High Speed Rail in Canada:
Sustainability Challenges

CITE WATT Consulting Group 'Transportation in a Sustainable World" Student Award submission

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Source: CBC

OUTLINE

- What is HSR?
- History of HSR in Canada
- What is Sustainability?
- Sustainability Challenges
  - Environmental
  - Economic
  - Societal

WHAT IS HSR?

- Standard varies worldwide
- In Ontario, HSR is defined as "a system as a rail system that operates at or above **250 km/h** on dedicated tracks or at **200 km/h** on existing tracks."
- Canada is only G8 country without HSR

WHAT IS HSR?

	Long-distance passenger rail	Commuter rail	High speed rail
Speed	80 – 160 km/h	130 – 175 km/h	175 – 300 km/h
Power	Diesel-electric	Diesel-electric	Electric
Tracks	Some parts shared with freight rail	Some parts shared with freight rail	Exclusive to passenger service
Typical station distance	15-30 km apart	30-50 km apart	50-100 km apart

Source: Government of Ontario

HISTORY OF HSR IN CANADA

- UAC Turbotrain

HISTORY OF HSR IN CANADA

- Quebec City – Windsor Corridor Developments:
  - 1998: LYNX Consortium
  - 2001: ViaFast
  - 2008: Economic Study
  - 2017: Preliminary Design Work and EA Commences

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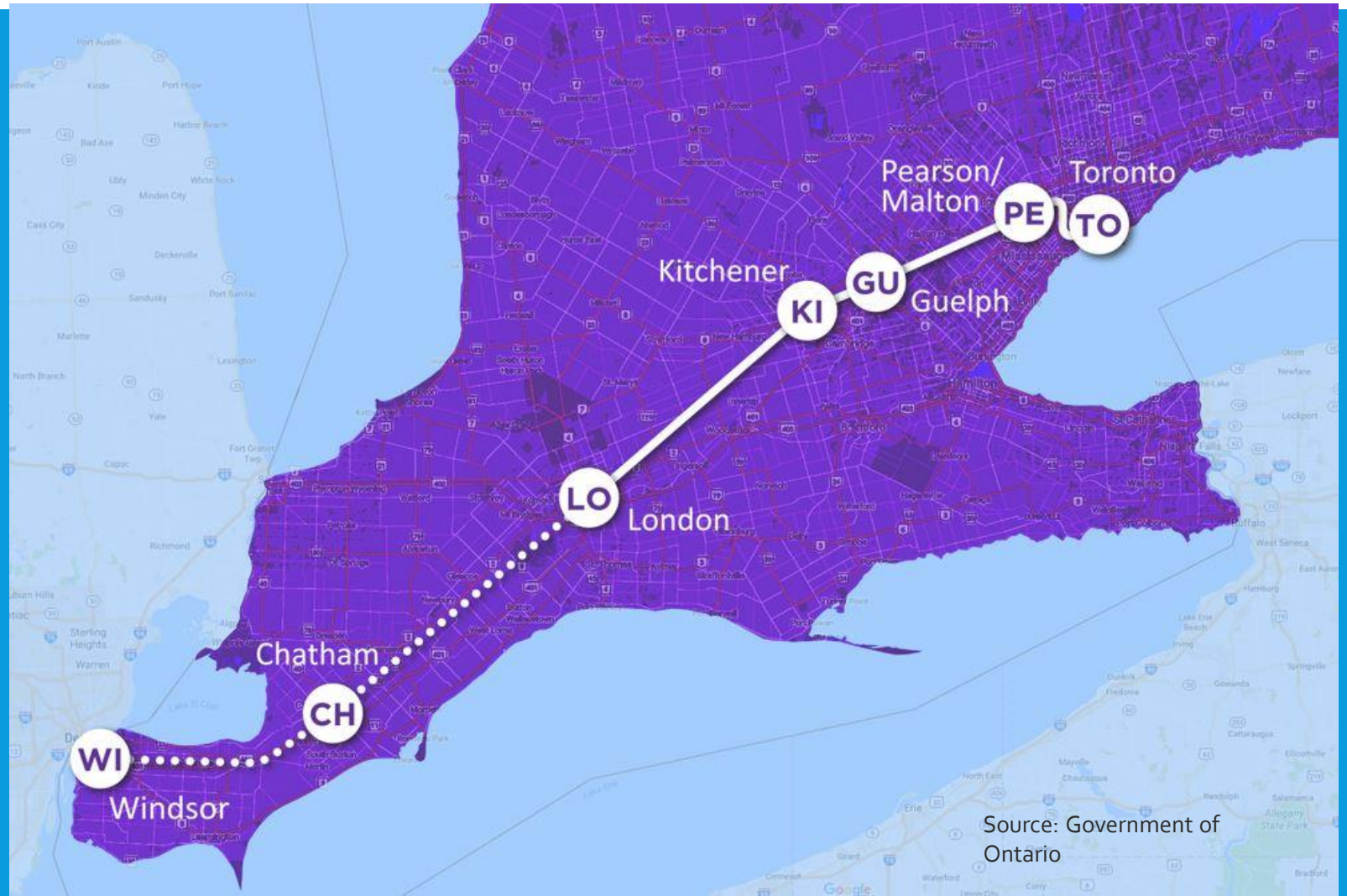
HISTORY OF HSR IN CANADA

- Toronto – Windsor Proposal

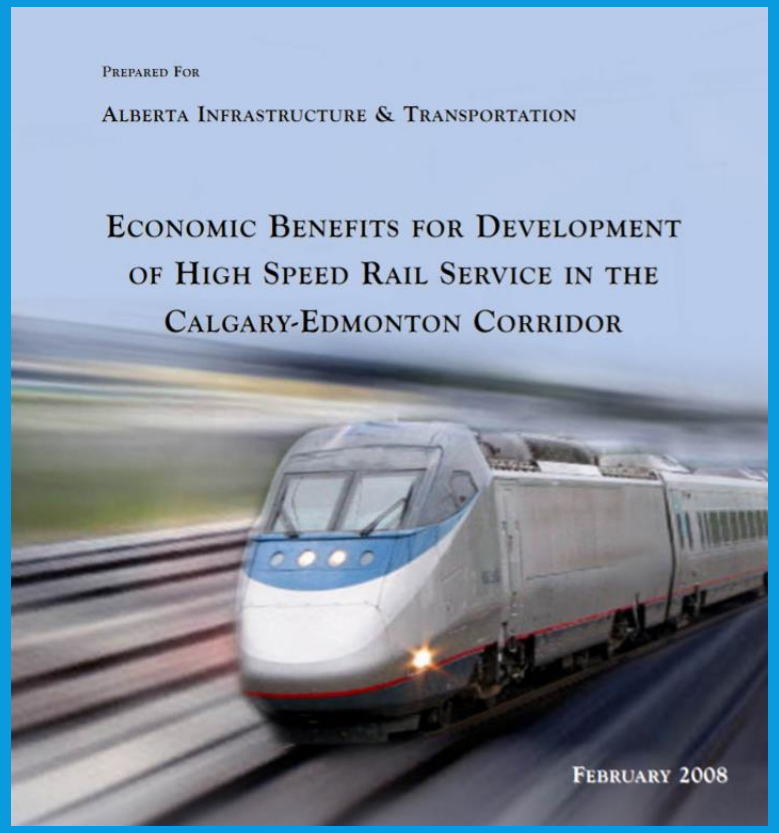


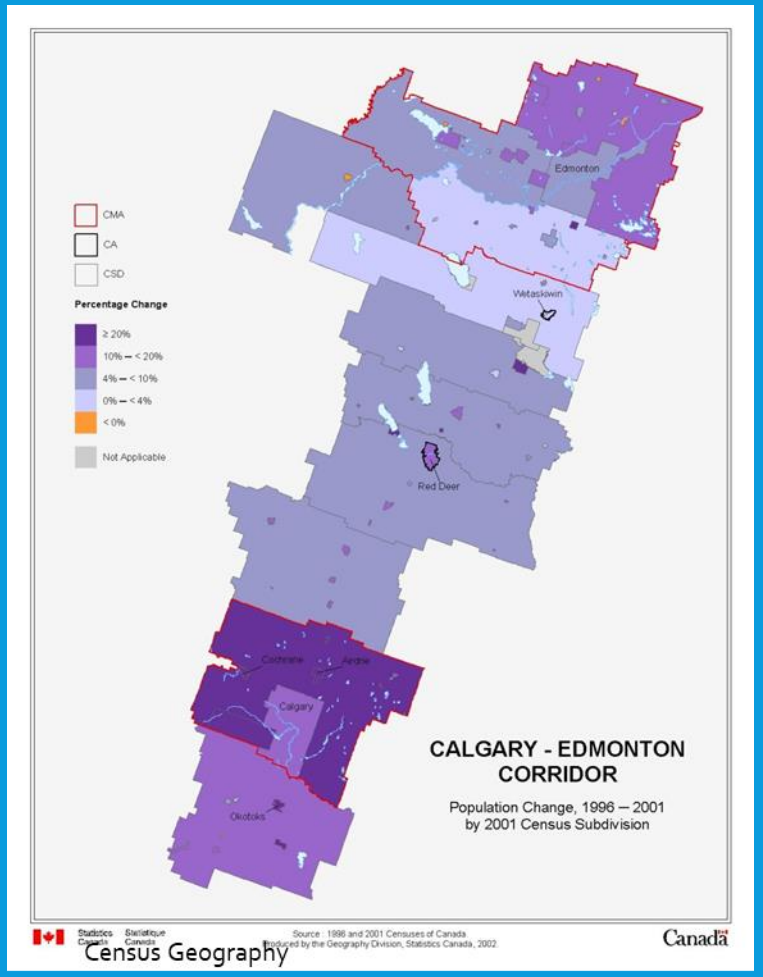
Source: Government of Ontario

HISTORY OF HSR IN CANADA

- Edmonton-Calgary Corridor

Source: Calgary Herald





HISTORY OF HSR IN CANADA

- Other Corridors:
  - Pacific Northwest Corridor
  - Montreal – New York/Boston Corridor

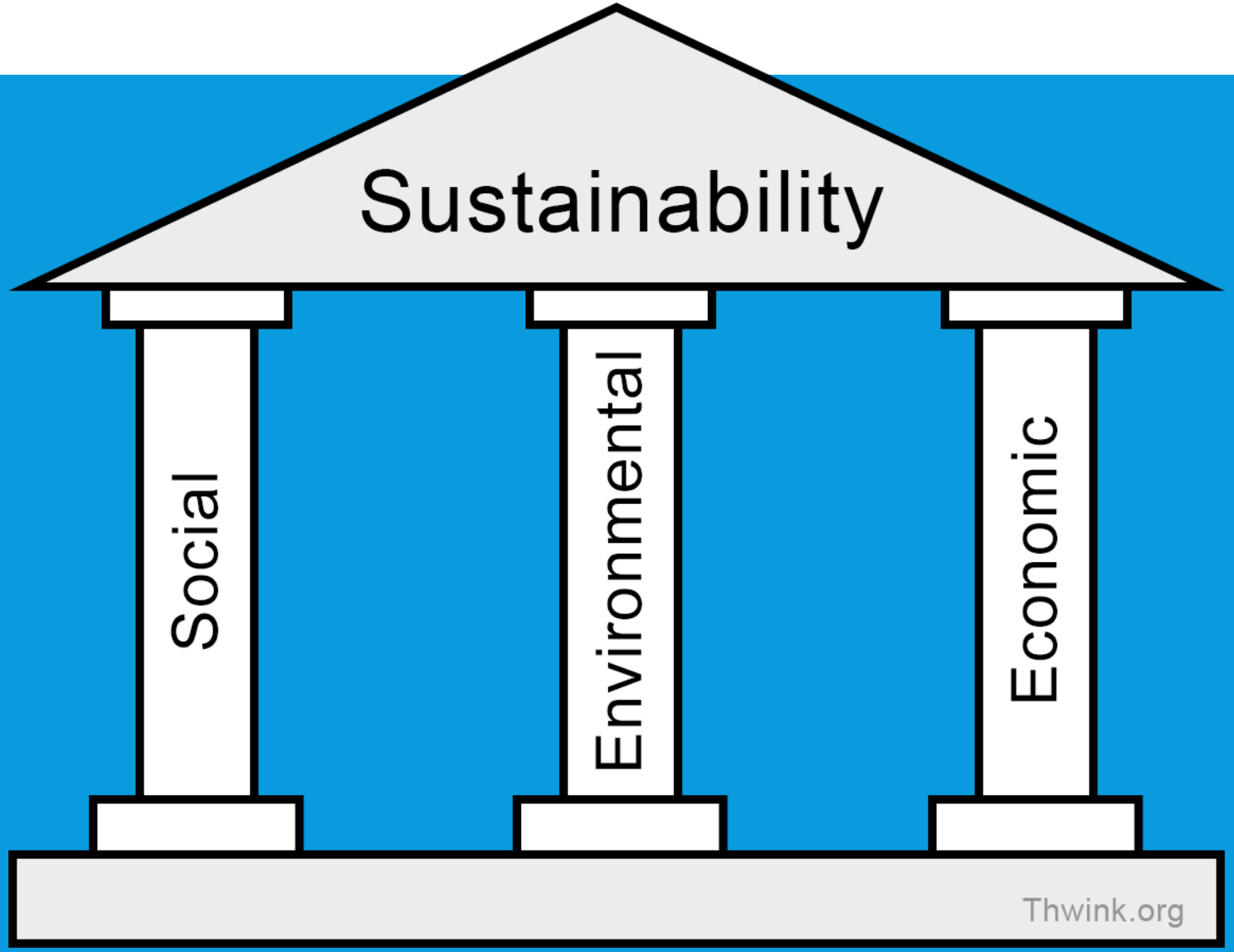
Source: Federal Railroad Administration

WHAT IS SUSTAINABILITY?

- Sustainable development "meets the needs of the present without compromising the ability of future generations to meet their own needs”

- -Brundtland Commission

WHAT IS SUSTAINABILITY?

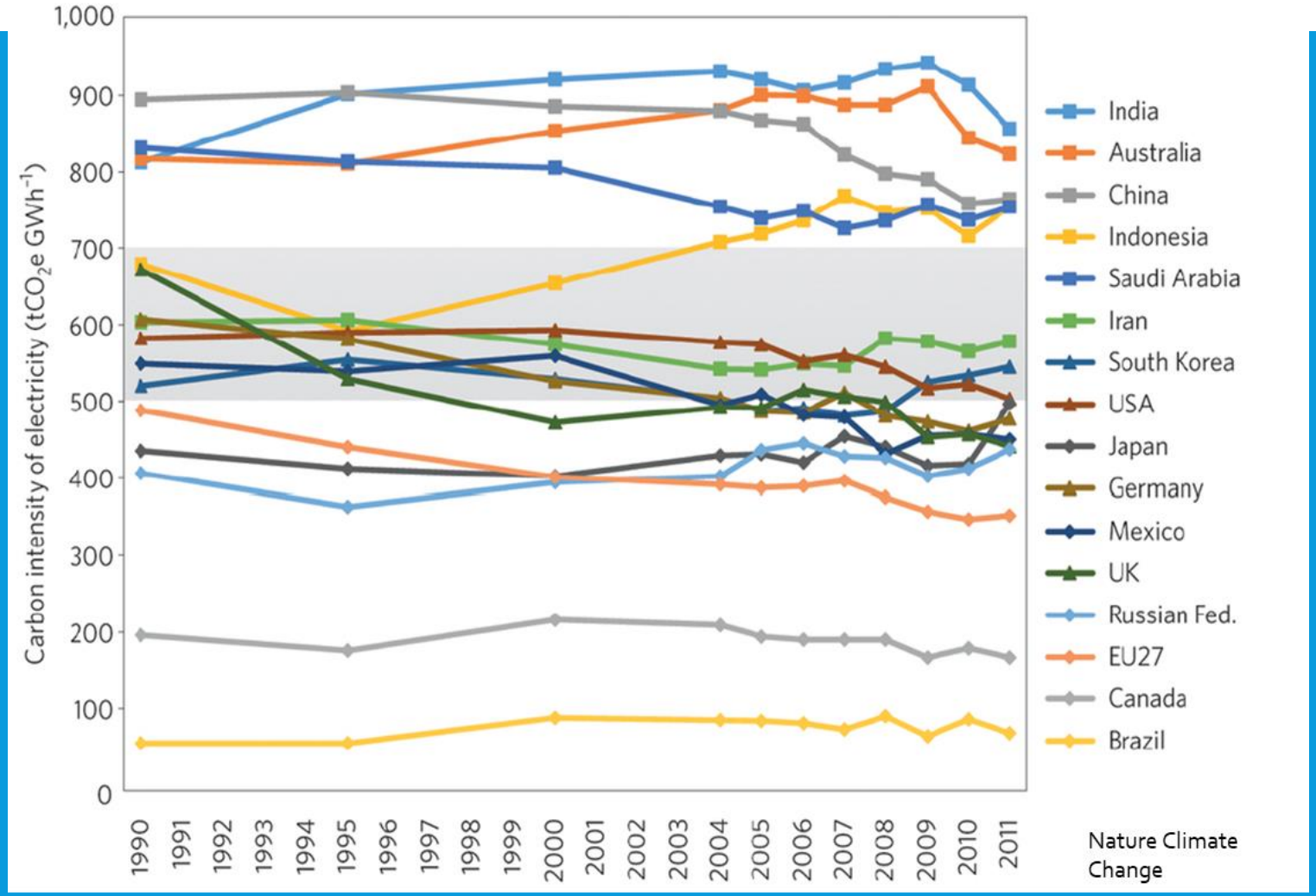


SUSTAINABILITY ISSUES WITH HSR

Environment	Economic	Society
Air Pollution	Fares	Safety
Noise Pollution	Subsidies	Station Aesthetics
Geotechnical Issues	Fuel	Station Distances

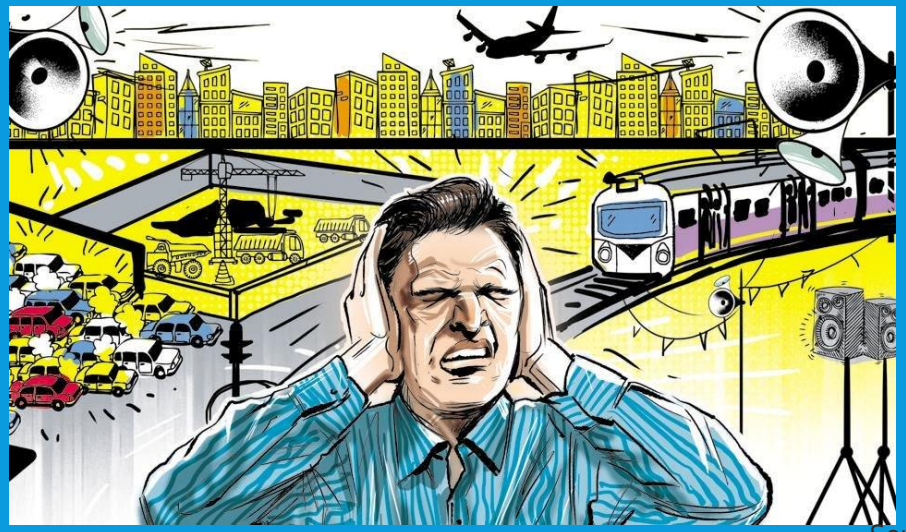
ENVIRONMENTAL CHALLENGES: AIR POLLUTION

- "Cleaner" energy
- Less people to use highways (if highway runs along corridor)
- If it runs on electricity….is it really green?



ENVIRONMENTAL CHALLENGES: NOISE POLLUTION

- Noise pollution effects the well-being of humans, animals and the surrounding environment
- Impacts include sleep loss, stress, high blood pressure, lost productivity, etc
- Dr. Arline Bronzaft "found that students in a school next to a elevated train in NYC were one year behind in reading ability if they had been on the noisy side of the school."



Source: Tehran Times

ENVIRONMENTAL CHALLENGES: NOISE POLLUTION

- Generally, High Speed trains "generate lower noise levels at speeds less than 125 mph than conventional trains"
- Due to aerodynamic effects, High Speed trains generate increased noise at higher speeds. At higher speeds, however, HST shows a noise increase over conventional trains due to aerodynamic effects.
- Rapid Onset Noise

Noise Sources for Trains at Different Speeds		
<64 km/h	**98 – 241 km/h**	**>274 km/h**
• Propulsion units, cooling fans, auxiliary equipment	• Structural vibrations and mechanical noise from wheel-rail interactions	• Aerodynamics

ENVIRONMENTAL CHALLENGES: NOISE POLLUTION

- Ways to Reduce Noise Pollution:
- Grade Separations
- Train Operations
- Construction Noise Mitigation
- Noise Walls

Source: Land Transport Authority

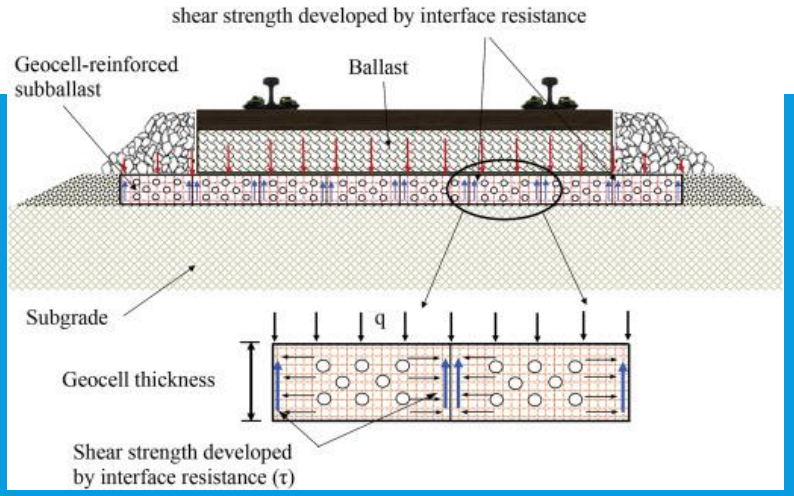
Source: Alameda Corridor-East Project

ENVIRONMENTAL CHALLENGES: GEOTECHNICAL ISSUES

- Building a segregated network from existing track can be expensive
- Higher train speeds may lead to track deformation
- Wet spots/beds

ENVIRONMENTAL CHALLENGES: GEOTECHNICAL ISSUES

- Ways to Improve Railway Subgrade:
  - Ground Improvement
  - Densification
  - Reinforcement Methods
  - Chemical Stabilization
  - Geocells



ECONOMIC CHALLENGES

- Fares and Transfers
- Government Subsidies
- Construction Costs
- Financing Methods
- Fuel Costs
- Distance between Stations

Source: TED Talks

SOCIETAL CHALLENGES

- Station Design

SOCIETAL CHALLENGES: SAFETY AT CROSSINGS

- Ways to Improve Safety at Grade Crossings with HSR:
    1. Close the Crossing (may be unrealistic)
    2. Upgrading Crossings (may lead to false negative issues when a conventional train comes by)
    3. Grade Separation (costly)
    4. Improve Safety Techniques at Crossings

SOCIETAL CHALLENGES

- Speed-Connectivity Trade-offs

Wikipedia

Wikipedia

CONCLUSIONS

- There are many factors to consider when implementing HSR in Canada. Economic, environmental, geotechnical, and political challenges must be overcome before making a decision as to whether an HSR network should be constructed. However, with proper research into lessons learned from the problems and solutions other countries have encountered when implementing HSR, overcoming these obstacles can be easier.

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