



**The Gateway Cities Fleet Modernization Program:
Cleaner Heavy-Duty Trucks for Port and Goods Movement Applications**

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FFCA 2008: Gateway Cities Program *Agenda*

- 1 Overview of the Gateway Cities Program
- 2 AVL Data and Analysis
- 3 Retrofit Opportunities and Challenges
- 4 Summary and Conclusions



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The Gateway Fleet Modernization Program facilitates a 3-step process to reduce emissions from **in-use** heavy-duty diesel vehicles



Step 1: Scrap older truck



Step 2: Replace with newer truck
(Newer truck emits ~35% less NOx and ~80% less PM)



Step 3 (optional): Retrofit PM-control
(Reduces replacement truck's PM by ~85%, w/ option for 25% NOx reduction)

Retrofits may also be performed independently on qualified trucks



- **Key premise:** truckers with oldest vehicles can't afford newer, cleaner trucks
- Fleet mod helps replace pre-control trucks with more modern, electronic-controlled trucks
 - Incentive-based, voluntary program
 - Trucker / awardee pays about 25 to 30 percent of total replacement truck's cost
 - Old truck engine / chassis are destroyed
- Allows site- and vocation-specific targeting (e.g., ports and local freight)
 - POLA requires minimum trips/year "to or from" its boundaries (500-750 typical)
 - MSRC focuses on "Goods Movement"
- Facilitates "capture" of MY 1994 to 2006 trucks for emissions upgrades and retrofitting of DECS
- AQ benefits: compelling and cost effective
- Other benefits also realized, e.g.:
 - Improved reliability and safety
 - Trucker reduces annual fuel costs (~35%)



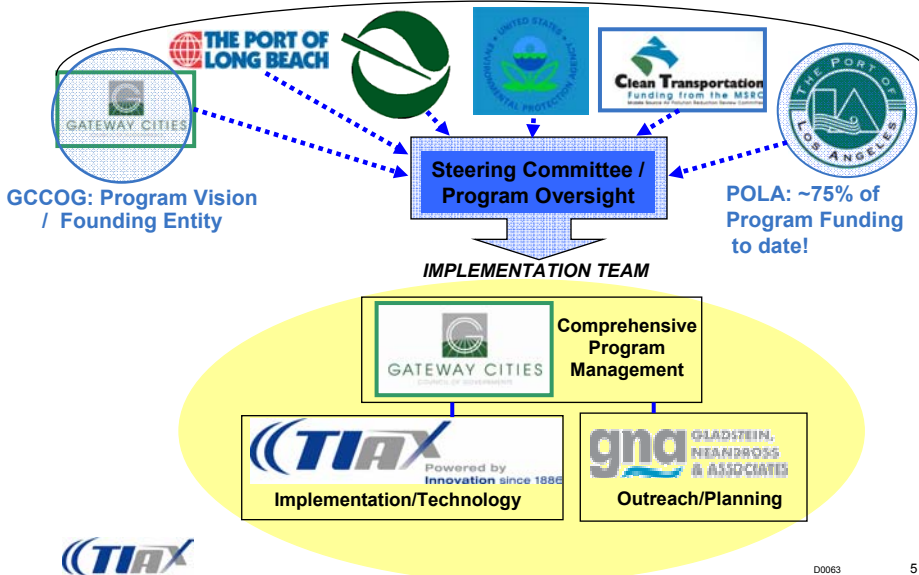
A pre-1987 Gateway Cities truck undergoing scrappage process



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The Program includes oversight and/or funding from 6 government entities . . .



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FFCA 2008: Gateway Cities Program *Snapshot of Current Program*

- Program began in September 2002 (~5.5 years)
- Approximately \$24.5 million in grant funds have been expended to replace **643** older trucks (mostly pre-1987 MY)
 - **\$19.0 million / 473 trucks** – special program funded by the Port of Los Angeles
 - **\$4.3 million / 153 trucks** – original program funded by ARB, EPA and MSRC
 - **\$1.24 million / 17 trucks** – recent program funded by the Port of Long Beach
- The Port of Long Beach has also initiated a pilot retrofit program that has funded **\$359,000 / 15 trucks**
- All replacement trucks now receive installation of GPS-based “Automatic Vehicle Locator” (AVL) device
- Program enhancements are ongoing, customized to the needs of each individual funding agency
 - Formula for calculating grant awards/incentives
 - Adoption of latest emissions factors
- Port funded elements of the program are ready to be transitioned into longer-term San Pedro Bay Ports Clean Trucks Program



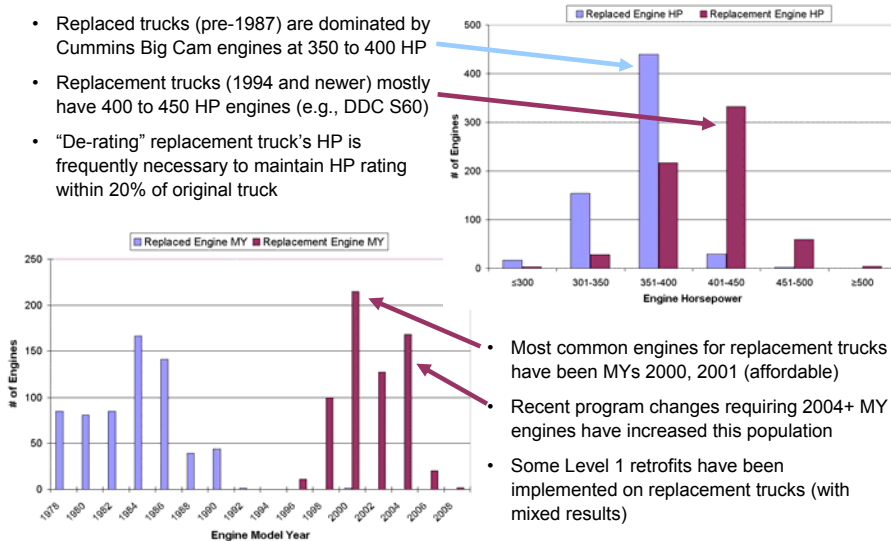
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FFCA 2008: Gateway Cities Program *Truck Replacements Accomplished to Date*

Fleet Mod Under Gateway Cities Program (643 Older Trucks Destroyed & Replaced)

- Replaced trucks (pre-1987) are dominated by Cummins Big Cam engines at 350 to 400 HP
- Replacement trucks (1994 and newer) mostly have 400 to 450 HP engines (e.g., DDC S60)
- “De-rating” replacement truck’s HP is frequently necessary to maintain HP rating within 20% of original truck

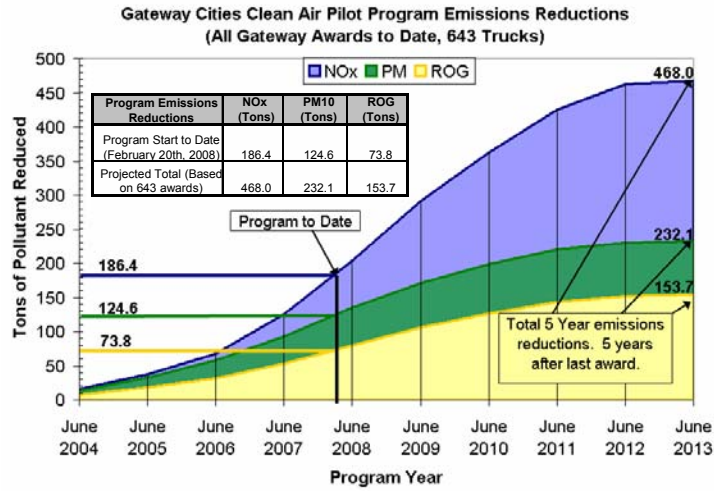


- Most common engines for replacement trucks have been MYs 2000, 2001 (affordable)
- Recent program changes requiring 2004+ MY engines have increased this population
- Some Level 1 retrofits have been implemented on replacement trucks (with mixed results)



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- Estimates are based on mileage estimates for all replacement trucks using EMFAC '07
- Provides a snapshot of the current program status (assumes no further awards are made)



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All Gateway Cities Replacement and Retrofitted Trucks Receive an Automatic Vehicle Locator (AVL)

- Purpose:
 - Automatically monitor vehicle usage by air basin (SCAB) and Port boundaries
 - Help ensure emissions benefits are **Real, Surplus, Verifiable and Permanent**
 - Eliminate biannual self-reporting forms for participants
- Logistics:
 - Installed on replacement trucks at dealership or retrofit shop by vendor's authorized technician
 - Truck usage data automatically transmitted to vendor
 - Summarized data provided to GCCOG (TIAX) on monthly basis

Important Note: Only parameters affecting the program's air quality benefits are monitored. No "real-time" monitoring is conducted by the GCCOG (unless vehicle theft or safety are involved).

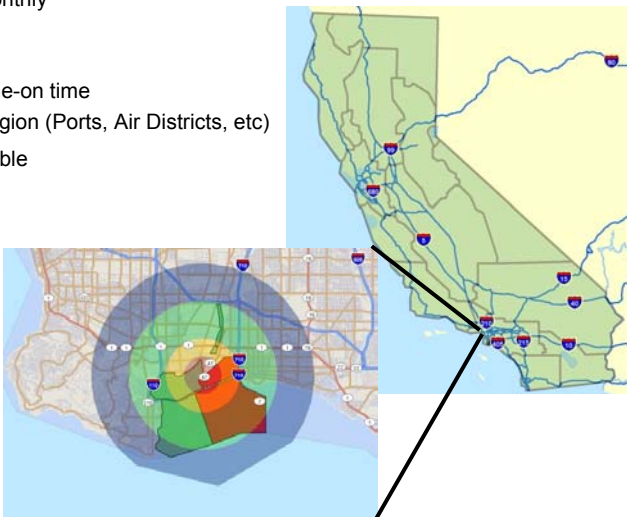


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AVL Data Collected to Date under the Gateway Cities Program

- Key data reported monthly
 - Port trips
 - Mileage
 - Idle time and engine-on time
 - Broken down by region (Ports, Air Districts, etc)
- Additional data available
 - Raw GPS records
 - Fuel economy
 - Telemetry inputs

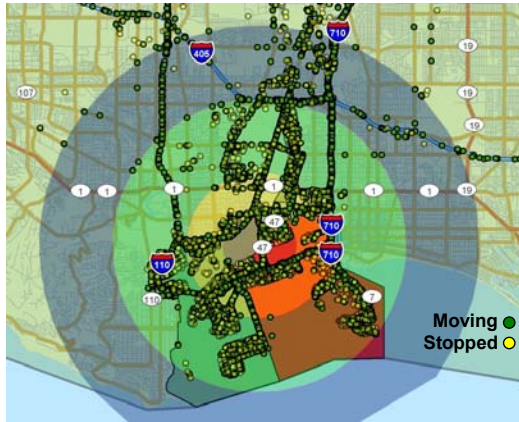


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Detailed Analysis of AVL Data

- Additional analysis can be performed to improve the program and assist funding agencies
- Examples include:
 - Average fleet fuel economy
 - Average vehicle speed by zone
 - Average trip distances
- Custom zones can be created and examined after data has been collected
- Preliminary results indicate
 - >85% operating time within SCAQMD
 - Significant fuel economy improvements



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Retrofits are a Key Strategy for Reducing Emissions from Pre-2007 Trucks

- The San Pedro Bay Ports Clean Air Action Plan (CAAP) is targeting the retrofit of thousands of port trucks
- ARB Fleet Rules will affect trucks across the state (public and private fleets, including independently owned / operated port trucks)
- Not all retrofit options are available/suitable to all trucks or vocations



Internal view of a DPF

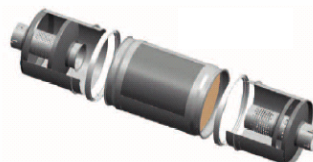


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General Suitability Tests for Retrofitting On-Road HDVs

- Considerations and selection criteria include:
 - Is there a CARB-verified device for the engine make/model year?
 - Are NOx reductions sought in addition to PM reductions?
 - Does engine have EGR?
 - Does intended duty cycle / application generate sufficient exhaust temperatures for a passive DPF? If not, can an active DPF work? Or, would a Level 2 flow-through filter be better for the application?
 - Are there horsepower restrictions? Does truck have dual exhaust?
 - Is targeted end user group conducive to using / maintaining device properly?
 - Can they afford higher operational costs (e.g., maintenance, fuel economy penalty)
- Additional considerations for retrofits:
 - Infrastructure requirements
 - Failure mode of the device
 - Variability of driver workload and duty cycle



Internal view of a DPF



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Specific challenges for retrofitting container port trucks include:

- Average daily mileage varies among drivers (from 50 to 300 miles per day)
- Driver's cargo and load constantly change (20,000 – 80,000 lbs GCWV)
 - 20' vs. 40' containers
 - Bobtailing (tractor with no trailer) or returning empty containers
- Workloads can change seasonally
- Drivers may change carriers, drive for multiple carriers, drive to the port part time, and/or temporarily leave for another trucking vocation
- Engine may not be properly maintained

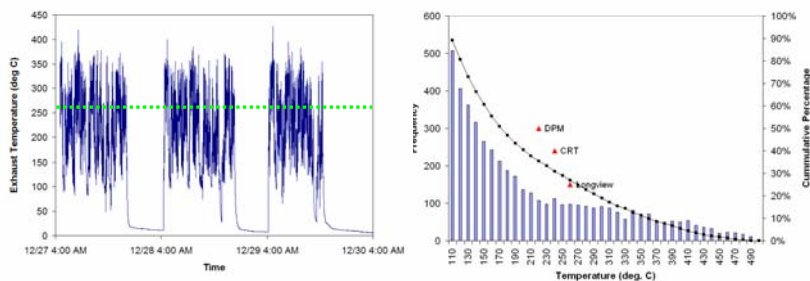
These factors affect the average exhaust temperature and/or PM generation rates of the engine, which partly dictate viability of a given retrofit device

Port truckers may not be able to afford higher O&M costs that can result from retrofitting an existing truck






TIAX's exhaust temperature testing effort of port trucks for POLA / POLB

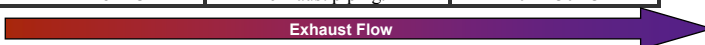
- **Objective:** determine if container trucks generate enough exhaust heat to meet verification requirements of **passive DPF systems** (especially Longview DPF / LNC)
- **Test Plan:** data log 30 trucks (MY '93 to '06, various engine makes, models, etc.)
- **Test Parameters:** mileage, exhaust temperature, driver workload (survey), engine on/off time (estimated)
- **Results:** Testing completed in March '07
- **Preliminary Conclusion:** Passive DPF systems can work for a large percentage of port trucks, with screening to eliminate poor candidate vehicles



Example raw exhaust temperature data and histogram showing viability of verified DPFs

TIAX measured temp. losses along the exhaust pipe of one Class 8 Tractor

Turbo Outlet	1995 Freightliner w/DDC S60 Engine	Muffler Inlet
		
Temperature Range: 11 – 482 °C	Approx. 12 ft. of non-insulated exhaust piping.	Temperature Range: 10 – 430 °C



- Container trucks typically have sleeper cabs, resulting in extra-long exhaust piping
- On average, there was a 36 °C loss along the non-insulated exhaust pipe
- **Turbo Outlet:** 31% of time above 260 °C → **Muffler Inlet:** 26% of time above 260 °C
- **Conclusions:** heat loss is significant, and exhaust pipe insulation would be beneficial in some cases; but this is probably not a practicable solution for port trucks



Port of Long Beach Funded Pilot Retrofit Program

- Program initiated in August of 2007 to retrofit up to 50 trucks with Cleaire Longview DECS system (85% PM and >25% NOx reductions)
- To date, the program has retrofitted 15 trucks / approximately \$359,000
- Participating Vendors: Cummins Cal Pacific, Ironman Parts and Renewal
- Applicants are pre-screened and vehicles inspected prior to retrofit

Benefits

- Retrofit technology is approved and ready for application today
- Level 3 retrofits are significantly less costly than replacements, while achieving similar reductions in diesel PM
- Devices like Longview provide much-needed NOx reductions (beyond DPF-only DECS)

Challenges

- Port truckers are IOOs, not fleet employees: special considerations may apply
 - Drivers need to maintain their trucks at levels to which they may be unaccustomed
 - O&M cost impacts (fuel economy, DPF cleanings) should be made clear, and may require offering of financial offsets



Retrofit Process for Existing Pilot Program (Claire Longview)

1. **Submit application to GCCOG**; requirements include:
 - Own/operate a heavy duty truck (class 8)
 - Perform 3.5-7 trips/wk to San Pedro Bay Ports (POLA and POLB)
 - Truck has a MY1999-2002 engine (subset of possible future program)
 - Proof of CHP Biennial Inspection of Terminals
 - Proof of insurance for past 24 months
2. **Pre-Inspection:** Truck has to pass mechanical inspection
3. **Data Logging:** After passing pre-inspection, a data logger is installed to determine if truck's duty cycle achieves DPF's exhaust temperature requirements
4. **Device Installation:** typically takes 2-3 days for the Claire Longview system
5. **Post-Inspection:** 3 months after installation, retrofitted trucks are inspected to confirm that truck and device are working properly as a system



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Program Commitments for Participants

- Once installed, truck owners agree to the following obligations for **5 years**:
 - Allow AVL (Automatic Vehicle Locator) installation
 - Apply clean air decals
 - Comply with applicable motor vehicle laws
 - Stay in port trucker vocation
 - Provide annual updates (insurance, registration, etc.)
 - Properly maintain retrofit device and truck



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- The program is a national model for successfully reducing emissions from in-use heavy-duty trucks used in port and goods movement applications
 - 643 trucks replaced and 15 Level 3 DPF + LNC retrofits installed (and counting)
 - Approximately 385 tons of NOx / PM / ROG reduced to date (and counting)
- The truck replacement pace has been determined by available funding (now exhausted)
- If additional funds are received, the program can rapidly move forward to:
 - **REPLACE** oldest trucks with new trucks at '07 emissions standards (diesel and LNG)
 - **RETROFIT** suitable existing trucks with DPF / LNC system to approach '07 standards
 - **DEMONSTRATE** emerging technologies (hybrid port trucks, new DECS systems, etc.)
- Retrofitting of port trucks can bring unique challenges, which are being addressed
- Passive DPFs can be viable for a large-scale retrofit effort, with application of:
 - ✓ Screening tools (to ID trucks with conducive duty cycle, good engine condition, etc.)
 - ✓ Outreach programs for affected port truckers (compensation for higher O&M costs?)
- Improved AVL technology and data analysis are significantly improving our understanding of truck operation in the drayage vocation
- The Gateway Cities program continues to evolve to meet the needs of specific funding agencies, such as the San Pedro Bay Ports



Thank You For Your Attention!



TIAX wishes to thank the following key program supporters:

- Gateway Cities Council of Governments
- Port of Los Angeles
- Port of Long Beach
- U.S. EPA
- Cal EPA / CARB
- Mobile Source Air Pollution Reduction Review Committee (MSRC)

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