

## **Kirk Marckwald**

Association of American Railroads

### **Rail Issues 101**

Faster Freight – Cleaner Air Conference  
February 25, 2008



## **Setting the Context**

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- What are the some of the challenges of lowering emissions from the Goods Movement System?
- Elements of the Railroads' Environmental Improvement Program (1994-2008)
- What's new in the past year?
- What are the emerging locomotive emissions control technologies?
- What reductions have been achieved to date?
- Are the railroads doing their "fair share" to achieve aggressive emissions reductions?

## Southern California Goods Movement

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- In 2007, POLA and POLB handled 15.7 million TEUs
  - 5<sup>th</sup> largest in world and largest in US
  - 64% are international containers
- Up to 40,000 trucks daily on the I-710, I-605 and SR91
- 80 trains from LA to inland empire (50 on Alameda Corridor)
- 1.8 billion square feet of warehouse and distribution
  - Another 28 million square feet under construction (82% in Riverside and San Bernardino)

Sources: <http://www.portoflosangeles.org/>

<http://www.polb.com/>

[http://www.metro.net/projects\\_programs/mcgmap/](http://www.metro.net/projects_programs/mcgmap/) "Existing Conditions and Constraints"

## Why Does it Matter?

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- Provides one out of 12 jobs in Southern California (SCAG)
- Growing fast: container shipments are estimated to double over the next 15-20 years
- Major Contributor to Emissions Inventory
- Large portion of goods are “transshipped”
  - Adding road congestion to the region

\* Source: CARB Proposed Emission Reduction Plan for Ports and Goods Movement in California (3/21/06), Page 14

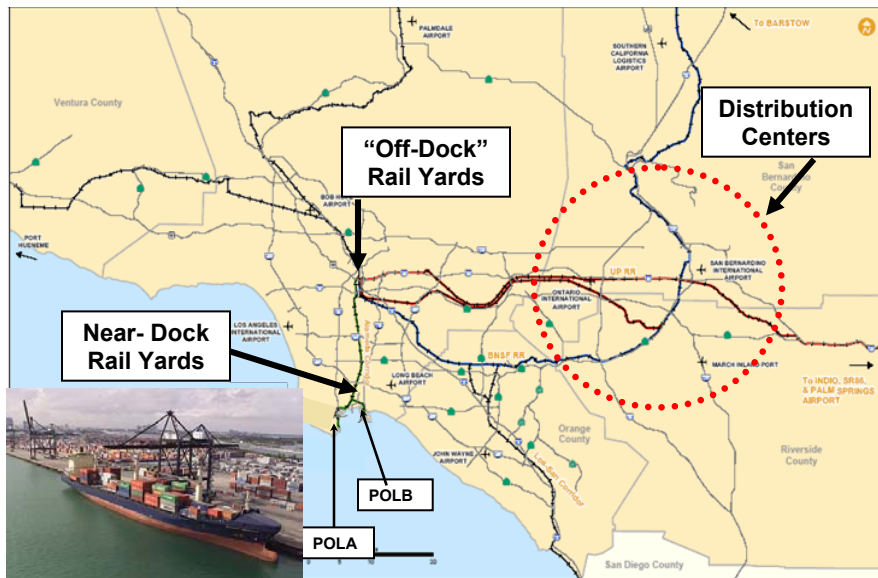
## Goods Movement Building Blocks



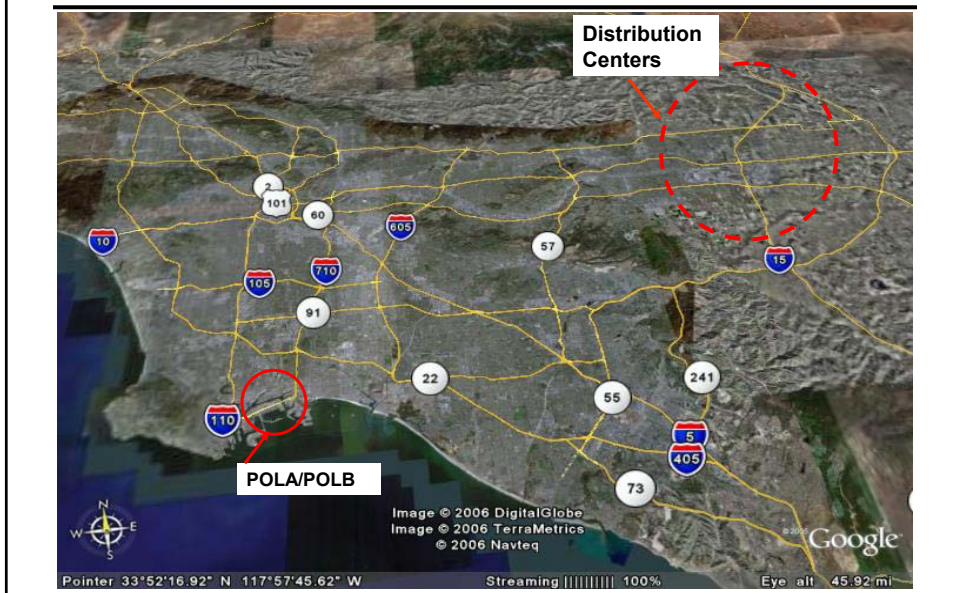
- Most goods arrive in Los Angeles in 40-foot marine containers
- However, a standard 53-foot domestic rail container has 60% more useable space and a standard 53-foot semi-trailer has 70% more useable space
- And because rail and truck rates are not directly related to box size, **there is a huge incentive to repack 40-foot marine containers into 53-foot domestic containers for trucks or trains as soon as possible in the region**

<http://www.ieor.berkeley.edu/People/Faculty/leachman-pubs/PortModal.pdf>

## The Challenge: Goods Movement Flow



## Another View



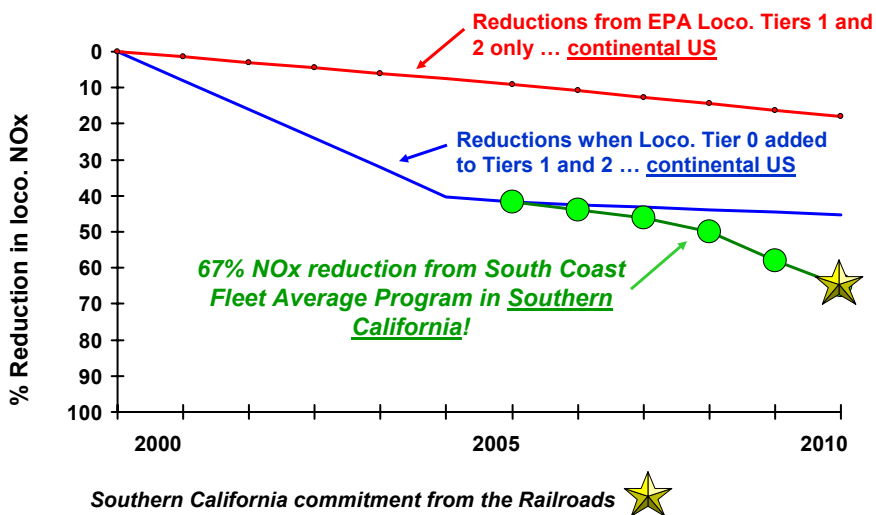
## Railroads Environmental Improvement Program (1994 – Present)

- 1994 – Supported the US EPA's standards for new and re-manufactured locomotives
- 1998 – Signed MOU with the ARB to ensure on average the cleanest and best locomotives would operate in Southern California by 2010
- 2000 – Created a \$5 million end-user research & development program for new particulate trap research at Southwest Research Institute
- 2005 – Signed MOU with ARB projected to reduce PM at statewide railyards 20% by 2008
- 2008 – US EPA to release new standards for both new and existing locomotives

## What's new since 2007?

- ARB staff determined both railroads are on target to meet all obligations under the 2005 MOU
- Health Risk Assessments for 9 railyards were released by the ARB
  - 7 more expected by the end of April 2008
- US EPA Rulemaking on Locomotives
  - Final expected by March 30<sup>th</sup>
  - Will mandate up to 90% reductions for NO<sub>x</sub> and PM
  - Will cover both new and existing locomotives
- BNSF partnership to develop a fuel cell locomotive
- Independent studies confirm benefits of using more rail to help reduce carbon emissions
  - About 1/3<sup>rd</sup> the emissions per unit of freight moved
- New truck rules by both the Ports and the ARB

## South Coast Fleet Average (1998 MOU)



## 2005 CARB/Rail MOU – Outcomes: 20% Reduction of Railyard PM by 2008

- Over 400 intrastate locomotives will be equipped with automatic shutdown devices with 15 minute idling limitation
- At least 80% of California fueling is low-sulfur
  - Six years earlier than required by federal regulation
- At least 99% of all locomotives will comply with stringent smoke regulations– a much higher rate than any other mobile source
- Health risk assessments will be carried out at the 16 major rail yards throughout CA

## How California MOUs Have Driven Air Quality Investments & Improvements

Locomotive Technologies	First Year Available	# of Units	% of CA Fleet	NOx Reduction from base line (per unit)	Incremental Air Quality Investment Nationwide to Date	CA Incremental Air Quality Investment Driven by MOUs by 2010	Are Other Mobile Sources Required to Do?
Mandatory Re-Build –Tier 0 (34% Complete Nationally)	2000	4938		30%	\$247 million		NO
Buy New Units – Tier 1	2002	1856		45%	[\$3.3 billion]		YES
Buy New Units – Tier 2	2005	1559		60%	[\$3.1 billion]		YES
Future Additional Line-haul Units to comply with 1998 MOU	2005	80				\$160 million	NO
Ultra Low-Emitting California Switchers in Service	2000	67	45%	80%		\$100.4 million	NO
Total ULEL California Switchers by 12/07	2005	91	60%	80%		\$ 136.5 million	NO
Automatic Shutdown Devices							NO
Line-haul units nationally (46% Complete)	2001	6451			\$24 million		
California units (Completed)		383	85%			\$ 7.8 million	NO
California units (Future by 6/08)		67	15%			\$ 1.3 million	NO
Incremental Air Quality Investment in California						\$ 305.5 million	

1998 MOU
  2005 MOU
  1998 and 2005 MOU

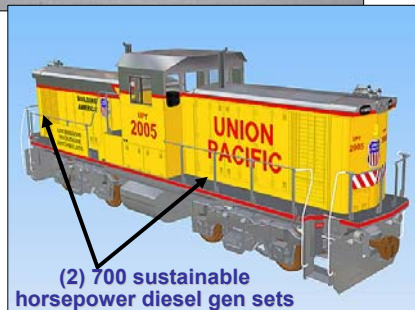
## Developing & Demonstrating New Technologies

- **Switch Locomotive Purchases:** By 12/07, at least 60% of units in Southern CA will emit at the ULEL rate
  - New “Gen-Set” switch engines using truck engine technologies
  - Hybrid switch locomotives (“Green Goats”)
  - Niche market for Spark Ignited LNG technologies
- **Line Haul Locomotive Purchases:**
  - 1,559 Tier 2 units as of November 2007
- **Research & Development**
  - Hybrid & Fuel Cell line-haul locomotives
  - Testing of OxyCats on 3800 hp line-haul units
- **Emission Reductions at Railyards**
  - Fume Hood Evaluation Program at Roseville
  - Health Risk Assessments at major railyards throughout CA
- **Remote Sensing Feasibility Evaluation to spot problem units**

## What near-term strategies & technologies are being implemented now in Los Angeles

- Dedicate/concentrate cleanest locomotives to service in CA ('98 MOU)
- Ultra Low-Emission switch locomotives
  - Hybrid Locomotives
  - Gen Set Switchers
- Development of retrofit particulate traps
- Expanded near dock rail
- More “on-dock” rail

*For more information: Go to  
BNSF Technology Exhibit  
on Monday*

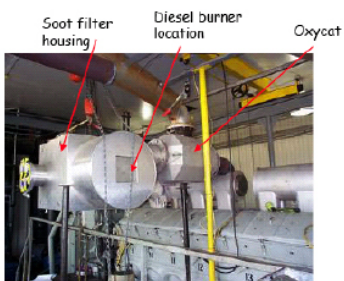


# Liquefied Natural Gas Switch Locomotive

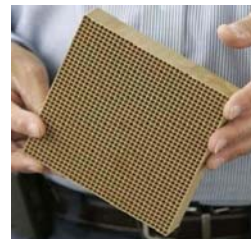
1200 sustainable horsepower, spark ignited



## Diesel Particulate Filter (DPF) R&D



- Railroads have been co-funding a \$5 million R&D project investigating performance durability and applicability of DPF to older switching locomotives
- R&D work being performed by Southwest Research Institute ("SwRI") through the Association of American Railroads
- One UP 1500 HP switcher equipped with DPF operating in Oakland
- One BNSF 1500 HP DPF equipped unit arriving to Southern California shortly



# What are Others Saying?



January 10, 2008

## BNSF Building Hydrogen-Powered Fuel Cell Locomotive

By Mike Hall  
The Capital-Journal

What may be the world's first hydrogen-powered fuel cell locomotive is being built in Top, promising a reduction in use of imported oil emission carbon dioxide that pollutes atmosphere.

And hydrogen-powered fuel cell locomotive would be much quieter than diesel locomotive.

centredaily.com  
CENTRE DAILY TIMES  
YOUR LIFE. YOUR PRICE. YOUR FINE PLACE.

Friday, Jan. 18, 2008

## Union Pacific Combines Strategic Energy Conservation and Technology to Reduce Emissions

OMAHA, Neb. — While automakers showcase prototypes of environmentally friendly vehicles during the North American International Motor Show, Union Pacific's green initiatives today are helping to reduce emissions through a mix of strategic energy conservation and new technology programs:

- Acquired newer locomotives and implemented operational changes leading to a double-digit improvement in fuel efficiency;
- Created and deployed the Fuel Masters



# Are the Railroads Doing Their "Fair Share"? Yes

	Trucks	Off-Road Equip.	Ships	Aircraft	Urban Buses	Locomotives
<b>Inventory**</b>						
<b>NOx</b>	29%	17%	13%	2.4%	2%	2.7%
<b>PM</b>	3.2%	7.5%	6%	0.5%		0.8%
<b>Standards for New Units</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Retrofit Existing Units</b>	No	No	No	No	Yes	Yes
<b>Rebuild to Standards</b>	No	No	No	No	No	Yes
<b>NOx Fleet Avg. in SCAQMD</b>	No	No	No	No	No	Yes
<b>Statewide PM 2005 MOU</b>	No	No	No	No	No	Yes

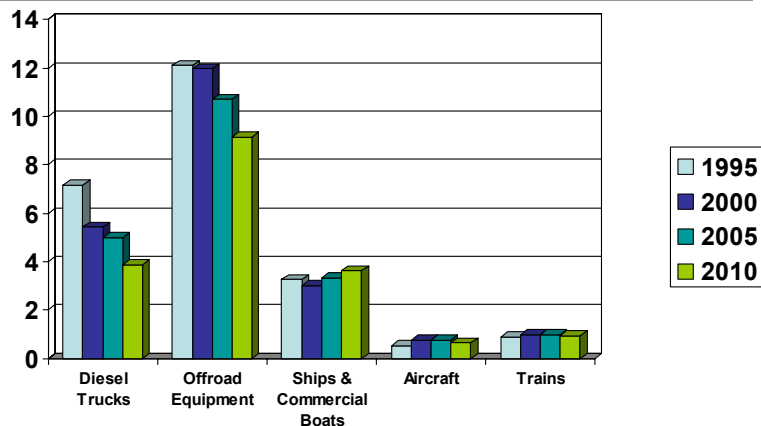
(\*\*South Coast AQMP Inventory 2010)

**Does the ARB believe that risks of diesel PM from railyards will be reduced between 2005-2010? **Yes****

Sources	Emissions (tpy) & Reductions			
	2005 (Base)	2010	% Reduction	Strategy
Through Trains	10	5	50%	'98 MOU
Switcher Locomotives	7	0.7	90%	'98, '05 MOU, CARB Diesel
Loco Refueling	2	0.5	75%	'98, '05 MOU
Cargo Equipment	34	13.6	60%	ARB Rule
Container Truck	7	0.7	90%	Bond Funding
<b>Total</b>	<b>60</b>	<b>20</b>	<b>65%</b>	

Based on chart the California Air Resources Board staff presented at the 1/27/06 ARB Meeting

## South Coast Basin PM2.5 Inventories

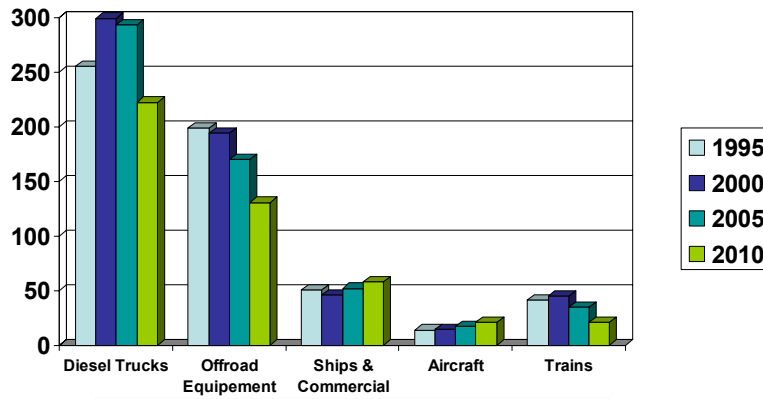


2005	Diesel Trucks	Offroad Equip	Ships	Aircraft	Trains
% SCAQMD NOx Inventory	3.2%	7.5%	5.6%	0.5%	0.8%

Data Source: ARB – Almanac Emission Projection Data (Published in 2005).

Diesel Trucks – LHDD1, LHDD2, MHDD, HHDD

## South Coast Basin NOx Inventories

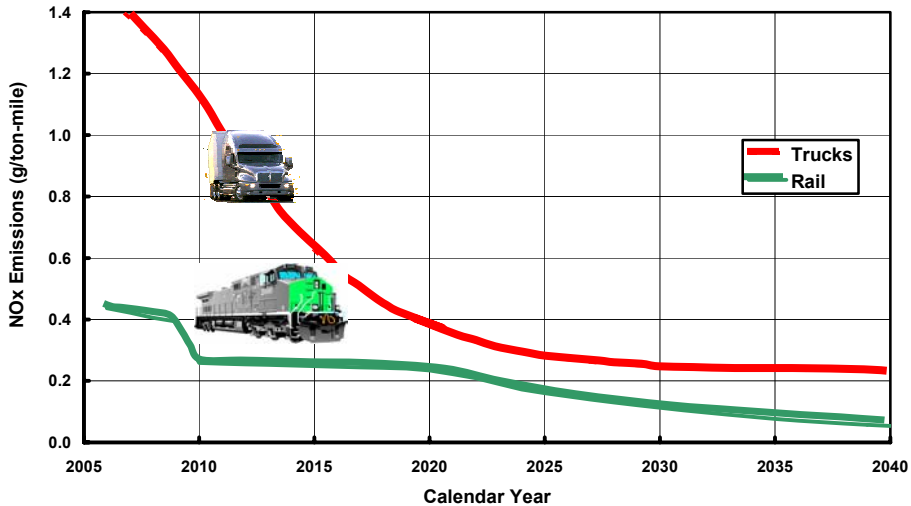


2010	Diesel Trucks	Offroad Equip	Ships	Aircraft	Trains
% SCAQMD NOx Inventory	28.5%	16.7%	12.6%	2.4%	2.7%

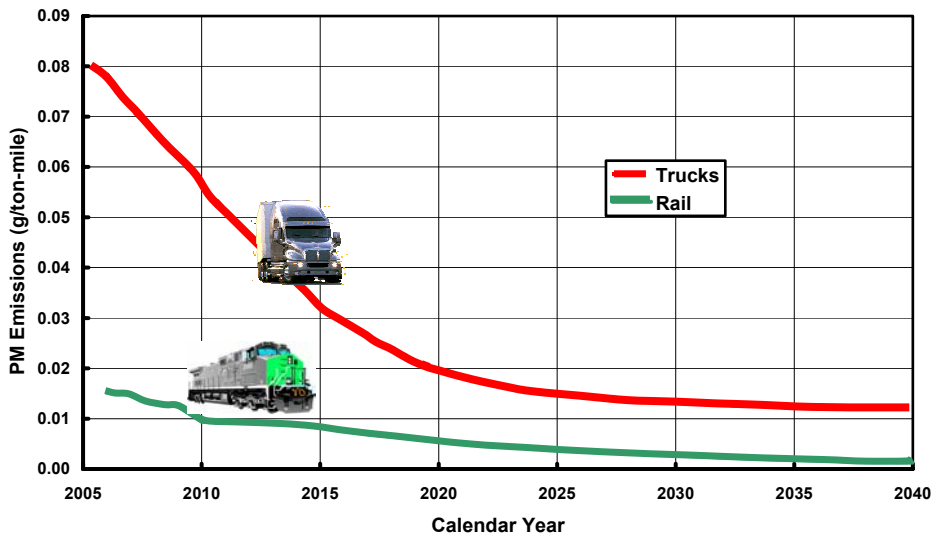
Data Source: ARB – Almanac Emission Projection Data (Published in 2005).

Diesel Trucks – LHDD1, LHDD2, MHDD, HHDD

## NOx Emissions per ton Mile of Freight South Coast Air Basin



## PM Emissions per ton Mile of Freight South Coast Air Basin



### **Most Difficult Challenge: Evaluate Possibilities from a Systems Perspective**

- System design must balance the needs of shippers, transporters, commuters, adjacent communities, regulators, and many other stakeholders
- Altering one part of the system can cause disruption to the entire goods movement system of ship, rail, and truck operations throughout California
- Unintended economic and environmental consequences of various public policy choices must be squarely addressed
  - Mode Shift, Port Shift, Country Shift
- This issue requires a statewide focus and management

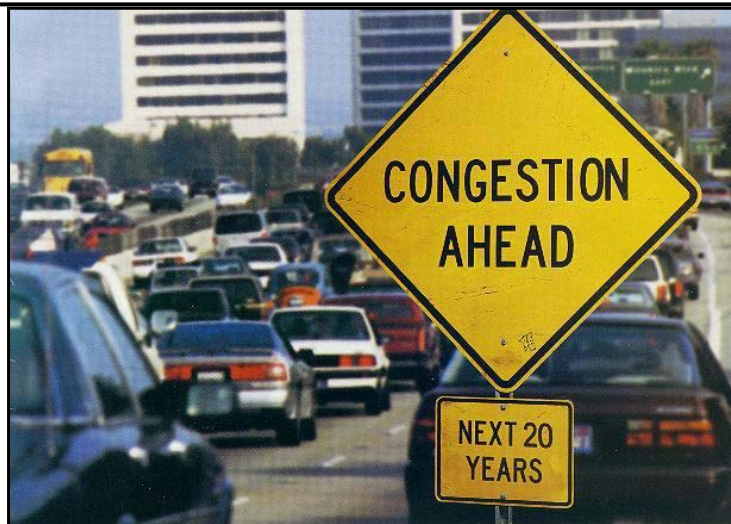
## **Please contact me if you would like additional information**

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## **The Future?**

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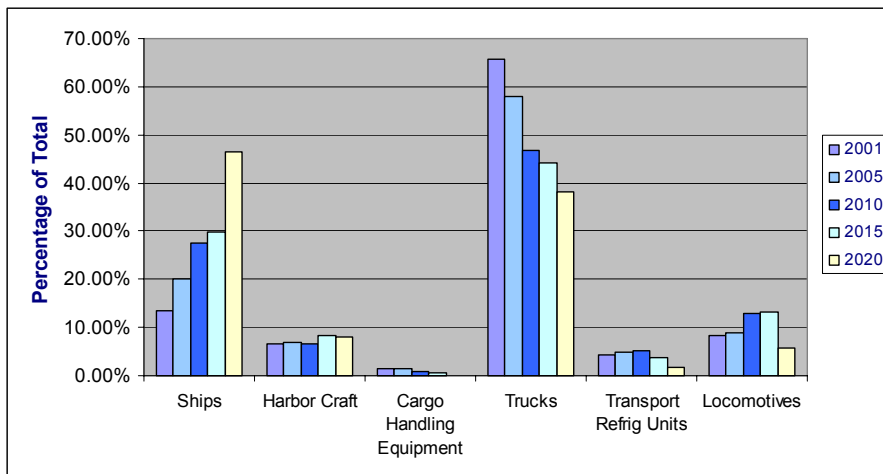


# California Railroad Freight Flows



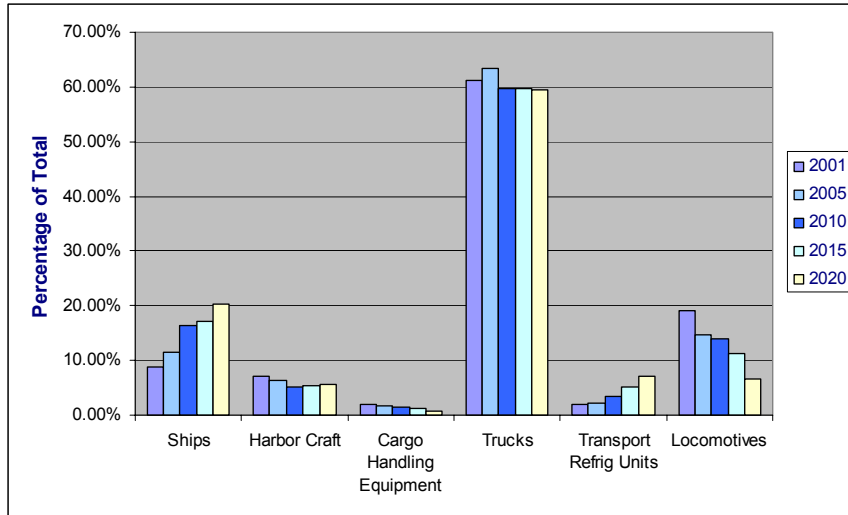
Rail Freight to and from California

# Projected Statewide Goods Movement Diesel PM Emissions w/ Implementation of CARB Strategies



Source: CARB Draft Emission Reduction Plan for Ports and International Goods Movement in CA (3/21/06), Page 117

# Projected Statewide Goods Movement NOx Emissions w/ Implementation of CARB Strategies



Source: CARB Draft Emission Reduction Plan for Ports and International Goods Movement in CA (3/21/06), Page 118