I-70 EAST CORRIDOR
Environmental Impact Statement

Commuter Rail Vehicle Definitions

Different types of commuter rail technology vehicles are being studied to determine which one will be the best overall for both the East Corridor and the rest of the RTD transit system. Two commuter rail vehicles are recommended to remain under consideration for the East Corridor, and are compared on the following exhibits. These vehicles include:

- ***DIESEL MULTIPLE UNIT (DMU)***
- ***ELECTRIC MULTIPLE UNIT (EMU)***

COMMUTER RAIL

DMU

Proposed - Portland/Wilsonville Oregon

DIESEL MULTIPLE UNIT (DMU)
Self-propelled diesel passenger cars
- Diesel motor powers railcar, no locomotive required
- Single car operation or multiple-unit trains of up to 12 cars
- Power cars have motors, passenger cars are unpowered

EMU

Montreal - Deux Montagnes

ELECTRIC MULTIPLE UNIT (EMU)
Self-propelled electric passenger cars
- Electricity from overhead wires or electrified third rail*, no locomotive required
- Single car operation or multiple-unit trains of up to 10 cars
- Power cars have motors, passenger cars are unpowered

What does this mean?

* Based on community concerns regarding pedestrian safety adjacent to tracks and at crossings, third rail operation is not considered for FasTracks corridors.

Commuter rail vehicles evaluated for FasTracks corridors are **compliant** -- they meet Federal Railroad Administration (FRA) requirements for operation along freight railroads.
- Railcars designed to operate along railroad corridors
- Trains typically connect a downtown and distant neighborhoods or activity areas
- All day service

How does light rail transit compare?

RTD's existing light rail service has electric trains that operate in streets or in exclusive rights-of-way. They operate on electricity from overhead wires and have the ability to speed up and slow down quickly. The existing RTD light rail system operates with up to four cars per train.

I-70 EAST CORRIDOR
Environmental Impact Statement

Commuter Rail Vehicle Operating Characteristics

COMMUTER RAIL

	Operating Grade	Maximum Operating Speed (mph)
DMU	<3% 	SPEED 79
EMU	<4% 	SPEED 79

Why is this important?

GRADE - Operating grade is the design guideline for reliable performance.
- Electric vehicles can climb shorter, steeper grades but with some decrease in performance and lower speeds.

SPEED - Operating speed of commuter rail is limited by policy, track conditions, and corridor characteristics.
- Policy - Federal Railroad Administration (FRA) regulations may require lower speeds
- Track - Switch locations, weather, and curves reduce speeds
- Characteristics - Frequent roadway and pedestrian crossings and stations reduce speed

How does light rail transit compare?

Light rail vehicles like the ones RTD currently use operate on grades less than 4.6 percent and have a maximum operating speed of 55 miles per hour. Light rail vehicles can also turn along tighter curves like a downtown street for example.

I-70 EAST CORRIDOR
Environmental Impact Statement

Commuter Rail Vehicle Vibration and Noise

Vibration

- **How does vibration from rail service affect people and buildings?**
  - *Typical vibration effects may include detectable movement of building floors. More severe vibration may include rattling of windows, shaking of items on shelves, or a rumbling noise.*
- **How is vibration measured?**
  - *Vibration is measured by velocity decibels (VdB). Vibration velocity is affected by how fast a train or other vehicle is traveling; how close it is to an object, building, or person; and the conditions of the ground and/or soil.*
  - *The threshold where people feel vibration is 65 VdB.*
- **What are the typical sources of vibration?**
  - *Common vibration sources which people may feel or hear include construction equipment, airplanes, thunder, trains, automobile traffic, and trucks or buses.*
- **How much vibration does commuter rail produce?**
  - *Vibration values for commuter rail range from 75 to 85 VdB for a person or building fifty feet away.*
  - *Commuter rail is typically located farther from pedestrians or residences. Since commuter rail usually operates along tracks used by freight trains (which effect stronger vibration), resulting vibration may not be noticed.*

How does light rail transit compare?

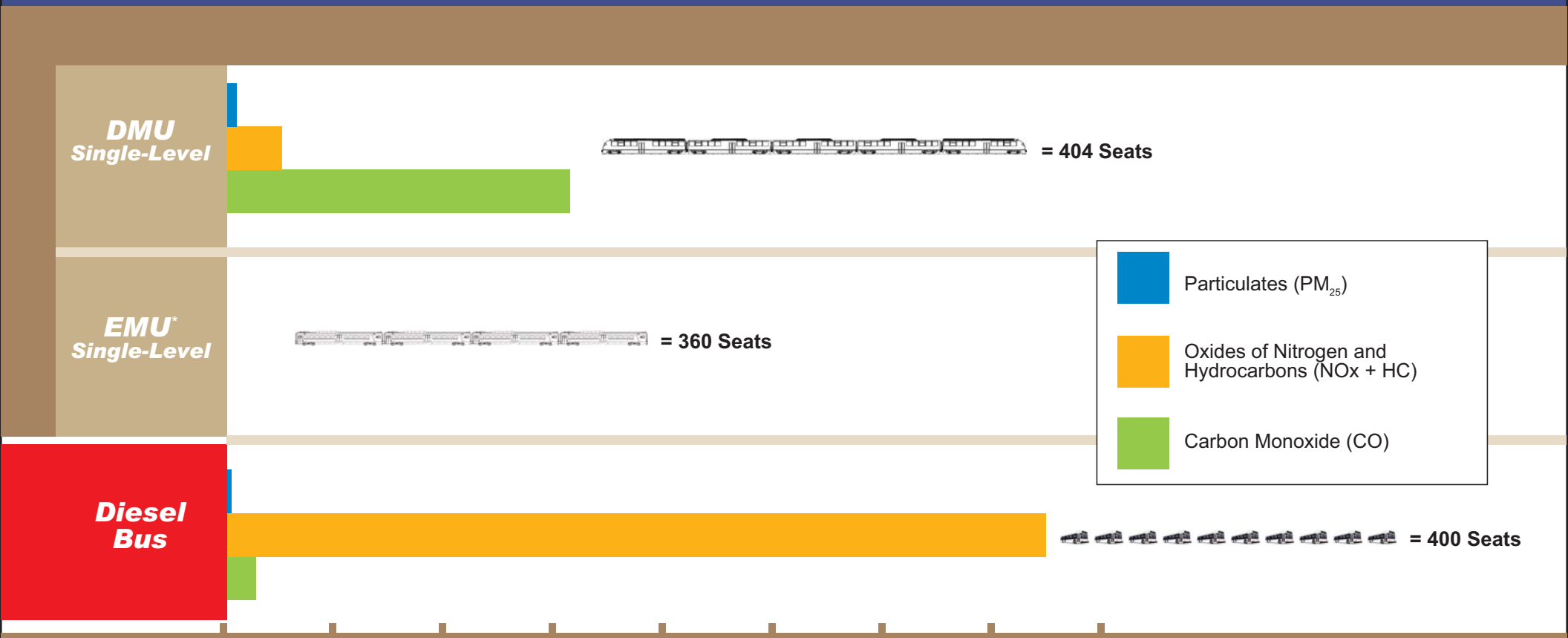
Light rail vehicles like the ones that RTD currently operate produce vibration levels of about 75VdB for a person or building fifty feet away. Light rail transit is typically located closer to pedestrians or residences than commuter rail.

Noise

- **How is noise from commuter rail measured?**
  - *Decibels (dB) are the unit by which noise levels are measured. Measured sound levels (in decibels) are usually weighted to correspond to the human range of hearing. A-weighted decibels (dBA) is the time weighted value for noise, it replicates what people can hear. Noise decreases with distance.*
- **How much noise does commuter rail or light rail produce as compared to other vehicles?**
  - *At fifty feet away from a person*
    - *a city bus measures 84 dBA*
    - *a heavy truck measures 90 dBA*
    - *a light rail vehicle measures 66 dBA*
    - *an Electric Multiple Unit measures 85 dBA*
    - *conversational speech measures 60 dBA.*
- **How does the Federal Transit Administration (FTA) decide when a train is too loud for nearby homes and people? What do they do to lower the noise?**
  - *The FTA groups noise sensitive land uses into three categories: Category 1, buildings and parks where quiet is an essential element of their purpose, Category 2, residences and buildings where people normally sleep; where nighttime sensitivity is very important. Category 3, institutional land uses with primarily daytime and evening use, such as schools, libraries, churches and active parks. FTA measures existing noise at a location, then models expected noise levels with the addition of rail and future traffic.*
- **What do they do to lower the noise?**
  - *Two levels of impact are included in the criteria: Moderate Impact and Severe impact. Noise mitigation is normally specified for severe impact areas unless there is no practical method to decrease the noise. Mitigation may include earth berms or noise walls.*

I-70 EAST CORRIDOR
Environmental Impact Statement

Commuter Rail Vehicle Air Quality



Emission in grams/round trip to provide 300 - 500 seats

What does this mean?

* Please note: All systems produce emissions. Electrified systems get power from a plant located elsewhere, so they may not have an impact locally but may have a regional impact.

PM_{25}, particulate matter smaller than 2.5 microns, is the emissions component affecting visibility. This standard will be in effect in 2011.

- Buses emit 60 grams per round trip, about three times of the amount of a single-level DMU.

NOx are oxides of nitrogen, and HC are hydro carbons. These elements combine in sunlight to form ozone (O_3), a key component of smog.

- Buses emit the highest amount, over 15,000 grams per round trip
- DMUs emit about 500 to 900 grams per round trip, 3% to 6% of the amount for buses

CO is a product of incomplete combustion from engines and a key component of DMU emissions.

- A single-level DMU emits the highest amount, over 5,200 grams per round trip
- Bi-level DMU trains emit about 2,800 grams per round trip, about half of the amount for single-level DMUs
- Buses emit the least amount, 660 grams per round trip, about 13% of the amount for single-level DMUs