Sustainability & EPDs at Oregon DOT

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Oregon Department of Transportation

Oregon House Bill 4139 (2022)

- Requires ODOT to set-up a “program for GHG reductions”
- ODOT to collect EPDs on asphalt, concrete and steel
- ODOT to devise strategies for reducing GHG emissions
- Allows for regional variability and prioritization of quality / performance

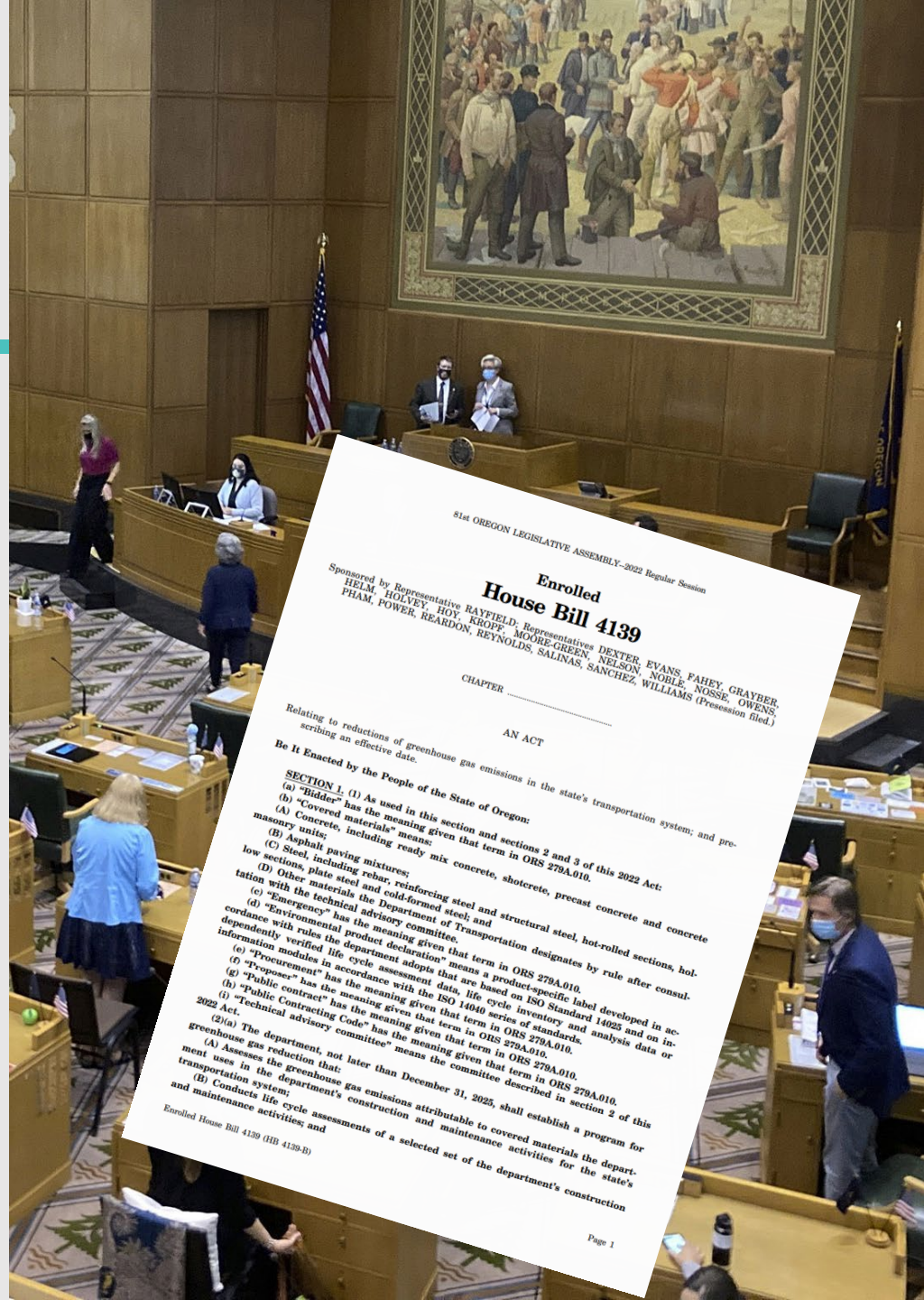

Photo credit: NBC News

Additional Requirements

- Conduct Life Cycle Assessments (LCA)
- Report Annually to the Oregon Transportation Commission
- Setup a Grant Program to offset costs
- Work with Technical Advisory Committee (TAC) to setup program

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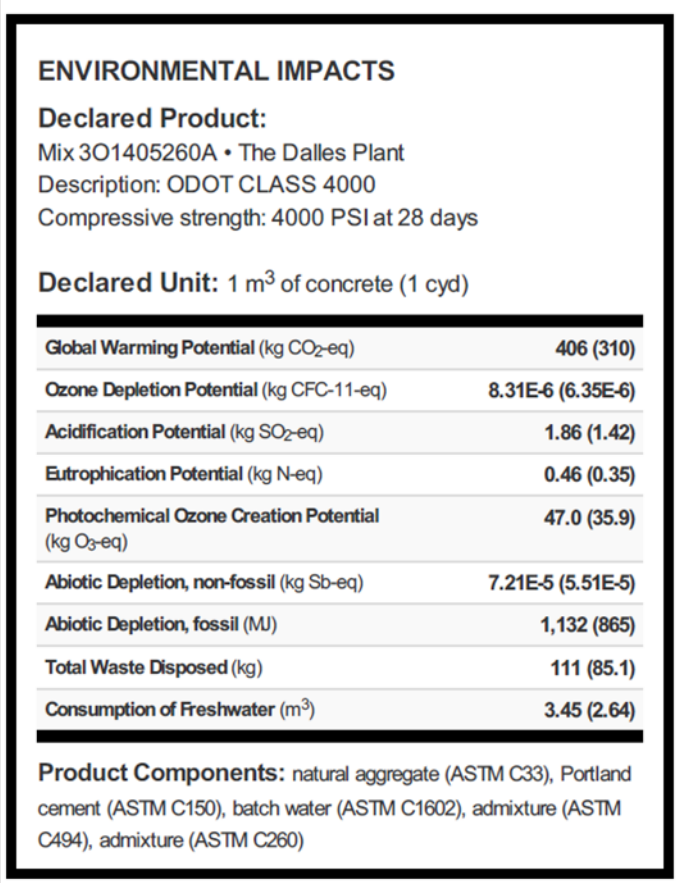
Technical Advisory Committee

- Membership requirements listed in legislation:
  - DOT
  - DEQ
  - Construction Firms
  - Material Suppliers
  - Industry Associations of Workers in Construction or Manufacturing Industries
  - Environmental Organizations
  - Academia
- Committee (not incl. DOT & DEQ):
  - OCAPA- CalPortland, CRH
  - APAO
  - AGC - HP Civil
  - NAMC - GeoGrade Constructors
  - ACEC – Jacobs
  - DEQ
  - Cascade Steel Rolling Mill
  - Local Iron Workers 29
  - United Steelworkers District 12
  - BlueGreen Alliance
  - Good Company (Parametrix)
  - Carbon Leadership Forum
  - Oregon State University

EPD 101

- ISO Standards
- Product Category Rules (PCRs)
- Reports Environmental Impacts
  - Product label similar to food nutrition label
- May take up to 6 mo. staff time /up to $10k for first plant (more for steel)



ENVIRONMENTAL IMPACTS

Declared Product:
Mix 3O1405260A • The Dalles Plant
Description: ODOT CLASS 4000
Compressive strength: 4000 PSI at 28 days

Declared Unit: 1 m^3 of concrete (1 cyd)

Global Warming Potential (kg CO_2-eq)	**406 (310)**
Ozone Depletion Potential (kg CFC-11-eq)	**8.31E-6 (6.35E-6)**
Acidification Potential (kg SO_2-eq)	**1.86 (1.42)**
Eutrophication Potential (kg N-eq)	**0.46 (0.35)**
Photochemical Ozone Creation Potential (kg O_3-eq)	**47.0 (35.9)**
Abiotic Depletion, non-fossil (kg Sb-eq)	**7.21E-5 (5.51E-5)**
Abiotic Depletion, fossil (MJ)	**1,132 (865)**
Total Waste Disposed (kg)	**111 (85.1)**
Consumption of Freshwater (m^3)	**3.45 (2.64)**

Product Components: natural aggregate (ASTM C33), Portland cement (ASTM C150), batch water (ASTM C1602), admixture (ASTM C494), admixture (ASTM C260)

Image: Building Transparency (EC3), accessed 27 March 2024, <EC3 - https://buildingtransparency.org/ec3/epds/ec372b5sProduct EPDs> (buildingtransparency.org)

EPD 101

PRODUCT EPDS Type to search ...

Subcategory	Plant or Plant Group (Compare)	Product: mix 3o1405 (Compare)	Description	Compressive Strengt... (Plot)	[redacted]	≤ Reported GWP	Columns: @28D × Reported
Ready Mix	The Dalles	Mix 3O1405260A	ODOT CLASS 4000	4000 psi		310 kgCO2e	Details Open
Ready Mix	Hermiston	Mix 3O1405260A	ODOT CLASS 4000	4000 psi		264 kgCO2e	Details Open
Ready Mix	Boardman	Mix 3O1405260A	ODOT CLASS 4000	4000 psi		247 kgCO2e	Details Open
Ready Mix	The Dalles	Mix 3O1405260A	ODOT CLASS 4000	4000 psi		277 kgCO2e	Details Open
Ready Mix	Hood River	Mix 3O1405260A	ODOT CLASS 4000	4000 psi		318 kgCO2e	Details Open

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Image: Building Transparency (EC3), accessed 3 April 2024, <https://buildingtransparency.org/ec3/material-search>.

Items ODOT considered

- EPD exemptions:
  - Conditions listed in House Bill
  - Small Contract Values
  - Small Material Quantities
- Availability of EPDs
- Existing ODOT policies:
  - Awarded Contract Value
  - Material Small Quantity Acceptance

Photo credit: ODOT, Meachem

Program Development Process

Oregon Department of Transportation

Existing Award Value Policies

- OJT/Apprentice Program (HB 2649, 2023)
  - Contracts $3 Million
  - Requirement of Apprentice Hours

Photo credit: ODOT, accessed 27 March 2024, <https://www.oregon.gov/odot/business/ocr/pages/workforce-development.aspx>.

Other Programs Contract Value

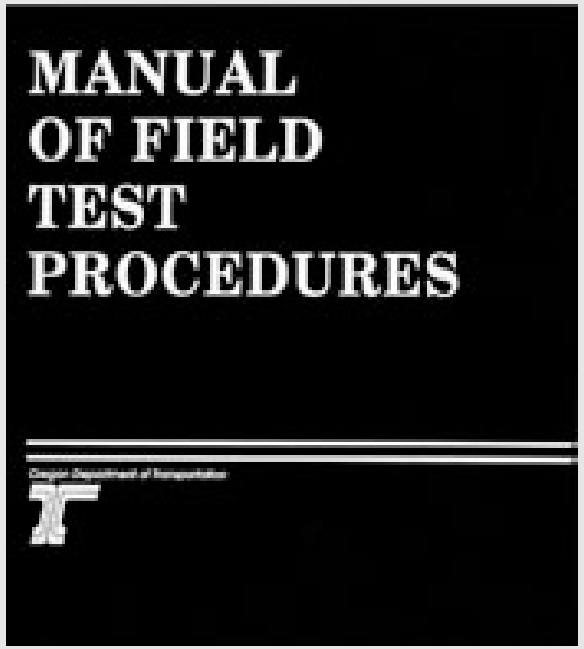
- Colorado DOT
  - Materials
    - Asphalt and Asphalt Mixtures;
    - Cement and Concrete Mixtures;
    - Steel
  - Engineers Estimate ≥ $3M

- California DOT
  - Materials
    - Carbon Steel Rebar
    - Structural Steel
  - Total bid over $1M and 175 or more original working days

Photo credit:
Left- Colorado Department of Transportation, accessed 27 March 2024, <CDOT Lohttps://www.codot.gov/assets/images/global/cdotlogo.png/image_view_fullscreengo (codot.gov)>.
Right- Caltrans, accessed 27 March 2024, <https://dot.ca.gov/>.

Existing Small Quantity

- ODOT Manual of Field Test Procedures (MFTP)



Small Quantity Table

Section	Type of Material	Approximate Quantity
00330	Earthwork (Embankment)	500 yd^3
00330	Earthwork (Excavation)	500 yd^2
00390	RipRap	100 yd^3
00405	Ditch & Trench Excavation, Bedding and Backfill	50 yd^3
00440	Commercial Grade Concrete (Non-Structural Items)	50 yd^3
00495	Trench Resurfacing	500 Ton
00510	Structure Excavation and Backfill	500 Ton
0A596, 0B596 & 0C596	Retaining Walls	500 Ton
00641	Aggregate Sub-base, Base & Shoulders	2000 Ton
00680	Stockpiled Aggregate	2000 yd^3
00730	Asphalt Tack Coat	50 Ton
00735	Emulsified Asphalt Concrete Pavement (includes asphalt cement)	2500 Ton
00745	Asphalt Concrete Pavement (Statistical Acceptance) (ACP-each Level) (includes asphalt cement).	2500 Ton

Photo credits: ODOT

Challenges with EPDs

- Only reports a product's cradle-to-gate
  - May inadvertently promote materials with a higher cradle-to-grave GHG
  - Data Quality
- No recognized method to perform Quality Assurance
- Lack of harmonization amongst PCRs

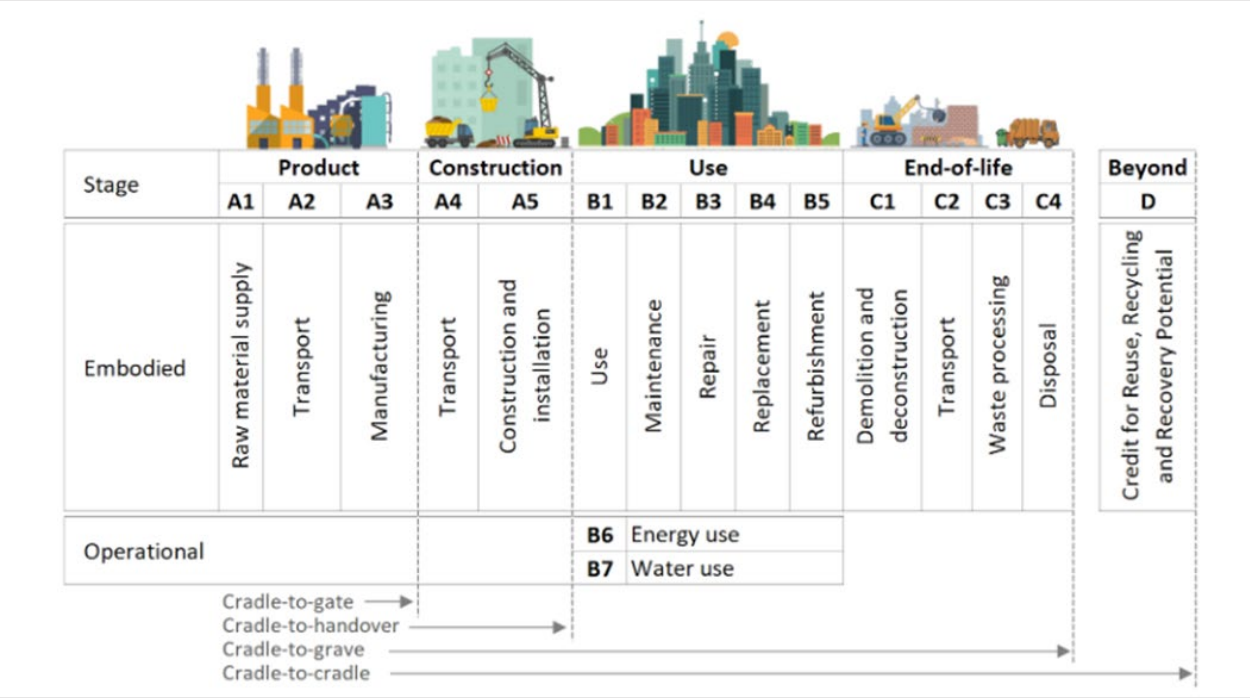


Image: Building Transparency (EC3), accessed 3 August 2023, <https://buildingtransparency.org/ec3/creator-contacts/epds>.

Goals for Program

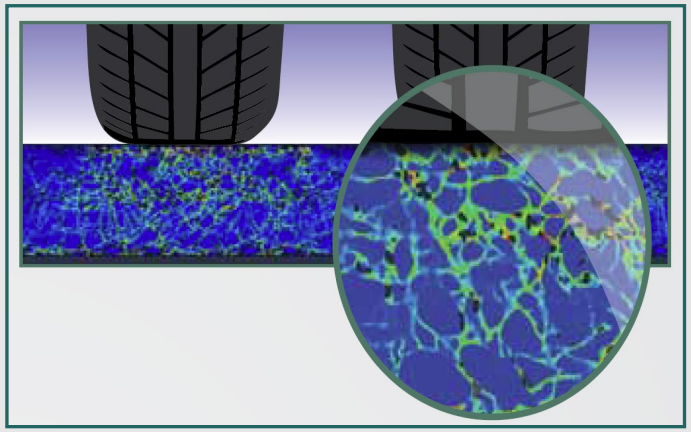
- Robust collection of EPDs
- Conduct LCAs
- Develop program level GHG reducing strategies

Photo credit: ODOT, Melrose Bridge

ODOT's Existing Carbon Reduction Strategies

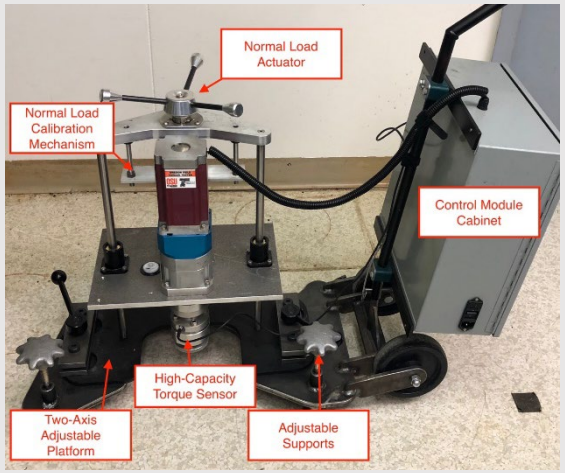
- Recycled asphalt pavement in asphalt pavement mix designs.
- Low-carbon supplementary cementitious materials in cement concrete mixes.
- Type IL cements (also known as Portland Limestone Cement) are a low-carbon alternative permitted.
- ODOT designs roads to optimize the lifecycle; this means pavement durability is prioritized, which reduces the need for more frequent maintenance.
- Incentives to pave smoother roads to increase vehicle efficiency and reduce GHG emissions from users.

LCA, LCCA, and Sustainability



Advanced numerical modeling

Performance based specs



Technology development

OSU ASPHALT MATERIALS AND PAVEMENTS RESEARCH PROGRAM

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School of Civil and Construction Engineering, Oregon State University

http://research.engr.oregonstate.edu/coleri/

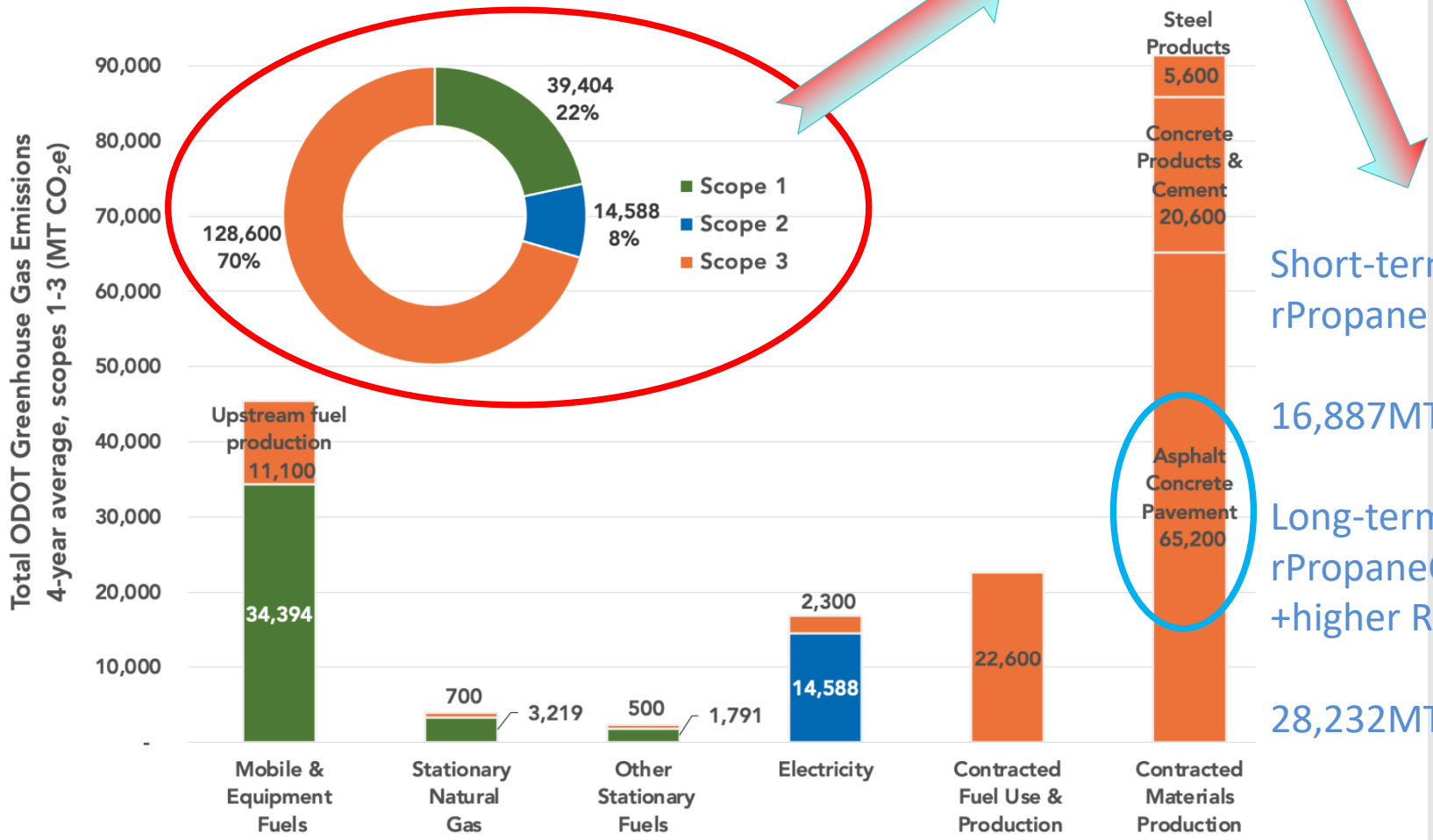
Oregon Department of Transportation

Oregon State University

Potential Impact on ODOT GHG Emissions

182,592MTCO2e

Figure ES1: Total GHG emissions across all analyzed sources of emissions (4-year average FY16-19)



Short-term – Switch to rPropane only – 25.9%

16,887MTCO2e 9.2% reduction

Long-term – Switch to rPropaneCamelina +higher RAP – 43.3%

28,232MTCO2e 15.5% reduction

Scope 1: *Direct GHGs from equipment and facilities owned or operated by ODOT.*

Scope 2: *Indirect GHGs from electricity purchased for equipment and facilities owned or operated by ODOT.*

Scope 3: *All other indirect emissions sources that result from ODOT's activities but occur from sources owned or controlled by ODOT Tier 1 contractors and other downstream supply chain vendors (e.g., asphalt and concrete plants and concrete and cement manufacturers).*

Operational Greenhouse Gas Reductions: Best Practices & Recommendations, Good Company, ODOT

Federal NCHRP Project 720

- During their field trials to get their information, they used five different vehicle types with installed fuel meters.

(a) Medium Car

(b) SUV

(c) Van

(d) Light Truck

(e) Articulated Truck

ODOT has the following vehicle types available in the PMS:

- Medium Car
- SUV
- Articulated Trucks

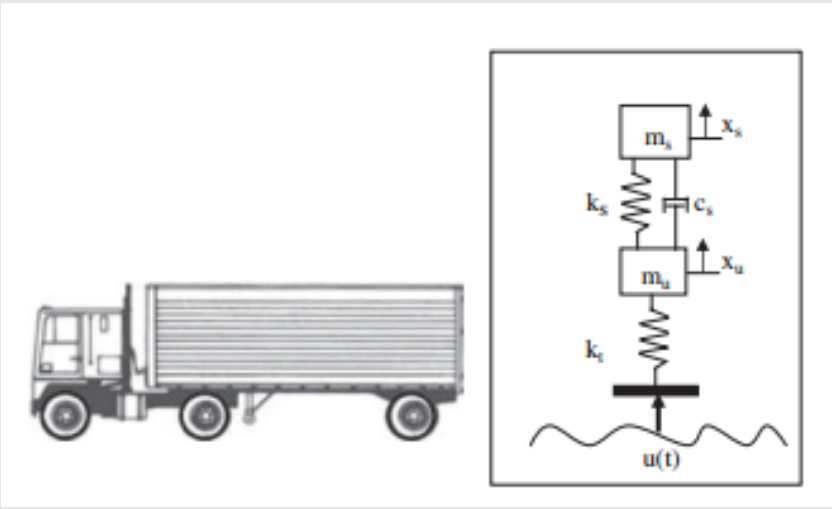
How do they measure the IRI?

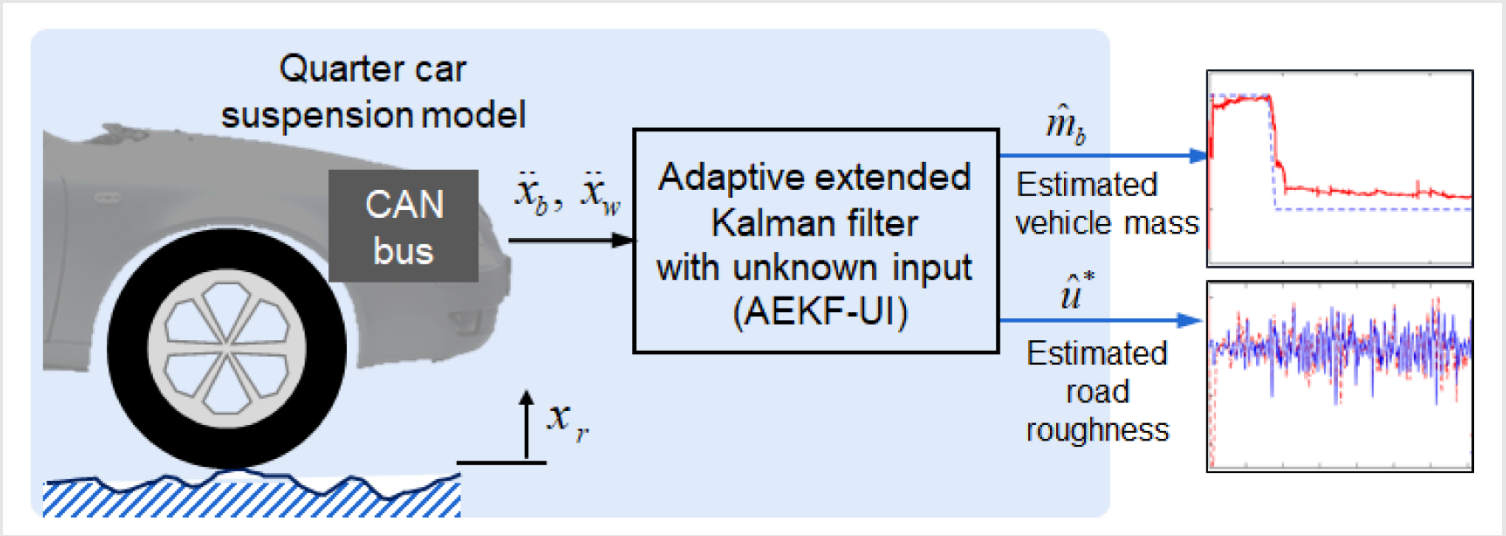
- Dynamic measurements of the road profile are collected with instruments mounted on vehicles (inertial profilers).
- Lasers installed on the vehicle measure the height of the vehicle relative to the road. These laser measurements were then converted to a surface profile.

Example of Inertial Profiling Systems (SSI)

IRI and Rolling Resistance

- Several models have been developed to predict the behavior of vehicles when traveling on bumpy surfaces
- Quarter car model is the one used to convert laser measured surface profile to IRI
- IRI is: the vertical movement of your axle (in inches) when you travel a fixed distance (in miles)



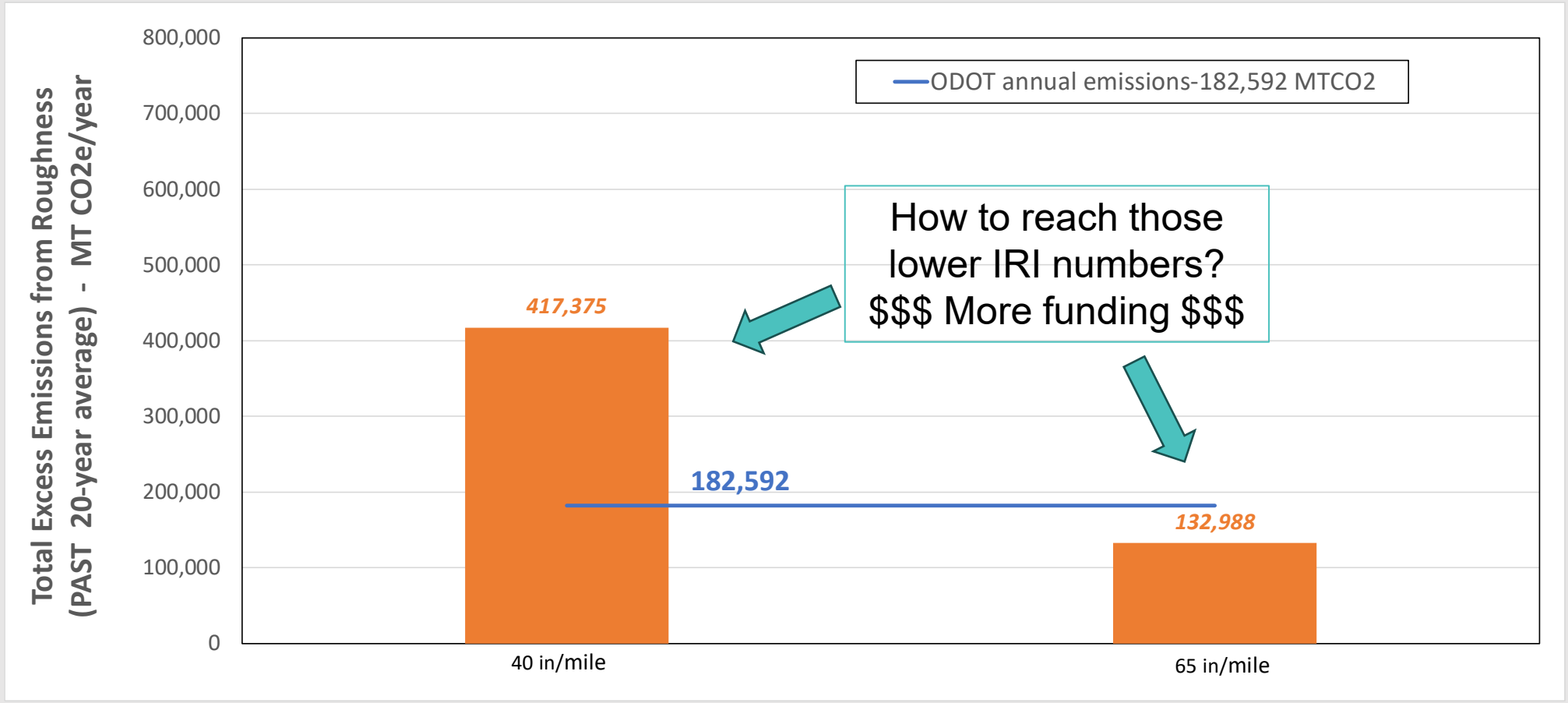


Yang et al. (2022)

CO2 Emission Outputs for the Analysis Conducted for the Past 20 Years – What If Scenarios

How much CO2 emission savings could have been created if the average IRI for the ODOT roadway network were 40in/mile and 65in/mile for the past 20 years?

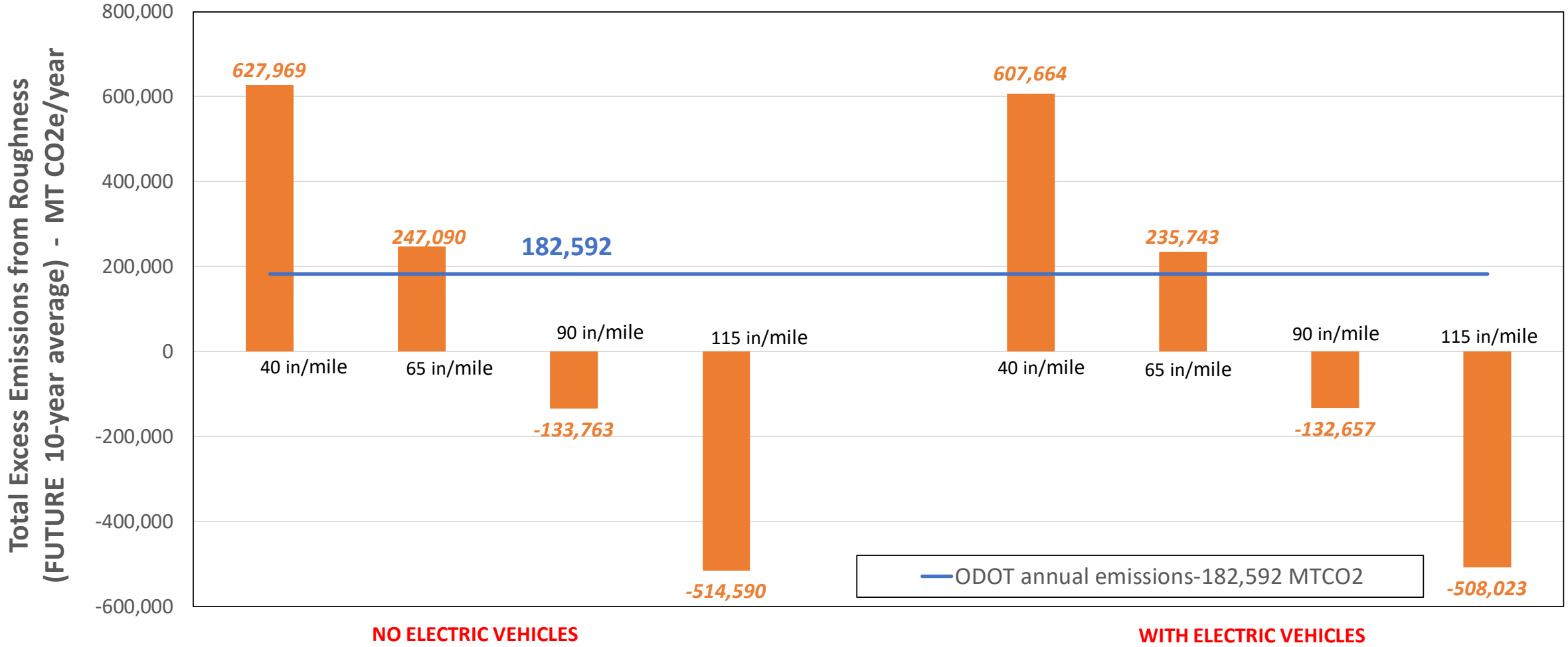
Our baseline is ODOT's actual roughness values in the PMS.



CO2 Emission Outputs for the Analysis Conducted for the Future 10 Years – What If Scenarios

Our baseline is “do nothing” to improve the roughness next 10 years.

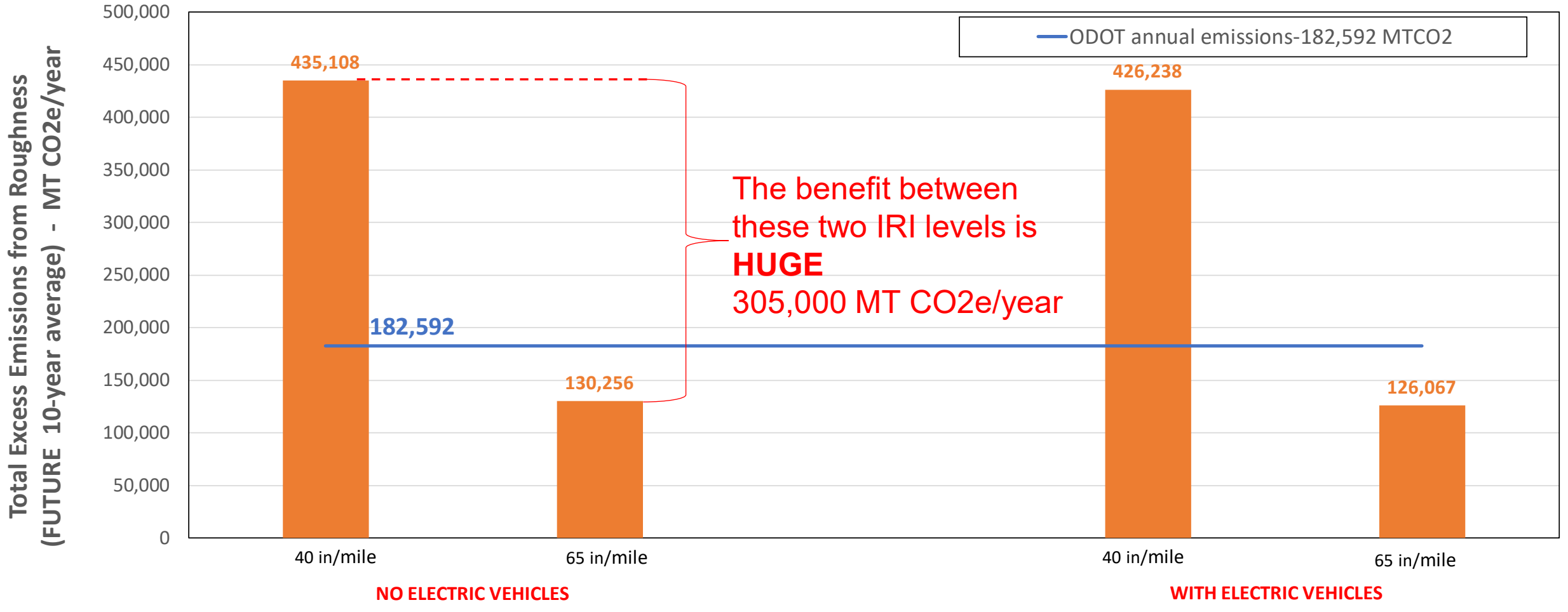
What would be the CO2 savings if we can keep the roadway network at Xin/mile IRI level next 10 years?



CO2 Emission Outputs for the Analysis Conducted for the Future 10 Years – What If Scenarios

Our baseline is “do nothing” to improve the roughness next 10 years.

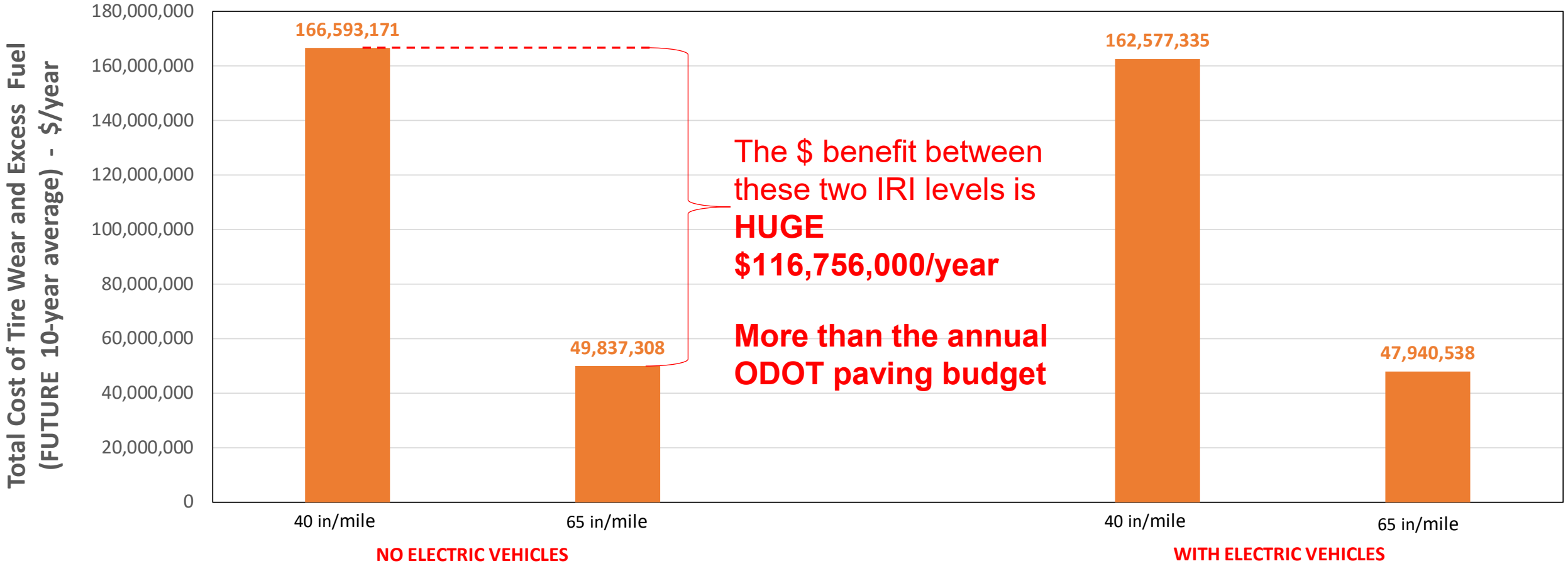
What would be the CO2 savings if we pave 5.6% of the highest traffic roadway network to reach Xin/mile IRI annually?



CO2 Emission Outputs for the Analysis Conducted for the Future 10 Years – What If Scenarios

Our baseline is “do nothing” to improve the roughness next 10 years.

REDUCING EMISSIONS IS GREAT!!! HOW ABOUT THE SAVINGS FOR THE TAX PAYERS?



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