

# Burlington Northern Santa Fe Corporation

## Railroads, Goods Movement and Air Quality, Next Steps

February 28, 2007

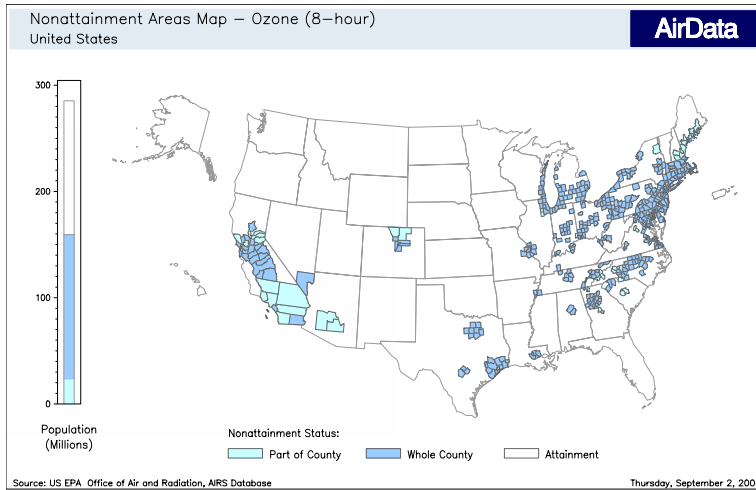


## Items of Future Significance

- 1998 CARB MOU for NOx reduction from locos
- 2005 CARB MOU for PM reductions
- CARB Cargo Handling Equipment Rules
- Ports Clean Air Action Plan
- USEPA Tier 3+ Locomotive Emission Rules
- California Goods Movement Plan and Bond Money
- Federal Transportation Bill
- Permitting of New Facilities
- Line Capacity Expansion



# Ozone Non-Attainment Areas



**BNSF**

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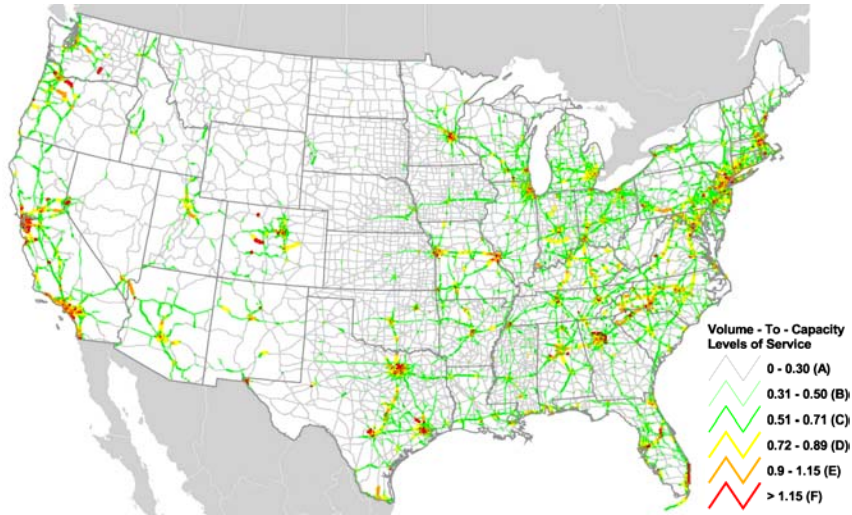
# US Railroad Intermodal Flows for 2002



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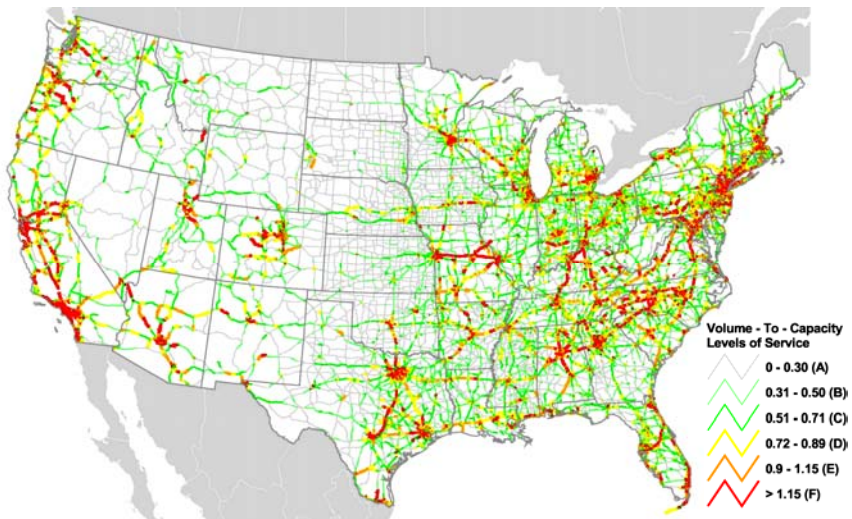
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# Congested Highways, 2000



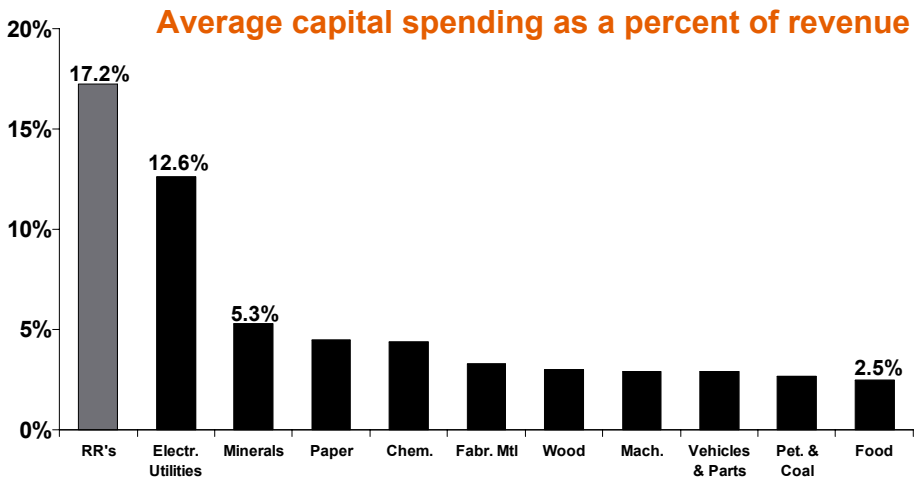
**BNSF**

# Congested Highways, 2020 predict



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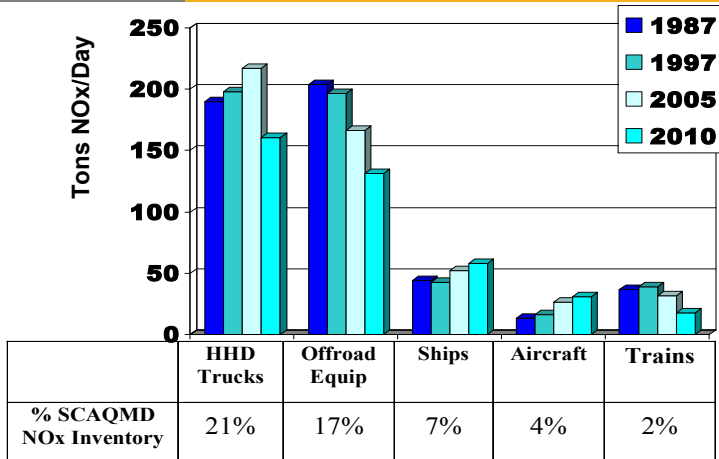
# Railroading Is Capital Intensive



Source: U.S. Census Bureau; EEI, AAR, Average 1996-2005 (Note: Utilities are 1999-2005)



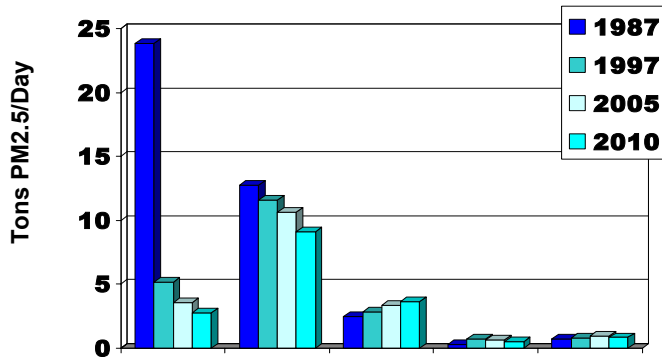
# Mobile Source NO<sub>x</sub> Inventories



Data Sources: SCAQMD AQMPs & Other Materials



## PM 2.5 Inventories



	HDD Trucks	Offroad Equip	Ships	Aircraft	Trains
% SCAQMD PM2.5 Inventory	2.4%	7.9%	3.2%	0.4%	0.7%

Data Sources: SCAQMD AQMPs & Other Materials



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## Railroad Emissions, a Unique Future

- 1998 CARB NOx MOU, some dedicated fleet required
- 2005 CARB PM MOU
  - Ultra low sulfur fuel 6 yrs earlier than EPA rules.
  - Health risk assessments
  - Community meetings
  - Visible emissions program
  - Idling requirements, manual shutdown for all locos and install equipment on intrastate locomotives
- Purchase of low emitting multi engine gen set locomotives



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## Nitrogen Oxides Emissions From A Very Large Intermodal Yards With Existing Equipment, baseline 2005

Nitrogen Oxides, in tons/year	
Very Large Intermodal Yard	
Locomotive Servicing	0
Switch Engines	75
Cargo Handling Equipment	363
Yard Tractors	165
Cranes	125
Forklifts	73
Main Line Train Operations	150
Total	588
Estimated Drayage Emissions	1743 tons per year



## Particulate Matter Emissions From Some Very Large Intermodal Railroad Yard With Existing Equipment, baseline 2005

Particulate Matter Emissions, 2.5 micron PM in tons/year	
Very Large Intermodal Yard	
Locomotive Servicing	0.0
Switch Engines	1.8
Cargo Handling Equipment	24.9
Yard Tractors	12.5
Cranes	7.5
Forklifts	4.9
Main Line Train Operations	3.5
Total	30
Estimated Drayage Emissions	28 tons per year



# Switcher Locomotives



## Green Goat® Locomotives

- “Hybrid” light-medium duty switcher
- Reduces fuel consumption and atmospheric emissions by 60 percent
- Emits 80 to 90 percent fewer pollutants than conventional train engines
- Batteries recharged by 290 HP EPA *off-road Tier 2* diesel gen set (significantly exceeds EPA locomotive Tier 2 requirements)

## Liquefied Natural Gas Locomotive

- BNSF operates the only four environmentally friendly liquid natural gas locomotives that reduce emissions and fuel consumption
- 1200 sustainable horsepower, spark ignited



## Multiple Gen Set Switcher

- Powered by multiple diesel gen sets with truck-like engines
- 700 sustainable horsepower from each gen set

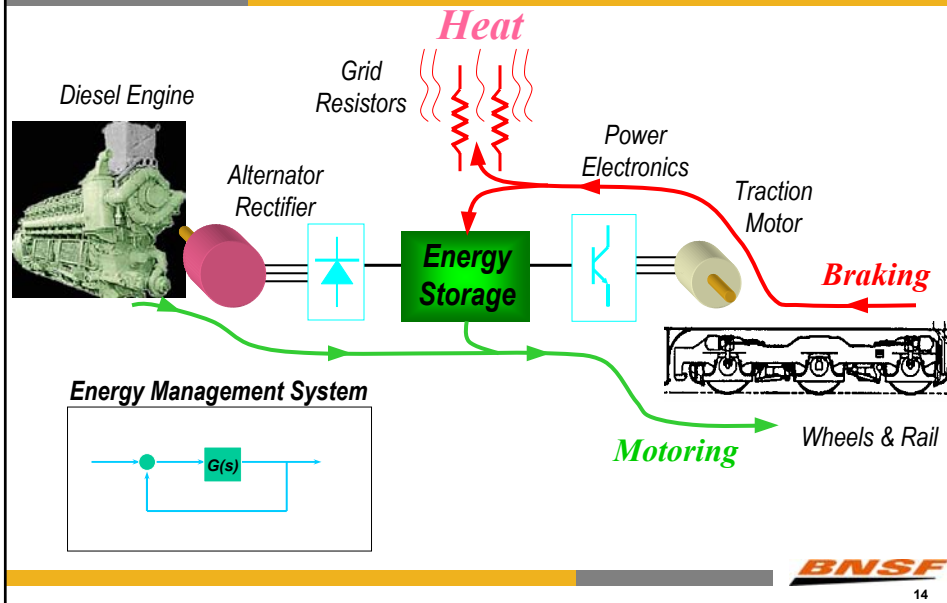


# Switch Engine Emissions in g/hphr EPA switch engine duty cycle

	1970 GP38 Style	EPA Tier 2 STDs	Green Goat	Spark Ignited LNG	Truck like Engines Now	Truck like Engines Future
NOx	17	8.1	3.8	1.4	3.0	1 ?
PM	0.42	0.24	0.11	0.09	0.11	.03 ?
HC	0.8	0.6	0.2	3.3	0.3	
CO	2.1	2.4	0.9	2.2		
Locomotive Cost			\$1.0 mil	\$2.0 mil	\$1.4 mil	\$1.6 mil



# Road Locomotive Hybrid Concept



## By the end of 2006

- Total fleet is 6600 locomotives
- Installed 3110+ locomotives with AES
- Retrofit 2200 locomotives to Tier 0
- Purchased 620 Tier 1 locomotives
- Purchased 600 Tier 2 locomotives
- 2260 more locomotives to retrofit to Tier 0
- 900 locomotives pre 1973 (not subject to retrofit)

## New Intermodal Yard Green Technology

- **Electric Rail-Mounted Gantry (RMG) cranes**
  - Reduced air emissions, noise and light
- **LNG (or equivalent) yard hostler tractors**
- **LNG, multi-engine or “hybrid” switch engines**
- **Low-sulfur fuel and idle shut-down feature for road locomotives**
- **Port controlled low emission drayage trucks**

