fuels e.g. oil and coal
- Direct positive relationship between fossil fuel use and GHG production—the more the fuel burned the more the GHGs produced
- GHGs emitted by freight rail and truck consist of 96% carbon dioxide (CO_2) by volume. The remaining GHGs are methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (HFCs, PFCs, SF_6)

Foundation Paper

Freight Transportation GHGs in NA

Mobile Source	Greenhouse Gas Emissions (million MtCO2e)*		
	United States (2007)	Canada (2007)	Mexico (2002)
Light Duty Gasoline Vehicles	620.9	41.1	-
Light Duty Diesel Vehicles	4.1	0.5	-
Light Duty Gasoline Trucks	493.9	45.0	-
Light Duty Diesel Trucks	26.9	2.3	-
Heavy Duty Gasoline Vehicles	35.6	6.6	-
Heavy Duty Diesel Vehicles	371.3	40.1	-
Motorcycles	2.0	0.3	-
On-road Subtotal	**1,554.7**	**135.9**	**101.9**
Railways	**46.0**	**7.0**	**1.6**
Domestic Marine	**8.1**	**6.1**	**2.3**
Domestic Aviation	**185.2**	**7.8**	**6.3**
Total Transportation	**1,794.0**	**156.8**	**112.0**
* MtCO2e = *Metric Tons of Carbon Dioxide Equivalent*		- *Denotes no data availability*	

***On-road includes light duty gasoline and diesel trucks and vehicles, motorcycles , and heavy duty gasoline and diesel vehicles*

****Data for all three countries in the same year were not available*

*****Table only includes vehicle classes for which data in all three countries were available*

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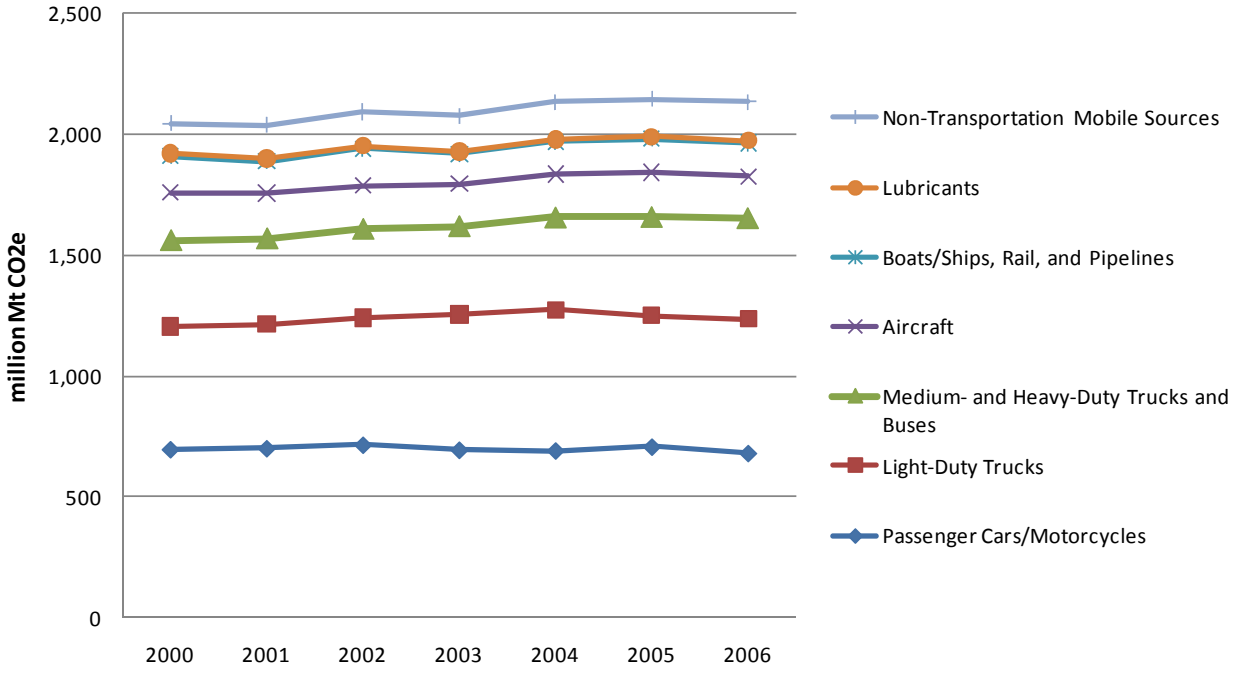
Freight Transportation GHGs in the USA

- US transportation GHG emissions are 12x Canada's and 16x Mexico's
- Trends in the U.S. and Canada are similar:

  GHGs from passenger cars and trucks have been decreasing

  GHGs from freight trucks have been increasing in recent years



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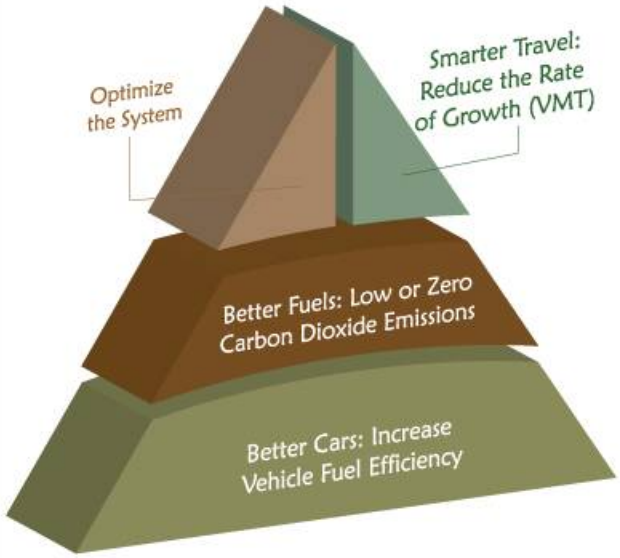
GHG Emission Reduction Challenges & Strategies

Reducing GHGs from freight modes may be more challenging than reducing GHGs from passenger modes or stationary sources

- Little or no discretionary freight movement
- Implications for the economy and global competitiveness
- Slower freight vehicle fleet turnover so slower rate of introduction of new technologies
- Due to economic competition, freight carriers already have significant incentive to minimize fuel costs and GHGs
- Freight VMT expected to grow faster than passenger VMT



Source: AASHTO

Greening NA Transportation Corridors

Case Study:
Mexico City to Montreal Corridor

Study Corridor Distance by Country and Mode (miles)

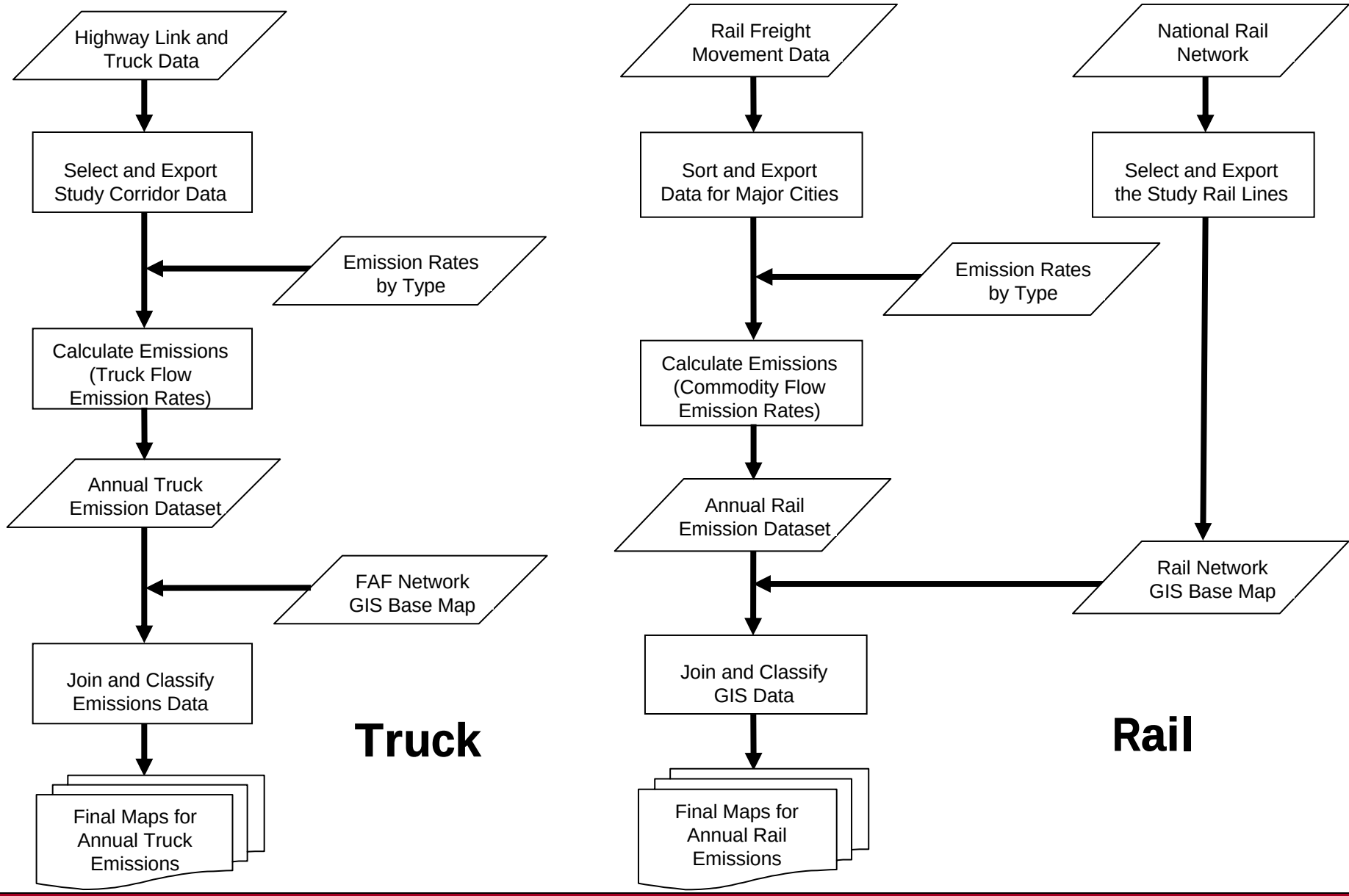
Mode	Canada	U.S.	Mexico	Total
Truck	531	1,624	693	2,847
Rail	575	1,903	717	3,194

Greening NA Transportation Corridors

Data Requirements for Corridor Level Air Quality Analysis of Freight Movement

Truck	Rail
Freight Activity - Annual truck VMT on each link (from annual truck volume) - Annual truck volumes at ports of entry - Fleet characteristics e.g. age distribution, VMT share - Speed profile for trucks crossing US ports of entry	Freight Activity - Annual ton-mile commodity flow between each major origin-destination pair
Emission Rates - Aggregated exhaust emission rates based on vehicle registration data and MOBILE6.2 - PEMS measurements	Emission Rates - Exhaust emission rates based on national average rates

Analysis Process for Emissions along the Corridor



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Total Annual Freight Emissions on the Mexico City to Montreal Corridor

		Annual Emissions				
	Year	CO_2 (kt)	CO (metric ton)	NOx (metric ton)	THC (metric ton)	PM (metric ton)
Truck	2010	13,508	10,746	76,733	2,231	713
	2035	32,218	4,209	17,015	3,730	217
Rail	2010	177	480	2,866	161	100
	2035	278	756	2,821	177	113

Greening NA Transportation Corridors

Data Requirements and Data Sources

Corridor data are highly uncertain, or even non-existent

Freight Data Sources

- FHWA/BTS databases most reliable sources
- Canadian and Mexican data difficult to obtain e.g. Transport Canada data & Canadian data sharing rules
- Data collection efforts & level of granularity vary in each country

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Data Requirements and Data Sources (cont.)

Trucking Activity

- FAF truck volume data do not include vehicle weight or load factor
- EPA *Smartway* fleet performance data not publicly available
- Uncertainty in emissions estimates: emissions rates of empty trucks might be underestimated

Network and Routing Data

- GIS network data for highway and rail are publicly available
- Truck volume data: publicly available hence higher reliability
- Rail routing & movement data: proprietary hence greater uncertainty

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Data Requirements and Data Sources (cont.)

Truck Emissions Rates

- MOBILE6.2 truck emissions rates are aggregate distance-based rates for different average speeds
- Suitable for medium- and large-scale analyses; not sensitive to changes in driving conditions at constant average speeds
- CO_2 and PM rates in M6.2 are not sensitive to speed; not very suitable for link level analyses
- EPA's newest model MOVES is capable of fine-scale analyses
- Requires disaggregate activity data not currently available; no standard collection procedures developed yet

Greening NA Transportation Corridors

Data Requirements and Data Sources (cont.)

Freight Rail Movement and Emissions

- High levels of uncertainty in freight rail movement data
- Available emissions estimation methods are aggregate procedures based on national average values that consider the total weight of hauled cargo to obtain fuel consumption and emissions

Overall Conclusions & Opportunities

Short Term

- More rigorous public investment
  - Catalyst to lower tech cost; large & small operators
- Freight-specific GHG regulation
  - Fuel efficiency standards for heavy duty trucks
- Cooperation with private sector
  - Tri-partisan relationship with tech R&D and operators
- Technology & Expertise Transfer in NA
  - Development & standardization in data & methods
  - Development of NA level GHG performance measures

Medium-Long Term

- Feasible alternative energy sources for freight modes
- Carbon emissions pricing (cap and trade, carbon pricing…)

For further information please contact:

CEC Foundation Paper

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