BENCHMARKING GROUP OF
NORTH AMERICAN LIGHT RAIL SYSTEMS

# The State of Light Rail Transit in America

**2018 APTA Rail Conference Presentation**

June 2018

Imperial College
London

# Presentation Agenda

- **Who are we :**
  - **Imperial College/Railway & Transport Strategy Centre**
  - **GOAL, the Benchmarking Group of North American Light Rail Systems**
- **An Overview of the Characteristics of Light Rail in North America**
- **Impacts of Characteristics on Operational Performance**

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# Introduction to the Railway and Transport Strategy Centre

# International Benchmarking: Eight Public Transit Groups – Benefits Drive Continued Participation

**Imperial College London**

**Railway and Transport Strategy Centre**

| CoMET | Nova | IBBG | ISBeRG |
|---|---|---|---|
| Community of Metros | Group of metros | | |
| Founded 1994 | Founded 1998 | Founded 2004 | Founded 2010 |
| 18 Members, including New York, London, and Hong Kong | 20 Members, including Rio, Toronto, and Barcelona | 15 Members, including Dublin, Montreal, Paris, and Singapore | 14 Members, including Munich, Tokyo, and Sydney |

| ABBG | GOAL | International Mainline Rail | Railway Infrastructure |
|---|---|---|---|
| Founded 2011 | Founded 2016 | Founded 2016 | Founded 2016 |
| 22 Members, including Austin, Cleveland, and Rhode Island | 11 Members | 6 Members, with Norway, Belgium, Netherlands, and Australia | 4 members, initially in Australia |

# Benchmarking is the Search for Best Practices That Lead to Superior Performance

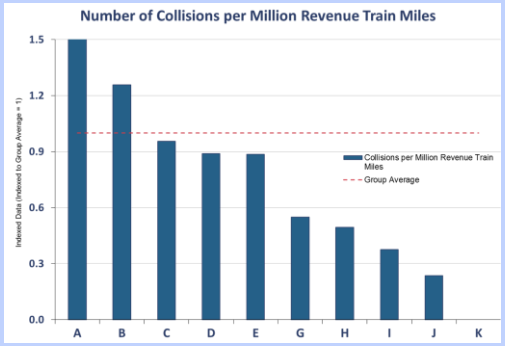
## Benchmarking Is:

**A systematic process of *continuously* measuring, comparing and *understanding* performance and *changes* in performance**

**Of a diversity of key business processes**

**Against comparable peers**

**To help the participants improve their performance**




*(Adapted from the definition by Lema and Price)*

## Benchmarking Provides:

- **Perspective through Data:**
  - How do we **compare** to our peers?
  - What are our **strengths**?
  - What are our **weaknesses**?
  - Quantitative Backing for "rules of thumb"
- **Best Practices through Discussion:**
  - What are others doing to **improve**?
  - What **works**/what doesn't?
  - How to **implement best practices**.

*"Rarely is there a challenge that someone else hasn't faced…"*

# Benchmarking Methodology – Normalization Options Adjust for Different Contexts, Including 'Extreme' Data Differences

| | Min | Max | | | | |
|---|---|---|---|---|---|---|
| Vehicle Weight | **40 Tons** | **70 Tons** | Total Ton Miles | Total Vehicle Capacity Miles | | |
| Layover & Deadhead Percentage | **11 percent** | **33 percent** | Revenue Vehicle Capacity Miles | | Total Vehicle Hours | Revenue Vehicle Hours |
| Vehicle Planning Capacity | **104 People** | **181 People** | | Revenue Vehicle Miles | | |
| Average Commercial Speed | **7.6 MPH** | **22 MPH** | Revenue Vehicle Hours | | | |
| Passenger Trip Length | **1.5 Miles** | **8 Miles** | Passenger Boardings | Passenger Miles | | |
| Train Length | **1 vehicle / 50 Feet** | **5 vehicles / 400 Feet** | Vehicle Miles | Train Miles | Train Hours | Vehicle Hours |

# GOAL Key Performance Indicator System

## Growth & Learning

**G1** **Passenger Boardings, Car Miles & Hours** *(5-yr % change)*
**G2** **Passengers per Revenue Mile & Hour** *(car & train)*
**G3** **Staff Training** *(by staff category)*

## Customer

**C1** **On-Time Performance** *(% of departures, 0 <> +5 min)*
**C2** **Headway Regularity (to come)**
**C3** **Delay Minutes** *(passenger & train)*
**C4** **Passenger Miles per Revenue Capacity Mile** *(seat & planning)*
**C5** **Capacity Miles per Route Mile**
**C6** **Percent of Trips Operated**

## Internal Processes

**P1** **Peak Fleet Availability & Utilization** *(not used by cause)*
**P2** **Staff Productivity** *(train or car miles or hours / labor hr)*
**P3** **Staff Absenteeism Rate** *(by staff category)*
**P4** **Mean Distance Between Technical Failures**
**P5** **Mean Distance Between Incidents** *(>5 min delay)*
**P6** **Lost Vehicle Miles** *(internal & external causes)*
**P7** **Percent On-Time Pull-outs** *(% of departures, later than 4:59)*

## Financial

**F1** **Total Operating Cost per Total Mile & Hour** *(car/train)*
(F2 service operation, F3 maintenance, F4 admin)
**F5** **Total Operating Cost per Passenger Boarding & Mile**
**F6** **Operating Cost Recovery** *(fare & other commercial revenue per operating cost)*
**F7** **Revenue per Passenger Boarding & Mile** *(categories)*
**F8** **Investment Rate** *(5yr rolling avg per operating cost)*

## Safety & Security

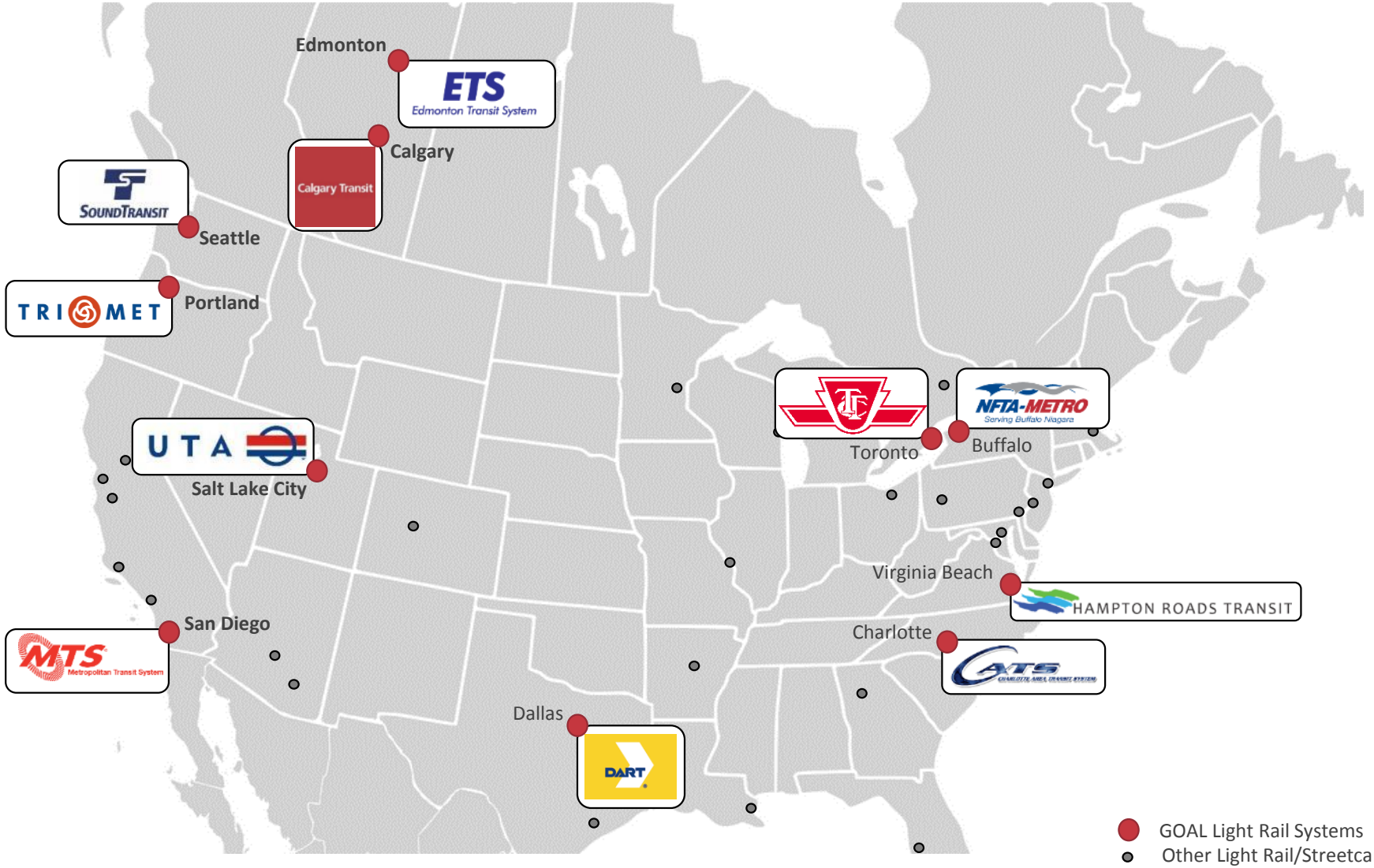
**S1** **Train Collisions per Train Mile & Hour** *(preventable, non-preventable)*
**S2** **Staff Injuries per Staff Work Hours**
**S3** **Staff Lost Time from Accidents per Staff Work Hours**
**S4** **Passenger Injuries per Boarding & Pax Mile**
**S5** **Incidences of Crime per Boarding** *(including station & on-board)*
**S6** **Signal Violations**
**S7** **Derailments** *(non revenue, revenue)*

## Environmental

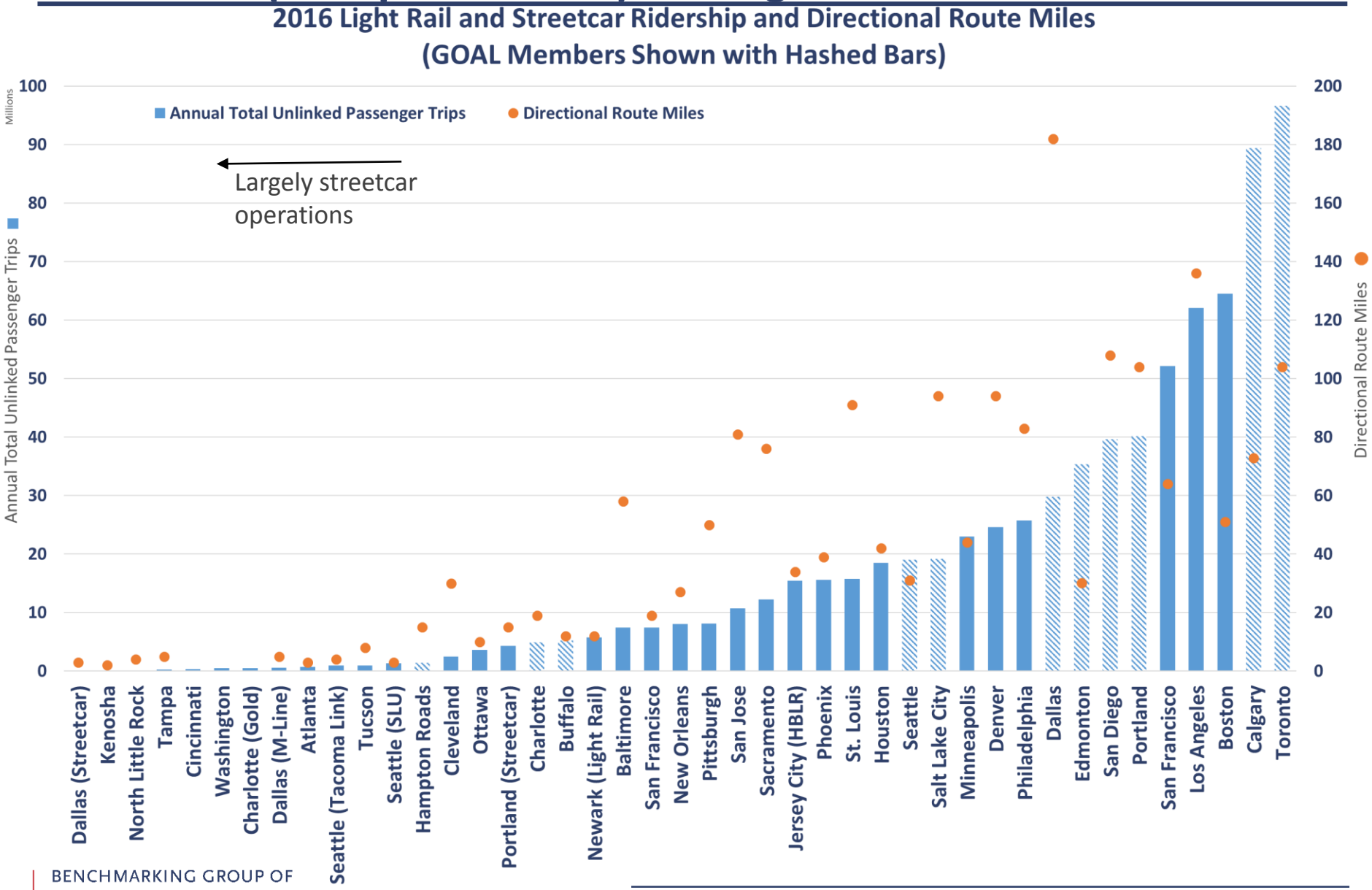
**E1** **Energy Consumption (Traction and Non-Traction)** *(per total car mile, pax mile, and capacity mile)*
**E2** **CO2 Emissions per Total Car Mile & Pax Mile**

# Introduction to GOAL

# GOAL: 11 Member Light Rail Systems Across North America – A Diverse Mixture of System Ages and Characteristics



# GOAL Covers Wide-Range of Light Rail Systems, from Smallest (Hampton Roads) to Largest Toronto

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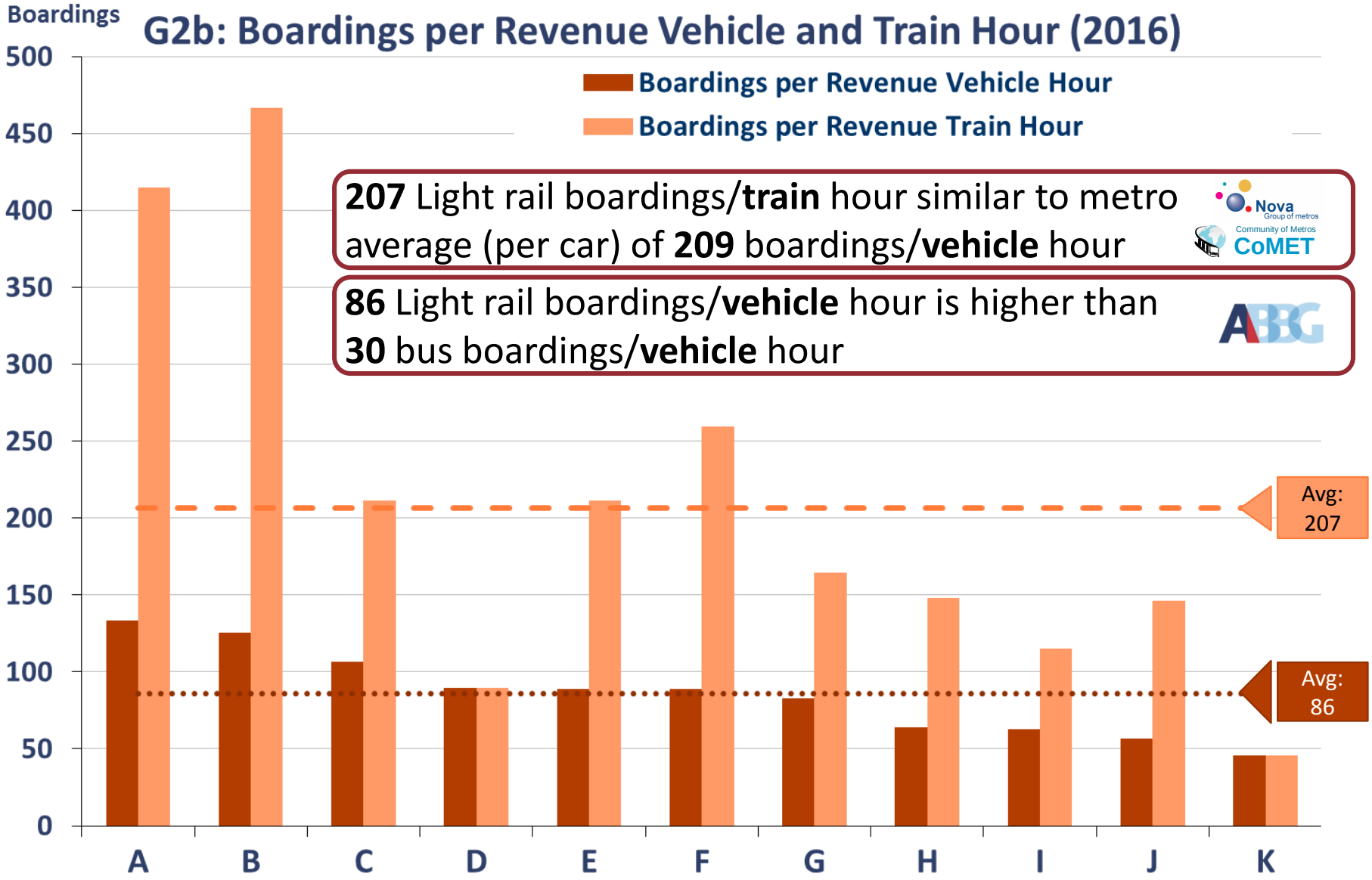
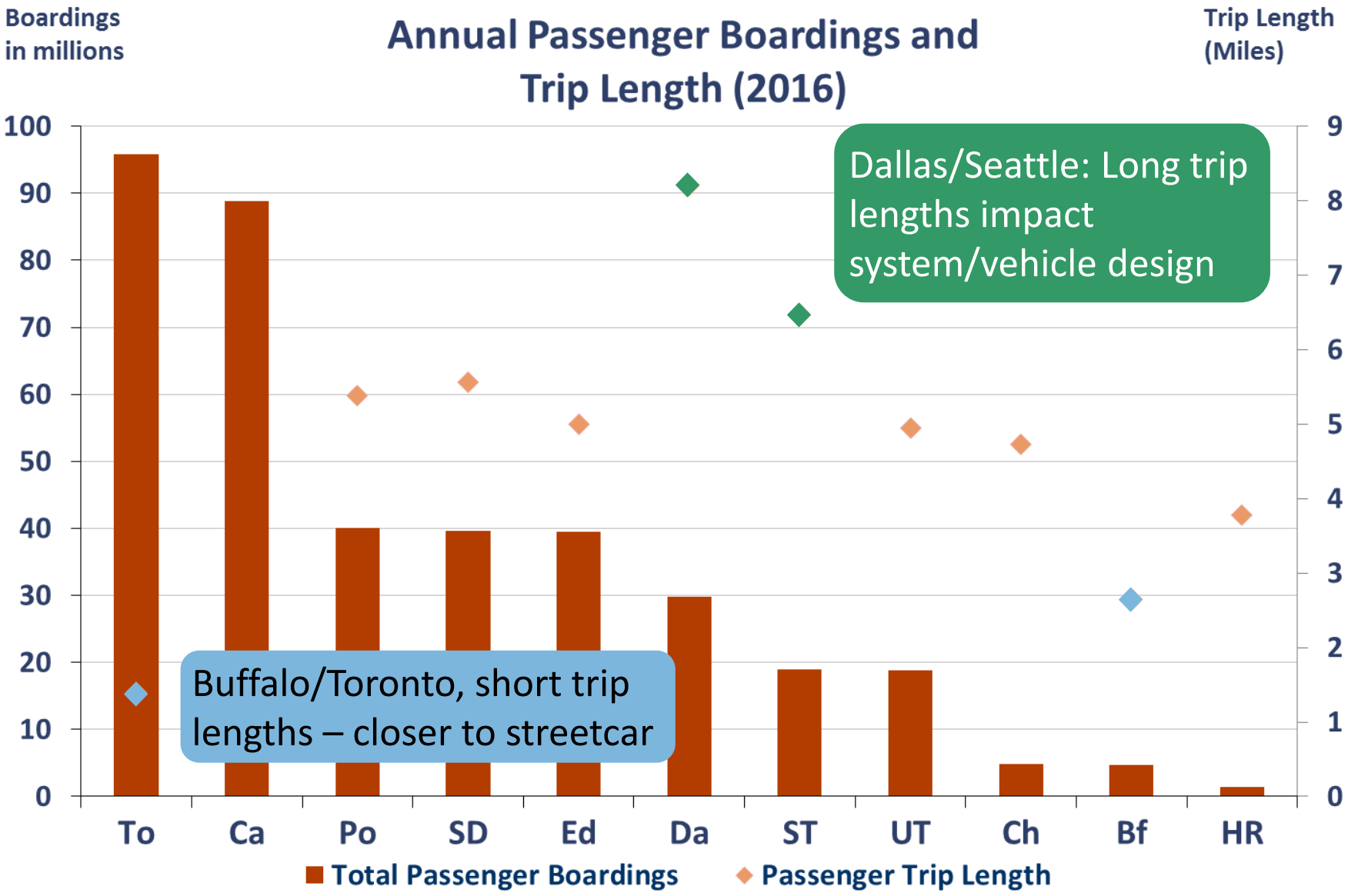
# Example KPI – Boardings per Vehicle / Train Hour: Range of Density, with Typical Light Rail Train Equal to a Metro Car



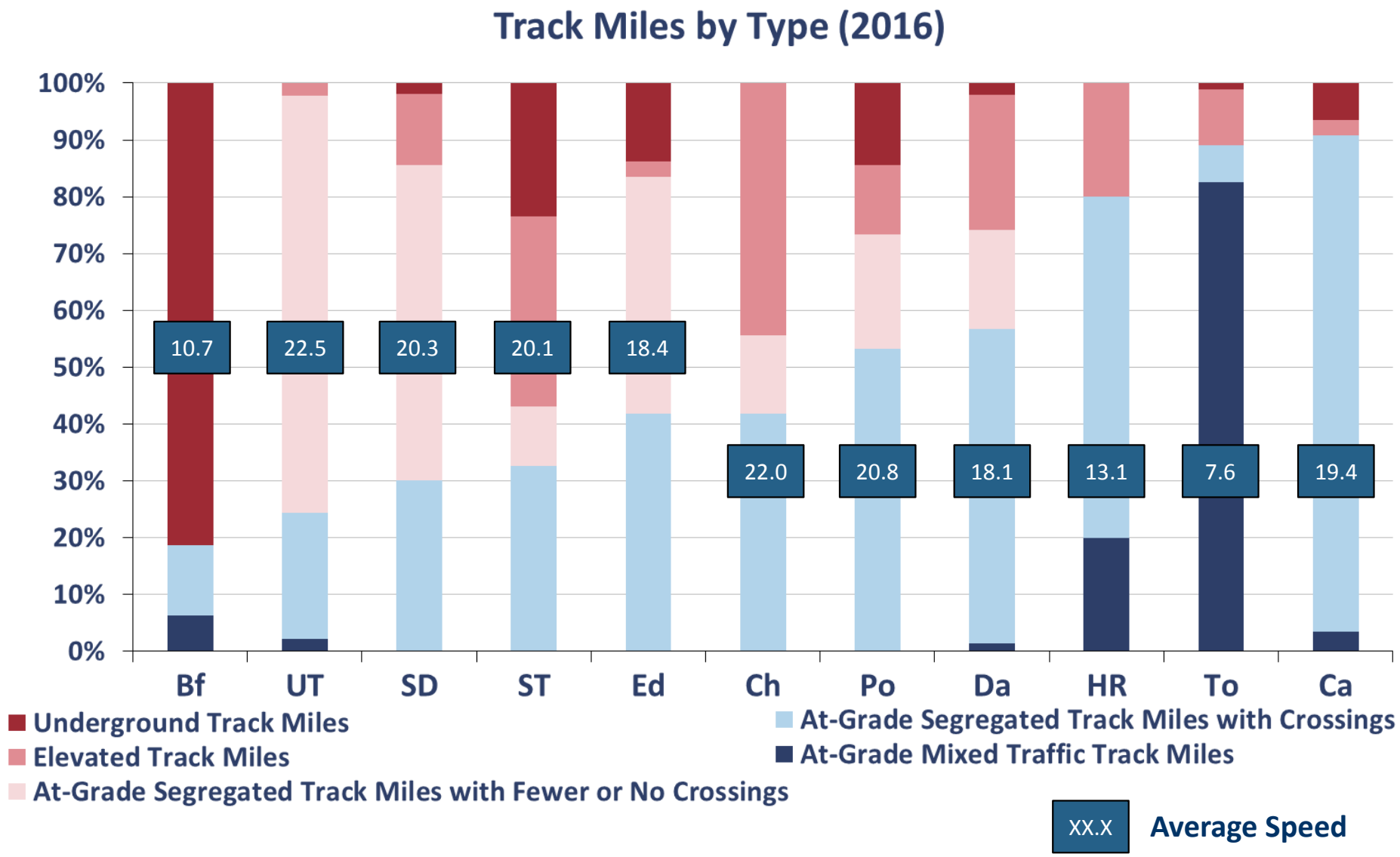

**207** Light rail boardings/**train** hour similar to metro average (per car) of **209** boardings/**vehicle** hour

**86** Light rail boardings/**vehicle** hour is higher than **30** bus boardings/**vehicle** hour

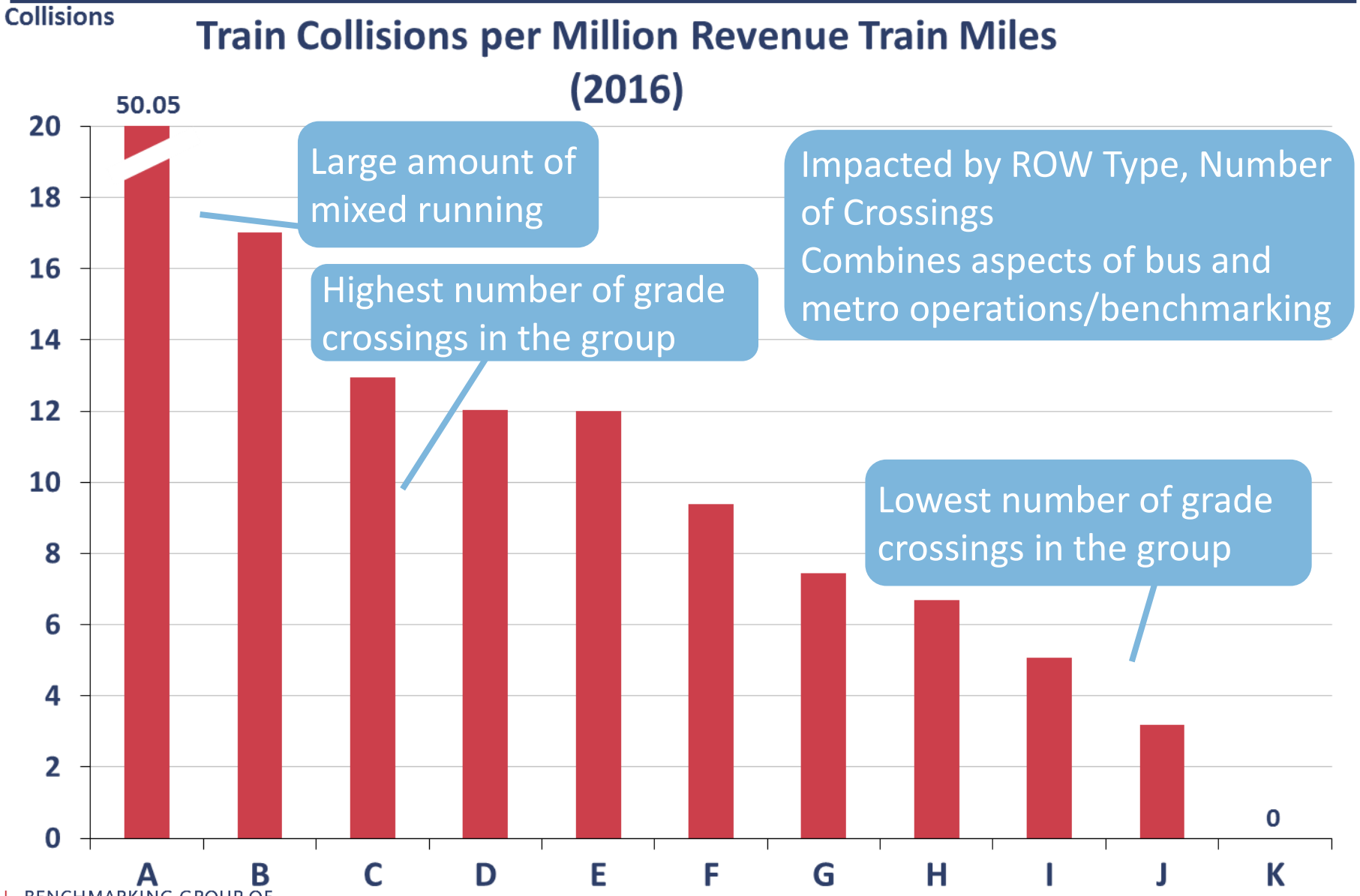
# Context - Ridership: Wide Range, but Normalization Allows for Direct Comparison of Different Sized Agencies



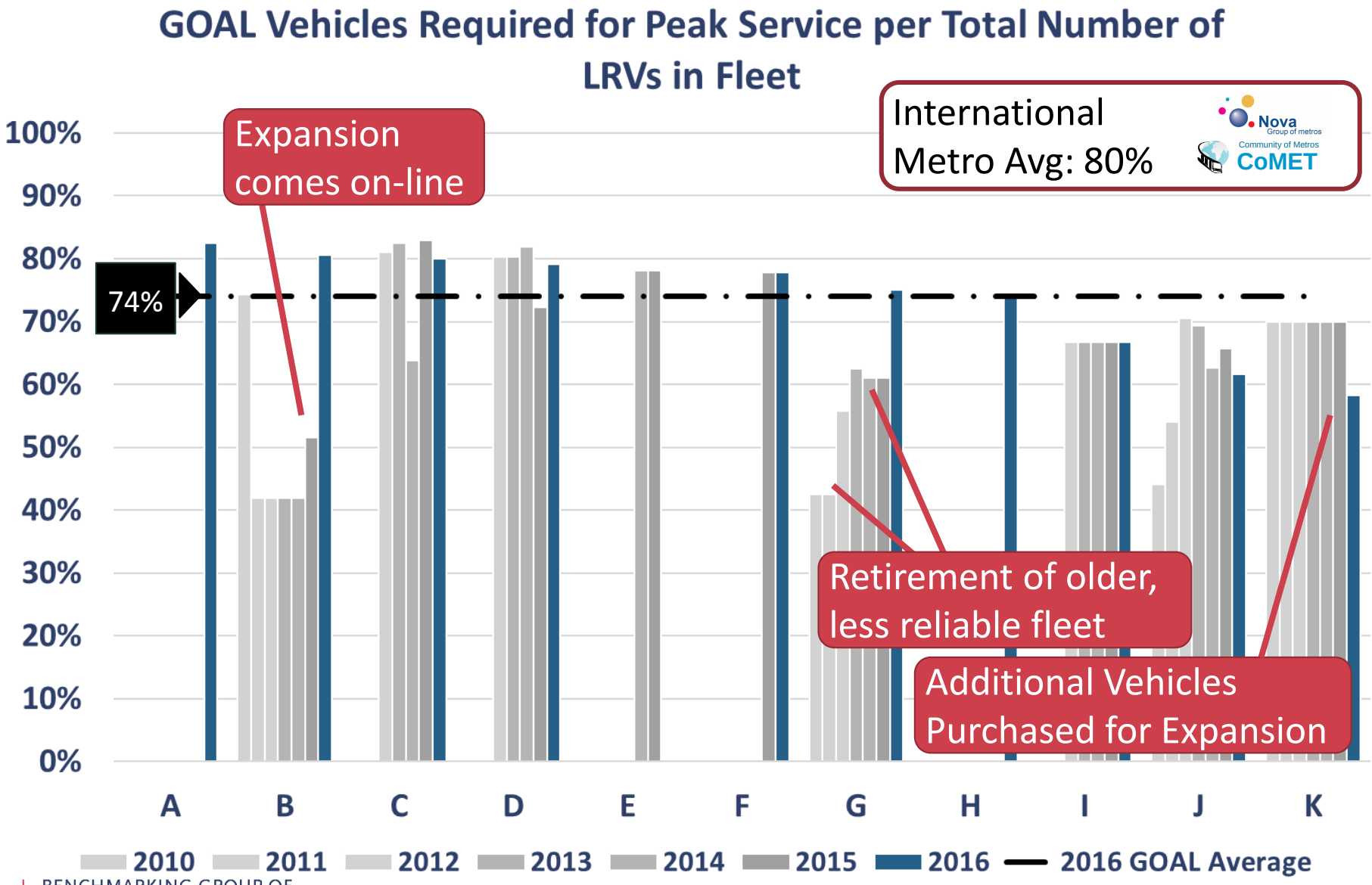
# Context: Network by Type – Broad Comparability Across the Group with Primarily At-Grade Segregated Running



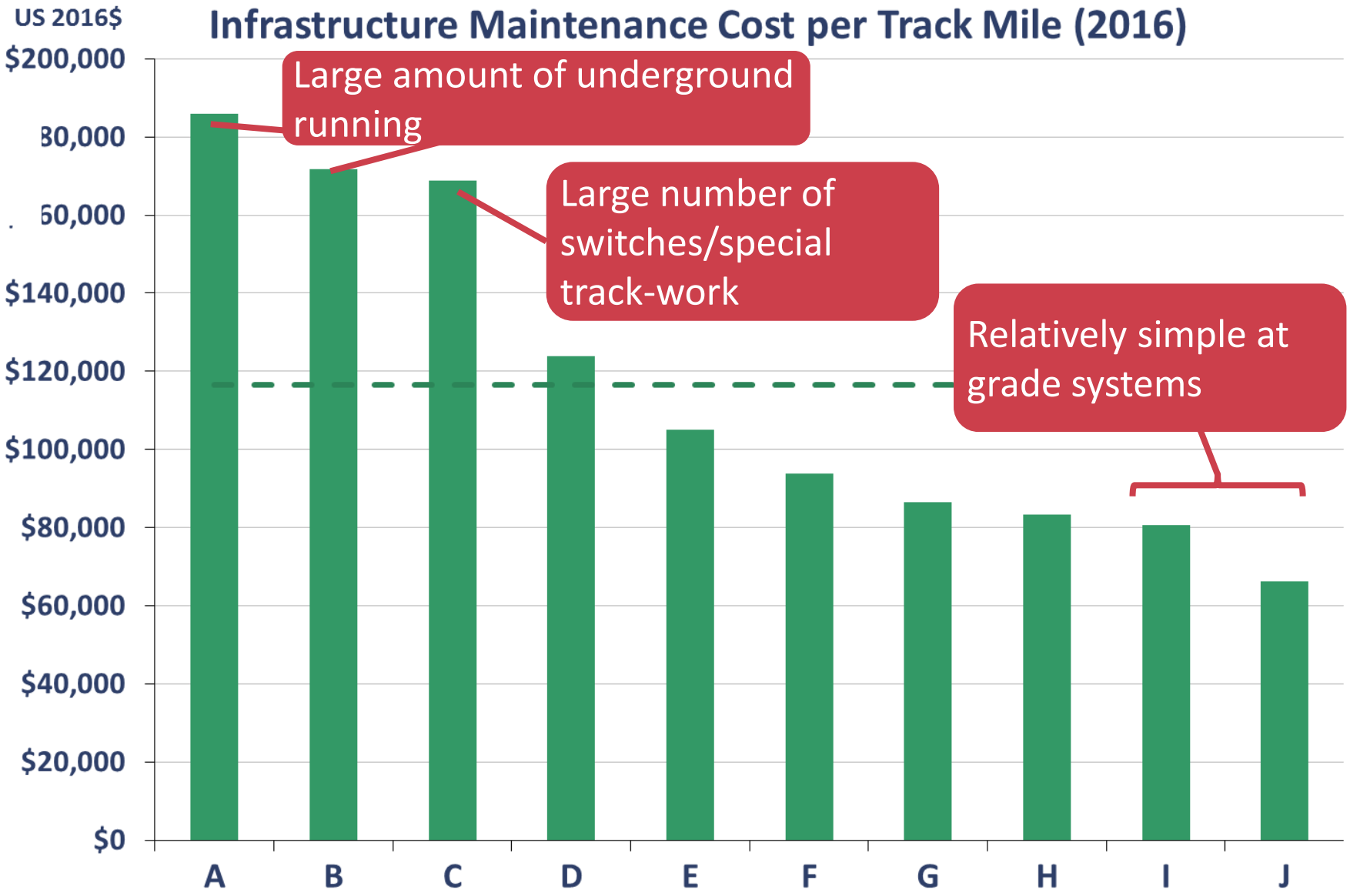
# KPI Example: Collisions per Revenue Train Miles – Impacts Safety, Vehicle Availability, Cost



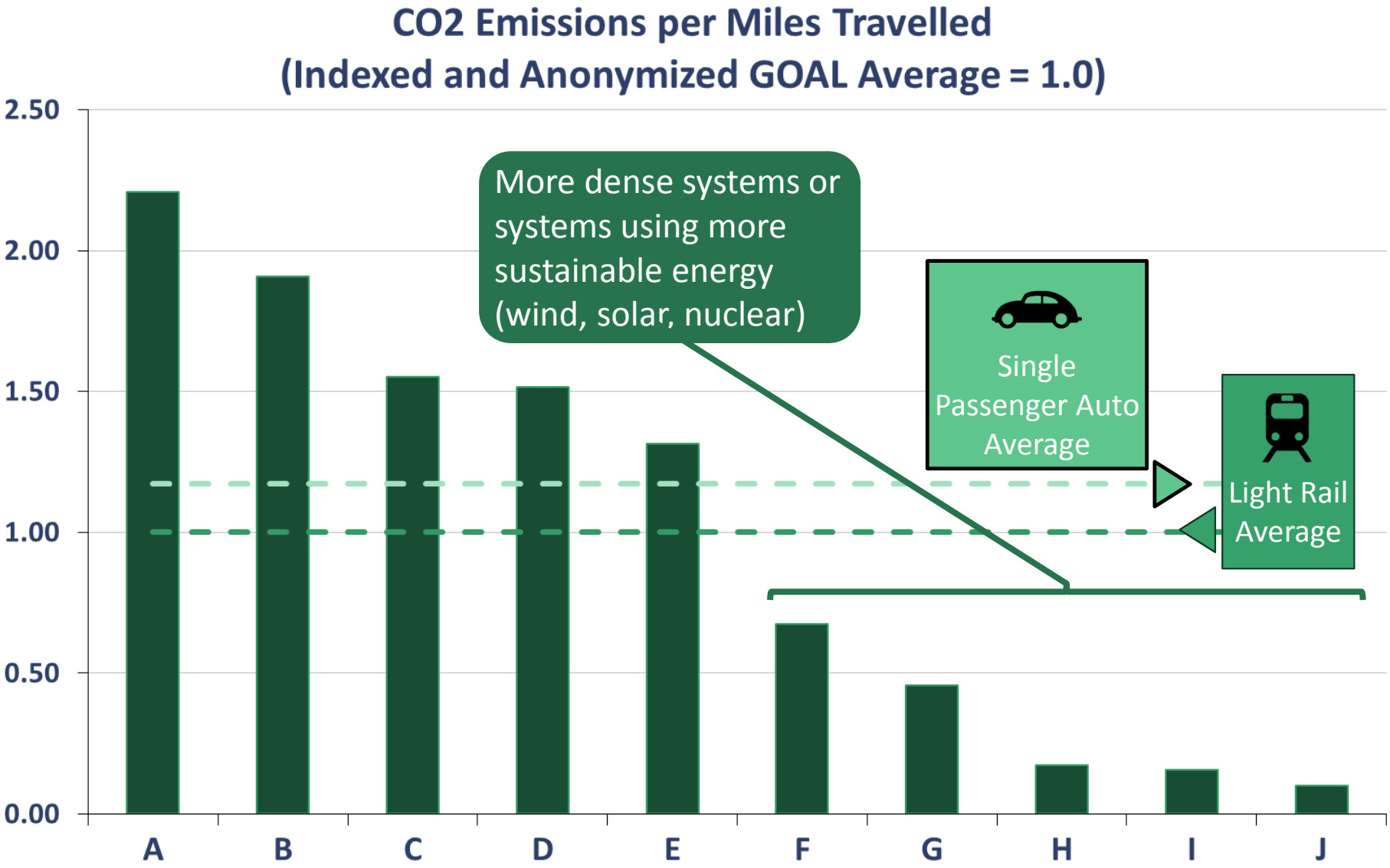
# KPI Example: Fleet Required for Peak Service – Reflects Service Levels, Fleet Availability, Age



# KPI Example: Influence of Infrastructure Complexity on Maintenance Costs

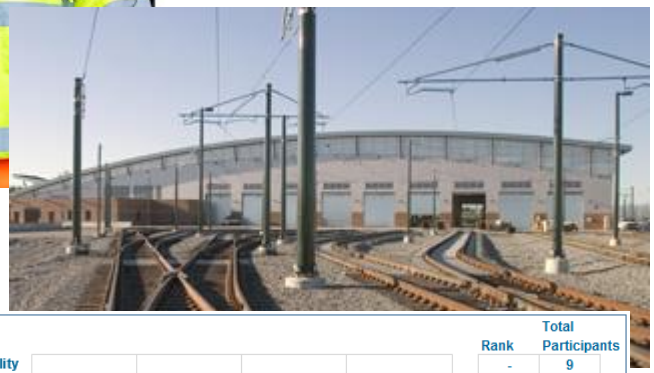


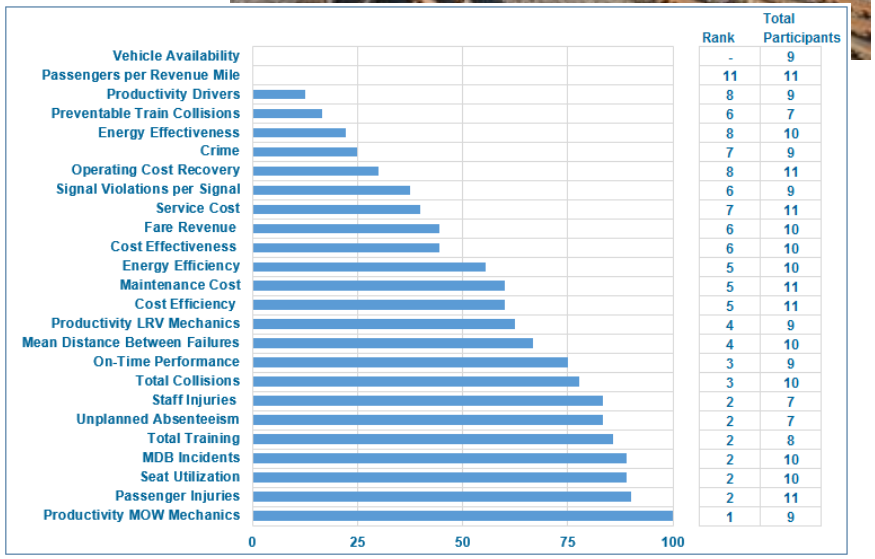
# KPI Example: Indexed and Anonymized KPI – CO2 Emissions for Light Rail vs Personal Automobile



# Examples of Benefits Identified Through Benchmarking

- **Member 1: Adjust supervision levels for LRV Operators**
  - Used a small study that looked into supervision levels and practices across the group
- **Member 2: Increase funding/staffing for LRV maintenance**
  - Use KPI data to understand how much comparable members spend on maintenance per vehicle, how many LRV mechanics per vehicle as well as mean-distance between failures
- **Member 3: Identify areas for operational focus**
  - Use dashboards to understand relative performance among members on KPIs and areas of improvement





# Thank You! Any Questions?

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