

Workshop on Information Regarding the Off-Road, Truck and Bus, and Drayage Truck Regulations



August/September 2010

California Environmental Protection Agency



Air Resources Board

Emission Inventory for the In-Use Off-Road Vehicles Rule



Outline

- Update Inventory
- Emission Inventory Inputs
- New Information
 - DOORS Data
 - Engine Load
 - Recession and Forecasting
- Emissions Results
- New Margin

Update Inventory

- Why ARB is updating the inventory
 - Recession
 - Harley paper –fuel consumption too high
 - New data available

In-Use Off-Road Vehicles Emissions Inventory Approach

Estimating Emissions

- Population - (POP)
- Activity - (ACT)
- Load Factor - (LF)
- Emission Factor - (EF)

$$\text{Emissions} = \text{POP} \times \text{ACT} \times \text{LF} \times \text{EF}$$



Population

- SIP inventory population based on California and national survey data.
- Revised inventory population based on DOORS reporting database
 - Fleet owners were required to report all relevant fleet information including total number of vehicles, vehicle types, horsepower and model year.
 - ~132,000 vehicles for 2009
- Additional assessment on DOORS reporting compliance

Reporting Compliance

- Survey of 1000 fleet owners was conducted in March 2010 to estimate number vehicles that have not reported to DOORS.
 - Sample derived from list of 21,800 buyers who financed equipment between 2005-2009
 - 7.3% fleets had not reported to DOORS.
 - Estimate about 25 vehicles per fleet for large fleets, 16 for medium and 6 for small.
 - Results in about a 10% non-compliance rate for population
- No estimates available for fleets in DOORS but operating out-of-state.

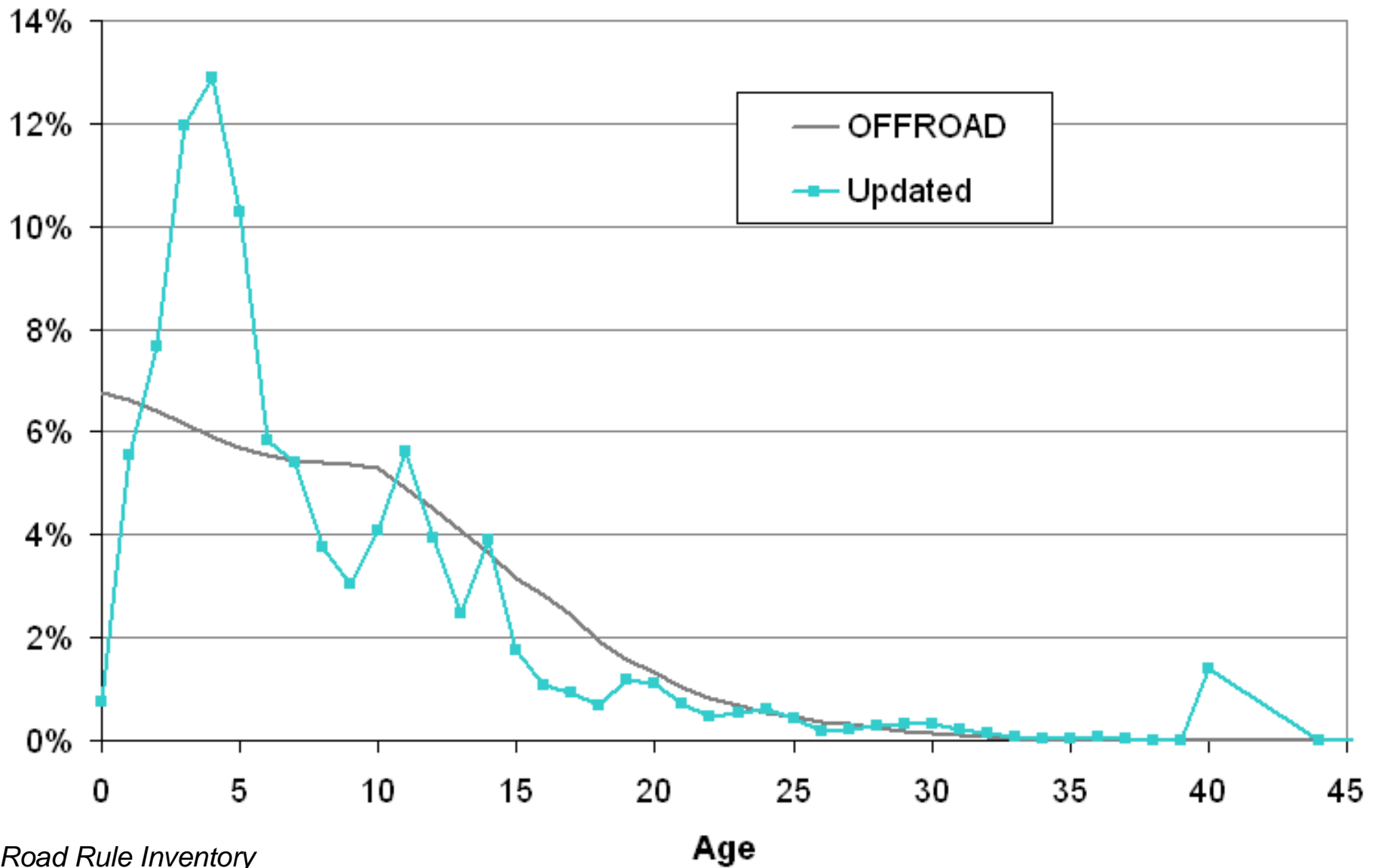
2009 Population

Sector	OFFROAD	Updated	Percent Change
Construction & Mining	172,915	116,861	-32%
Industrial	20,107	24,226	+20%
Airport GSE	1,830	3,705	+102%
Oil Drilling	1,021	822	-20%
TOTAL	195,872	145,614	-26%

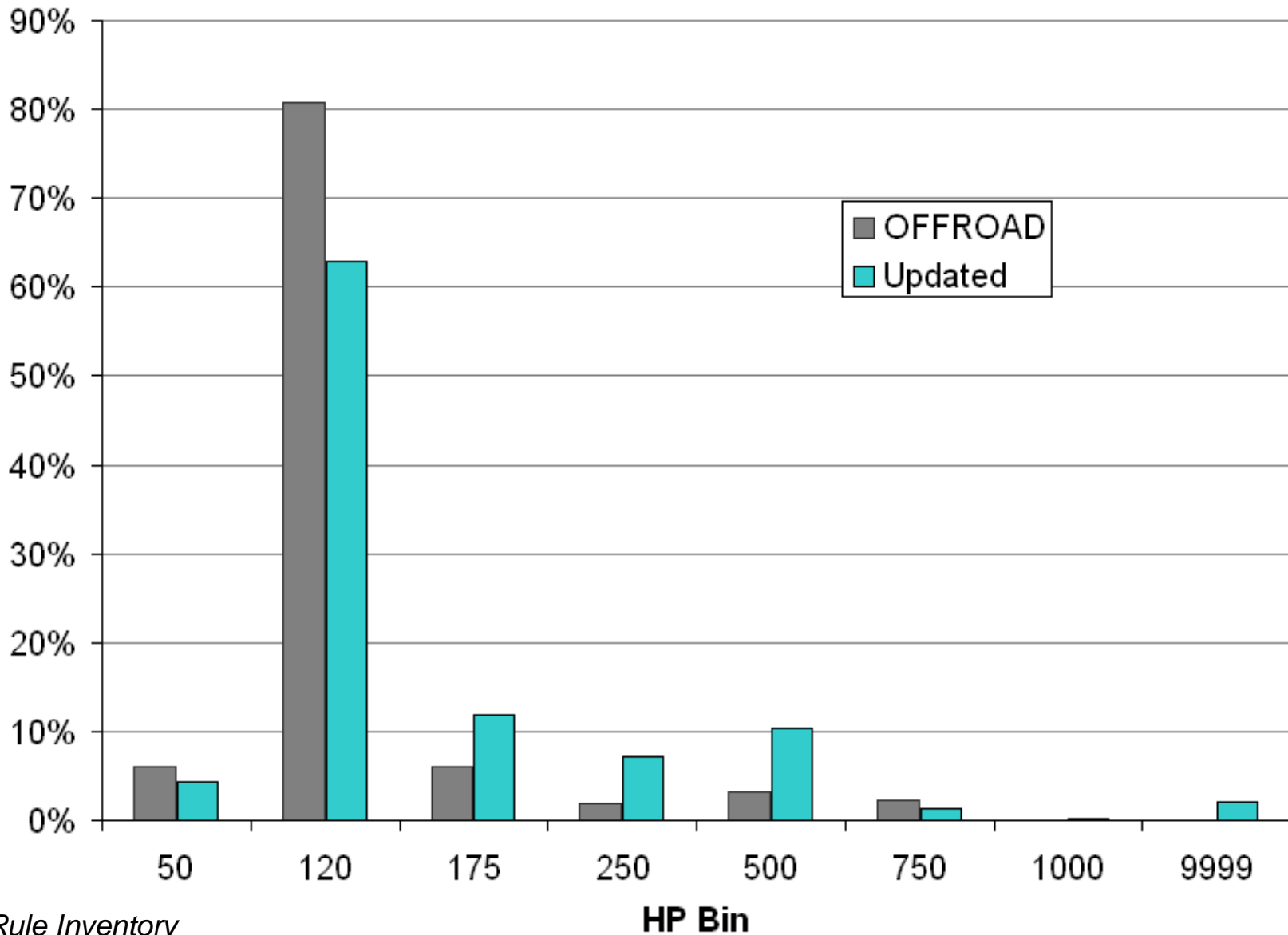
Age and Horsepower Distributions

- The age distribution from DOORS is skewed to younger vehicles than originally assumed.
- The horsepower distributions from DOORS vary.
 - For some equipment types the DOORS distribution is higher than originally assumed and for others lower.

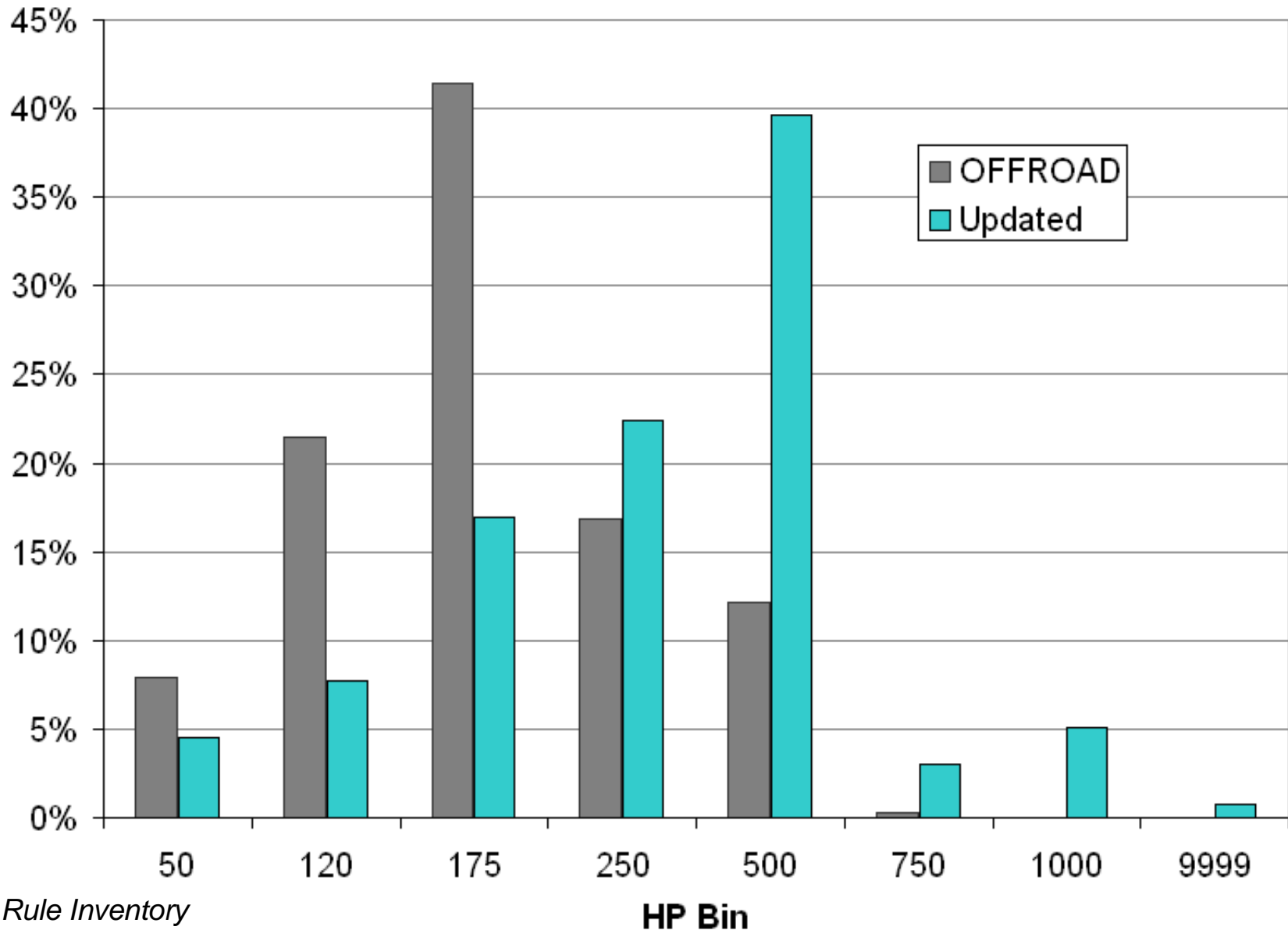
2009 Age Distribution - Excavators



Horsepower Distribution – Tractors/Loaders/Backhoes



Horsepower Distribution – Excavators



Off-Road Rule Inventory

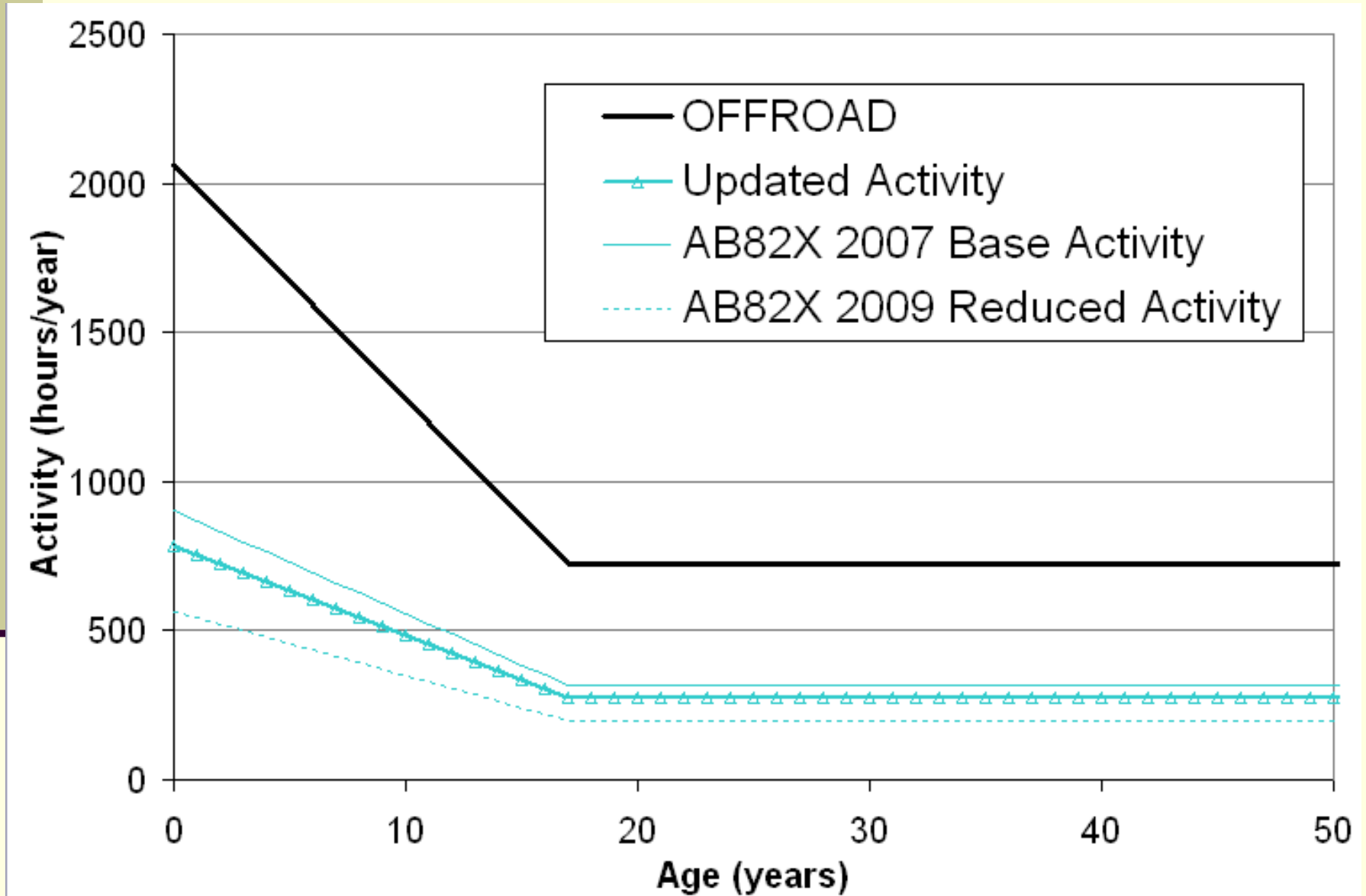
Activity

- SIP inventory activity based on national and some California specific data.
- In 2009, the California legislature approved Assembly Bill 8 2x, which required CARB to amend certain sections of the Off-Road Diesel regulation (AB 8 2x, 2009).
 - For credits fleet owners were required to provide equipment specific activity for the baseline year (2007) and activity for the same equipment in 2009
 - Both 2007 and 2009 activity significantly lower than originally assumed.

Activity

- Developed new activity profiles based on reported activity data
 - 2007 = baseline activity
 - 2009 = reduced activity
- Weighted activity – some fleets reduced population while other reduced activity
 - 34% reduced activity, 66% reduced population
- Compared results to other available data sources
 - TIAX Public Fleet Survey (2003)
 - ERG Survey <175 HP (2007)

Excavators



Average Annual Activity – Top 10 Equipment

Equipment Type	OFFROAD (hr/year)	Updated (hr/year)	% Change
Tractors/Loaders/Backhoes	942	512	-46%
Excavators	1,396	546	-61%
Scrapers	1,092	453	-59%
Rubber Tired Loaders	957	893	-7%
Crawler Tractors	1,013	409	-60%
Off-Highway Trucks	1,958	1,293	-34%
Forklifts	1,800	690	-62%
Other Construction Equipment	690	429	-38%
Rough Terrain Forklifts	1,123	237	-79%
Cranes	1,252	444	-65%

Load Factor

- Load varies by equipment type and usage
- Collected engine load data from ARB testing programs and manufacturer provided data
 - Analysis indicates that OFFROAD load factors are 25-50% too high
 - Staff concluded load factors should be reduced 33% for the updated inventory
 - Consistent with findings for other off-road equipment.

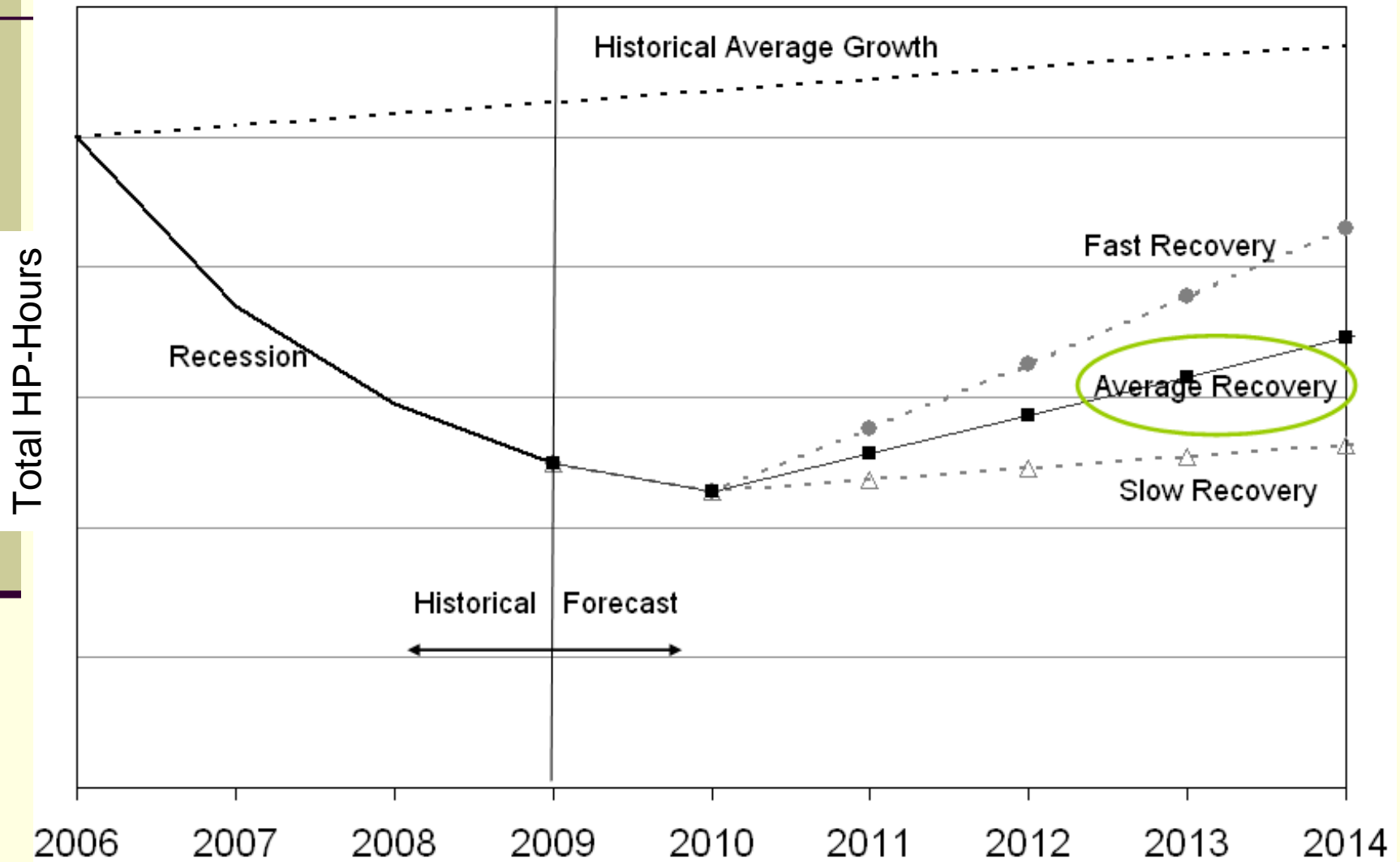
Growth – Annual Historical Rates

- Construction & Mining, and Industrial
 - SIP growth based on national 1970-2000 employment trends
 - Updated growth factor with California-specific growth in construction employment for 1970-2009
- Airport GSE
 - SIP growth based on 1991 Federal Aviation Administration flight operations data
 - Updated growth factor based on 1977-2009 US airline fuel consumption
- Oil Drilling
 - SIP growth based on 2005 ARB survey
 - Growth factor unchanged as most economic surrogates suggest no growth in the industry

Growth – Annual Historical Rates

Category	OFFROAD	Updated
Airport Ground Support	2.02%	1.78%
Construction and Mining	1.96%	1.84%
Industrial	0.63%	1.84%
Oil Drilling	0.00%	0.00%

Total Activity Forecast (2014)



Short Term Forecast (2009-2014)

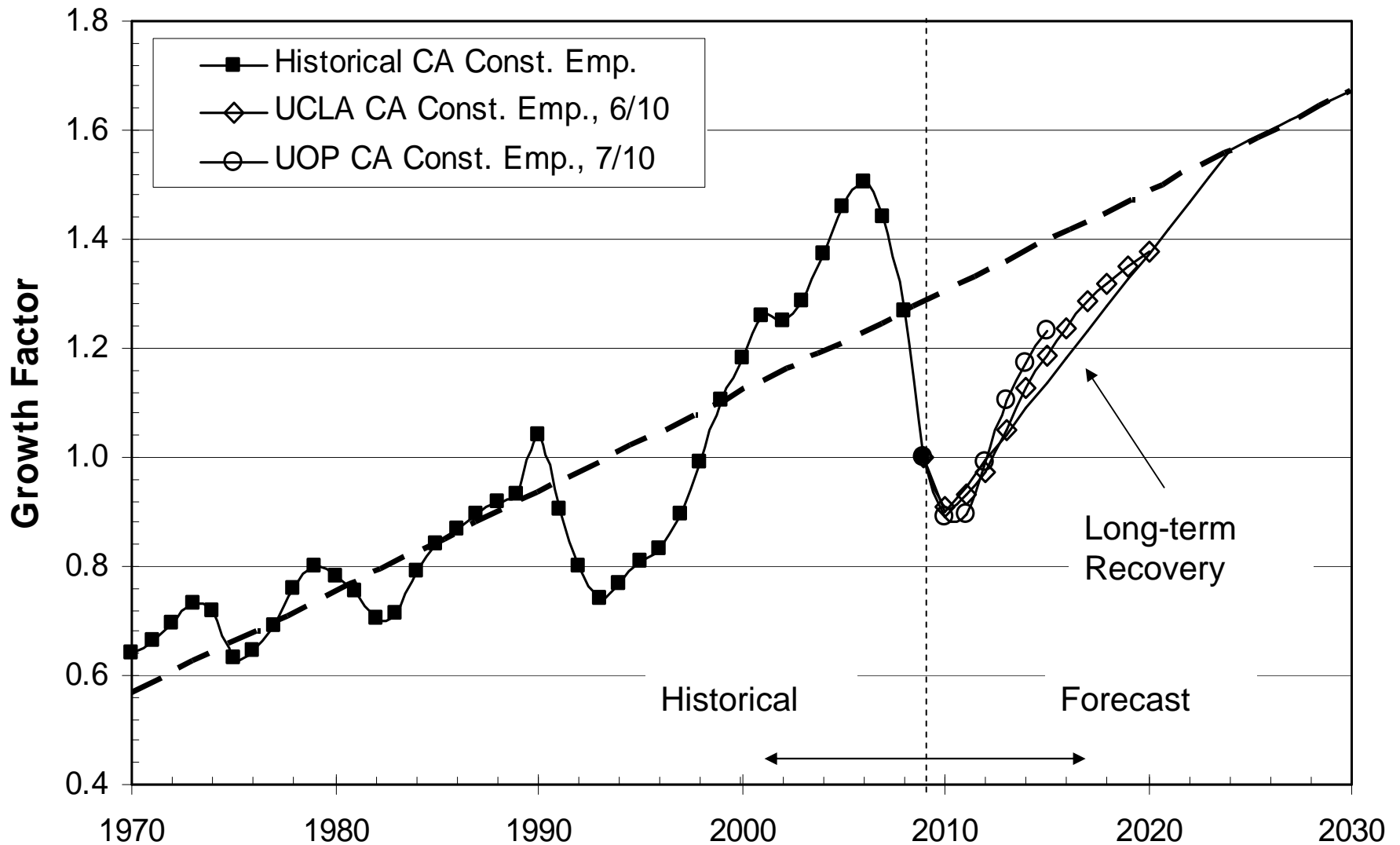
CY	Construction & Mining, Industrial¹	Airport Ground Support²
2009	1.00	1.00
2010	0.90	0.97
2011	0.95	1.01
2012	0.99	1.05
2013	1.04	1.08
2014	1.09	1.12

1. Based on California construction employment

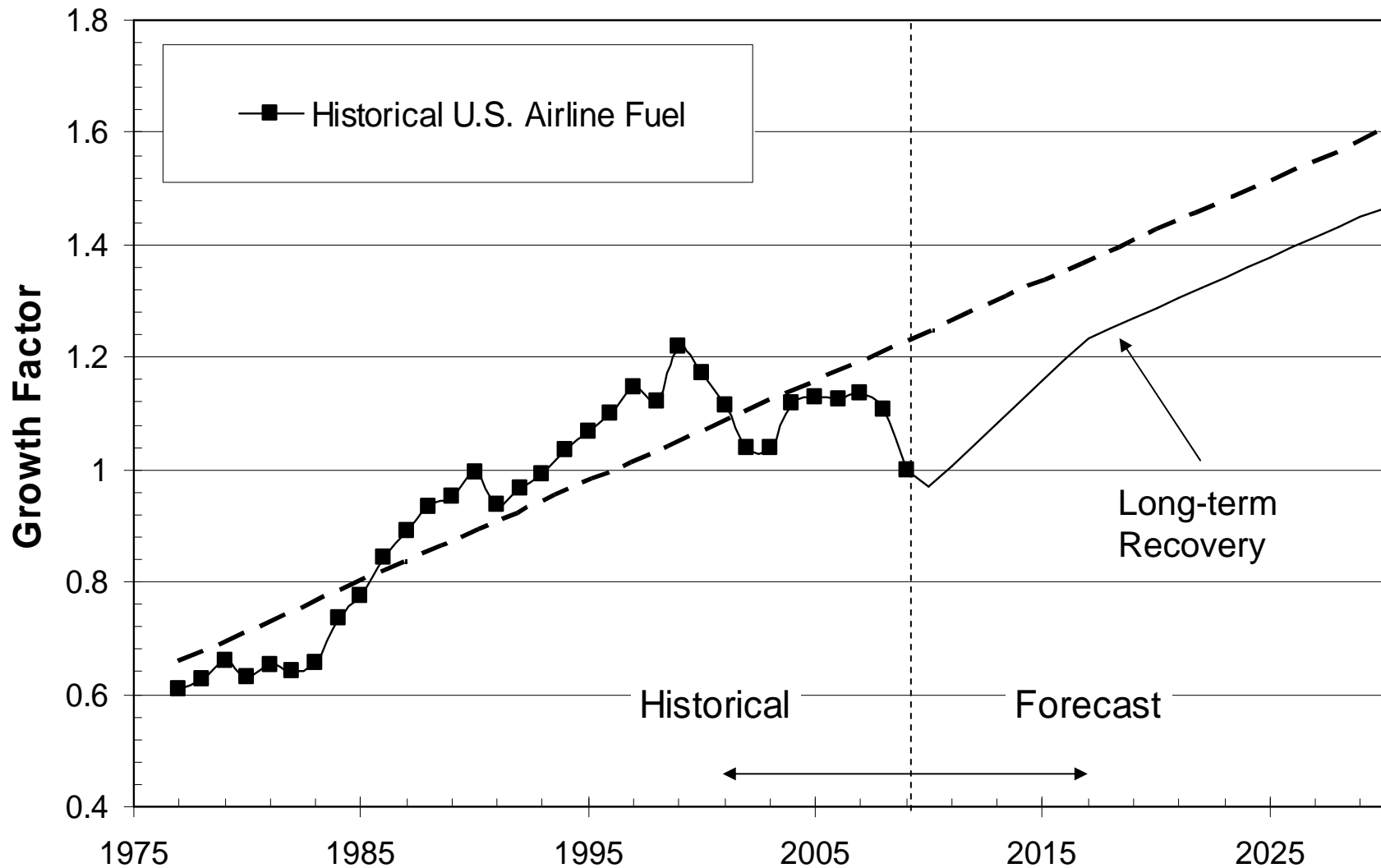
2. Based on U.S. Airline fuel

All fractions relative to 2009

Construction & Mining, Industrial



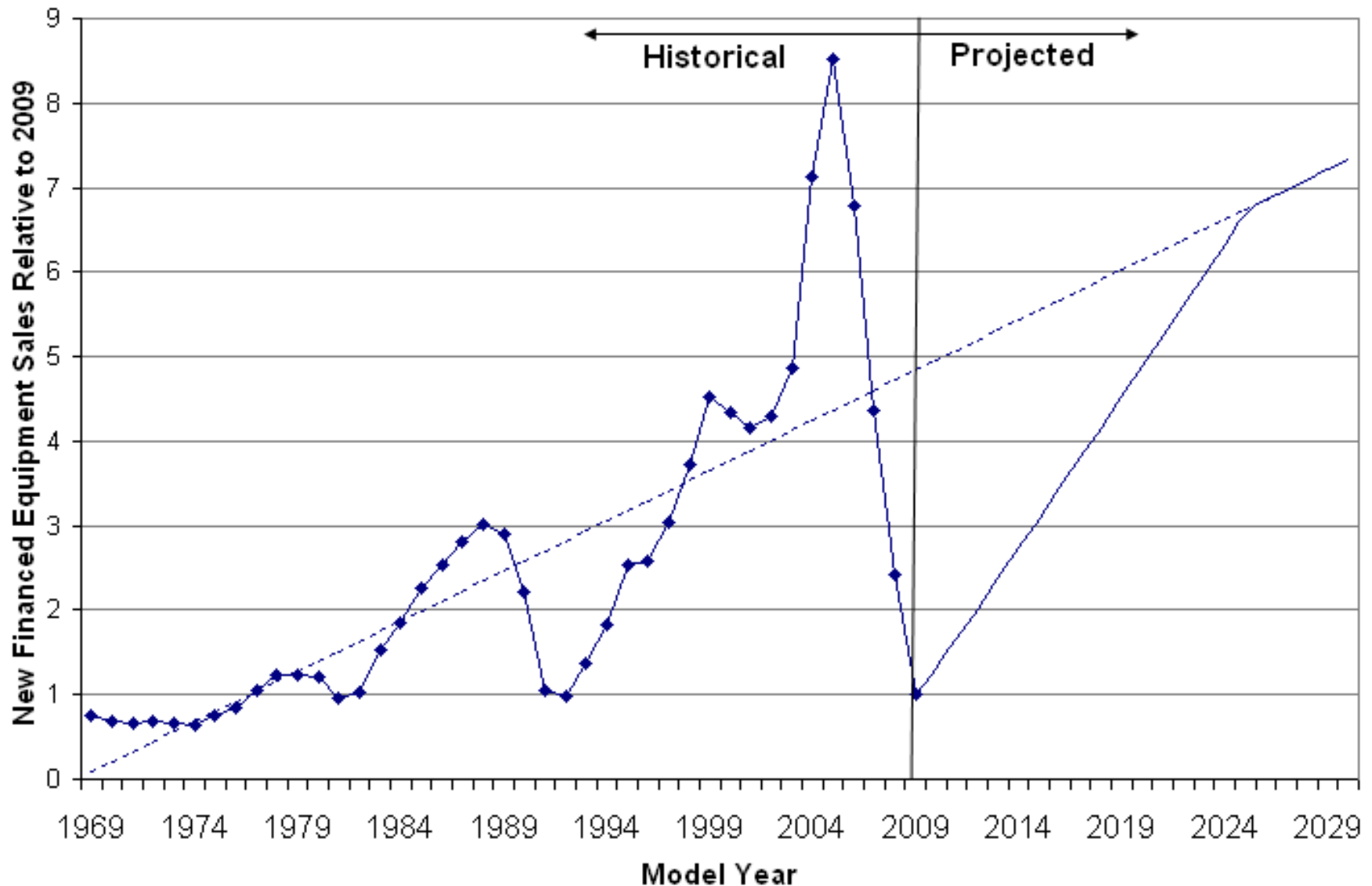
Ground Support Equipment



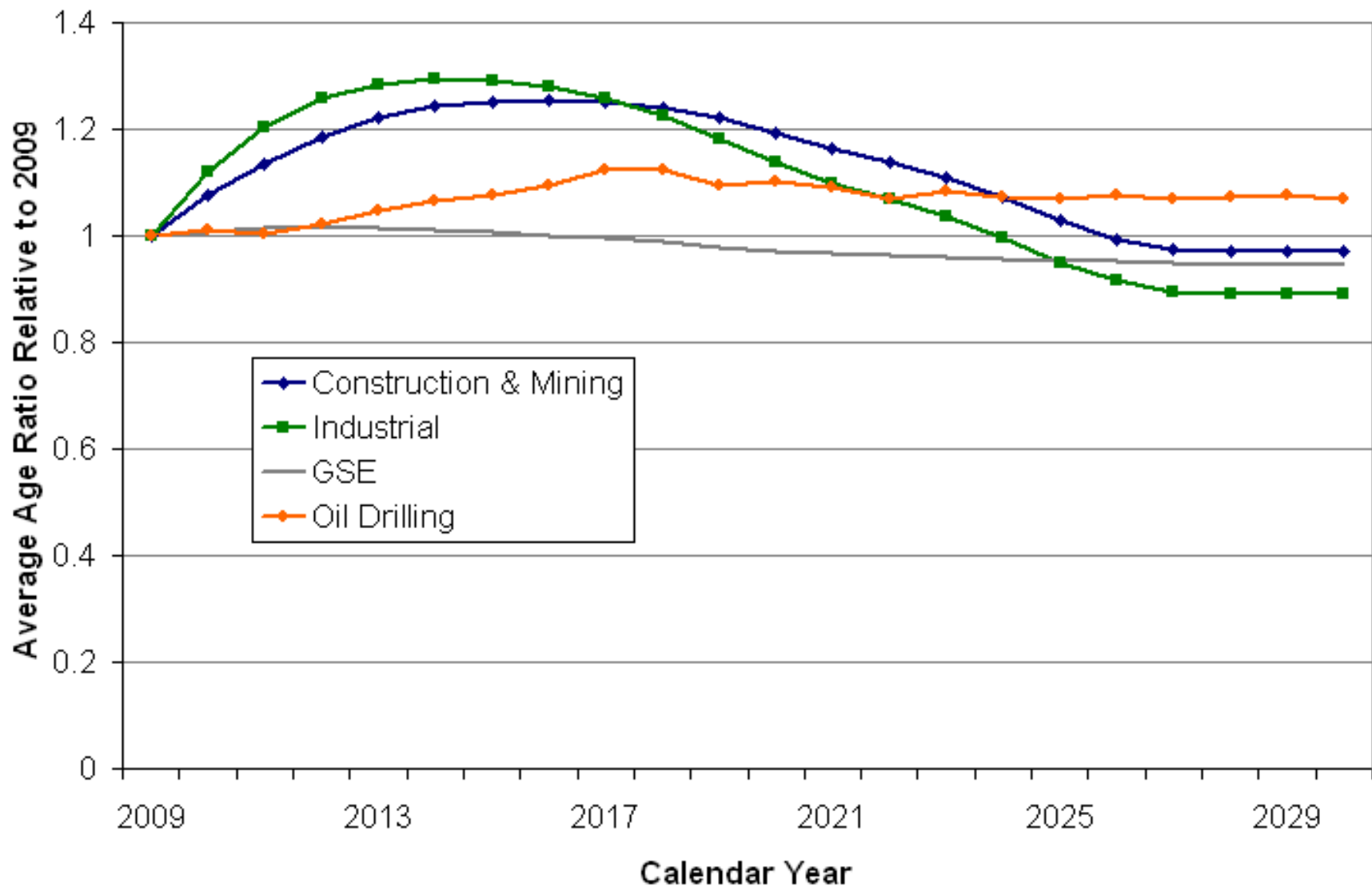
Impact of Recession and Forecasting on Age Distribution

- Staff incorporated the impacts of the economy on sales of new off-road diesel equipment. The strength of new equipment sales will impact the age distribution of the fleet into the future.
 - Depressed sales will lead to the fleet, as a whole, getting older over time
- The recovery scenario has a direct impact on the relative change in the fleet age over time.
 - Note: Activity renormalized to prevent changes in total activity as a result of changes in the age distribution.

Construction Equipment Sales



Impact of Sales on Age – Average Recovery Scenario



Other Inputs

- Brake Specific Fuel Consumption (BSFC)
 - OFFROAD fuel consumption rates are 0.401 lb/hp-hr
 - Staff adopted BSFC values from USEPA's NONROAD model (0.367 lb/hp-hr)
 - USEPA values very similar to engine data and industry comments
- Base Emission Factors – unchanged
- Deterioration Rates – unchanged
 - Capping deterioration at 12,000 hours

Spatial Allocation

- Construction equipment allocation methodology based on human population growth (same allocation used for trucks).
- Updated allocation of industrial equipment with newer employment data.
- GSE and Oil drilling equipment allocation remains unchanged.

Spatial Allocation - Construction

Air Basin	OFFROAD	2014 Updated
SC	36%	37%
SF	15%	16%
SJV	10%	17%
MD	2%	3%
SV	9%	9%
SD	9%	9%
Others	19%	10%

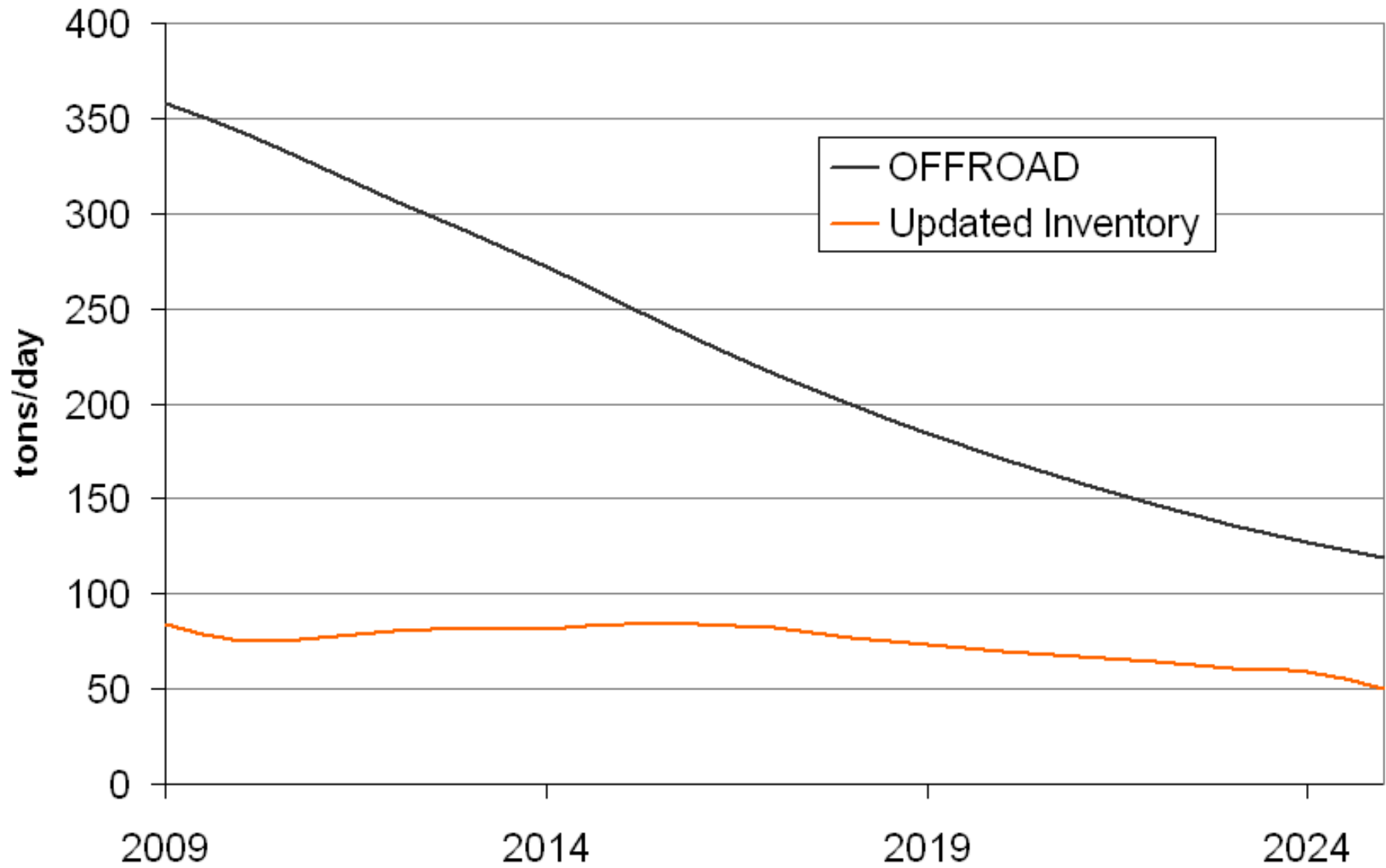
Spatial Allocation - Industrial

Air Basin	OFFROAD	2014 Updated
SC	56%	47%
SF	24%	24%
SJV	5%	9%
MD	1%	2%
SV	3%	4%
SD	6%	7%
Others	6%	8%

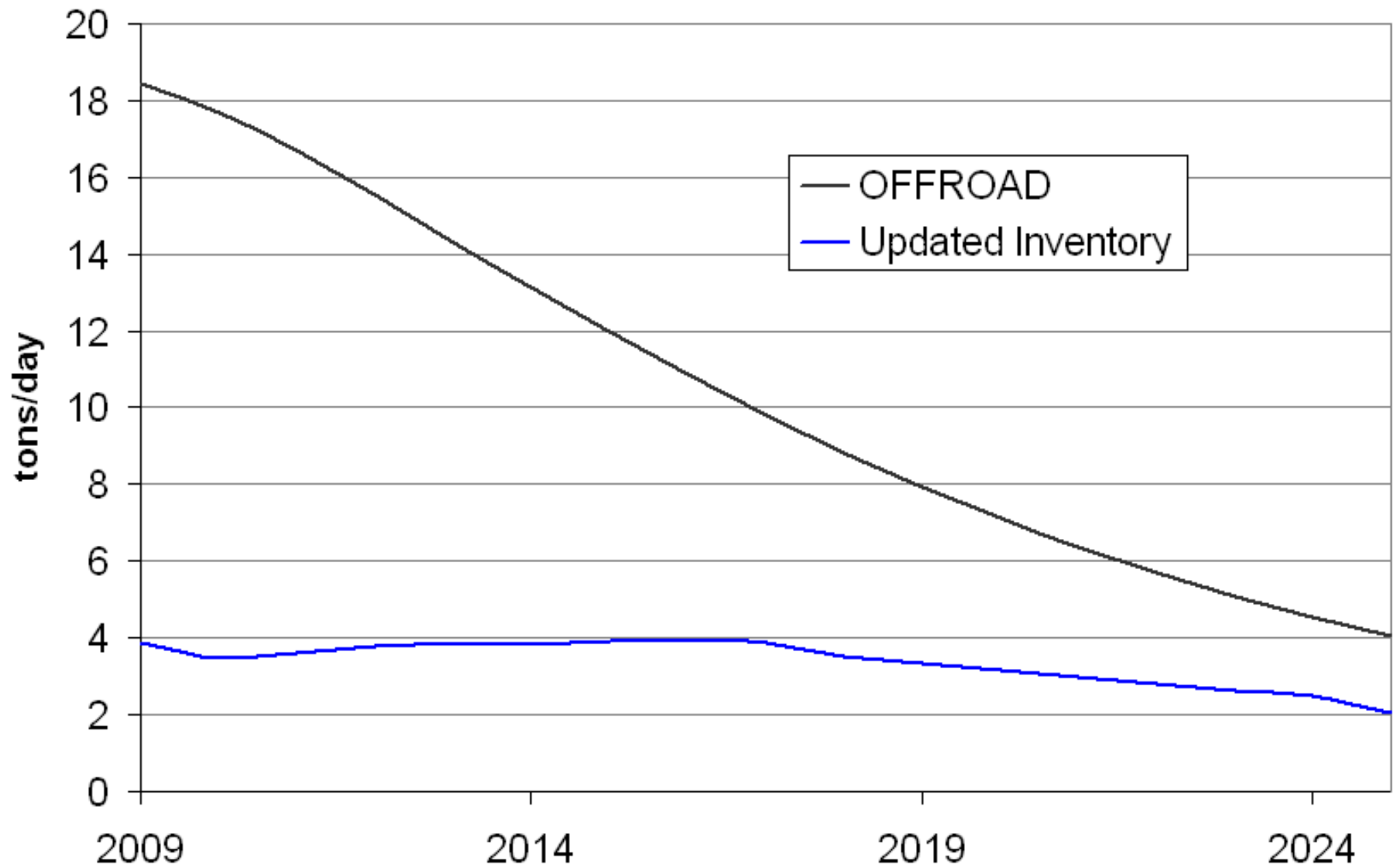
Overall Changes

- Population – lower
- Activity – lower
- Load Factor – lower
- Age – generally younger
- Growth – lower, especially in the early years due to the recession
- **Overall inventory is significantly lower than originally estimated.**

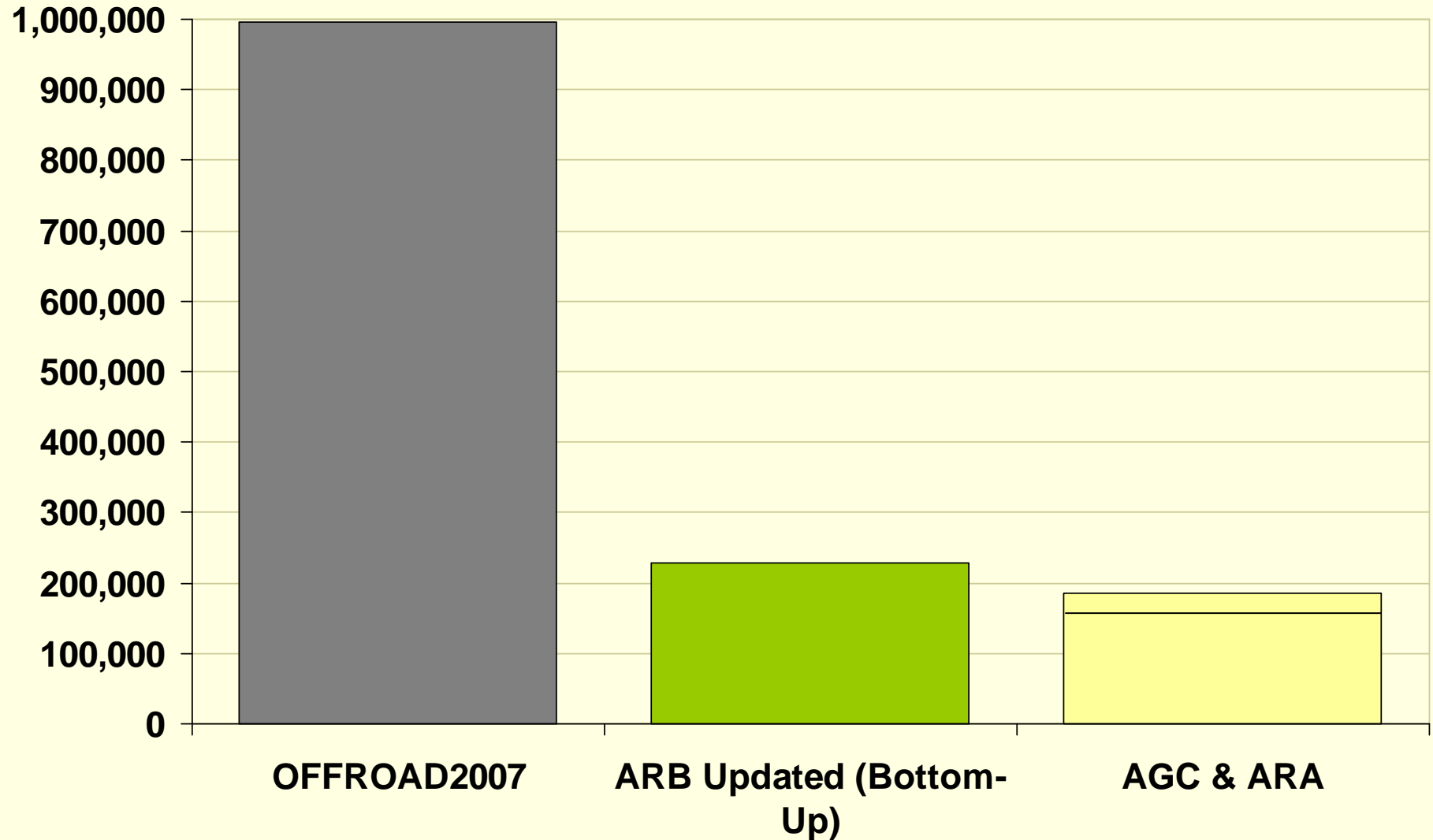
Statewide Baseline Emissions - NOX



Statewide Baseline Emissions – PM2.5



2009 Statewide Fuel Consumption (thousand gallons)



Next Steps

- Incorporate 'low use' vehicles
 - 7% DOORS vehicles designated as low use (<100 hours/year)
 - Assume 10% low use with threshold of <150 hours/year