Compliance & Commercial Vehicle Operators: A Systems Evaluation of the Problem & Virtual Solutions

PATH@20

Genevieve Giuliano, Ph.D.

Research Team

Caroline Rodier, Susan Shaheen, Samer Madanat, Mark Miller, Genevieve Giuliano

The VWCS Project

- Multi-phase project
- Develop business case
- Develop technology alternatives
- Field test and evaluate prototype system
- Implementation

Purpose of Research

- Develop business case for Virtual Weight and Compliance System in California
  - The problem of growing truck traffic
  - Crashes, air quality, pavement damage, security
  - Best practices
  - Stakeholder assessment
  - Technology alternatives (in progress)

Growing Truck Traffic

- Heavy-duty truck VMT have increased faster than passenger VMT since 1980
- Growth concentrated around major trade, transshipment nodes
  - Ports, airports, intermodal, distribution centers
  - Growing contribution to urban congestion

Current & Future Distribution of Commercial Vehicle Travel

1998

2020

Source: FHWA

Safety (Giuliano & McFerrin, 2006)

- General Trends
  - Number fatal crashes steady, vehicle registrations and VMT growing
  - Fatal crash rate from 4.96/100K VMT in 1980 to 2.15/100K VMT in 2004
- General Characteristics
  - Most crashes occur on weekdays, either in daytime between rush hours (0900-1400) or late night/early morning (0000-0700)
  - Majority of fatalities in rural areas

Safety (Giuliano & McFerrin, 2006)

- Causal Factors
  - Roadway characteristics
    - 2 lane undivided roads
    - No traffic control devices
    - Urban freeways: lane changes/merges
  - Driver characteristics
    - More compensation, less crash risk
    - pay by work (hours or miles), less crash risk
    - Truck driver DUI far less likely than pass driver
    - Hours of service effects mixed
  - At fault
    - In truck/passenger vehicle crashes, pass vehicle more likely at fault
    - If truck at fault, most likely reason is driver error

Safety (Giuliano & McFerrin, 2006)

- Role of Noncompliance
  - Trucking safety largely a driver issue
  - Vehicle problems
    - Brake failure most common
    - Many vehicles not compliant
      - Nearly 25% of 2004 roadside truck inspections resulted in out-of-service, vs. ~6% each for driver and hazmat inspections
  - Non-compliance and crashes
    - Size/weight violations 20% more likelihood of crash
    - Driver related violations (logbook, hours of service, driver qualification) 50% more likelihood of crash
    - Rollover crashes associated with higher speed, overweight vehicles

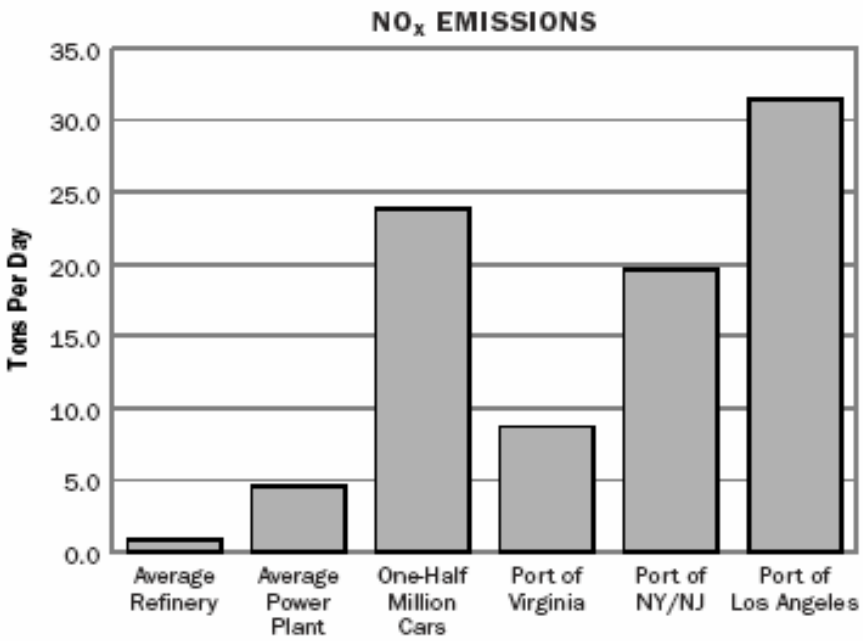
Air Quality (Rodier & Benjamin-Chung, 2006)

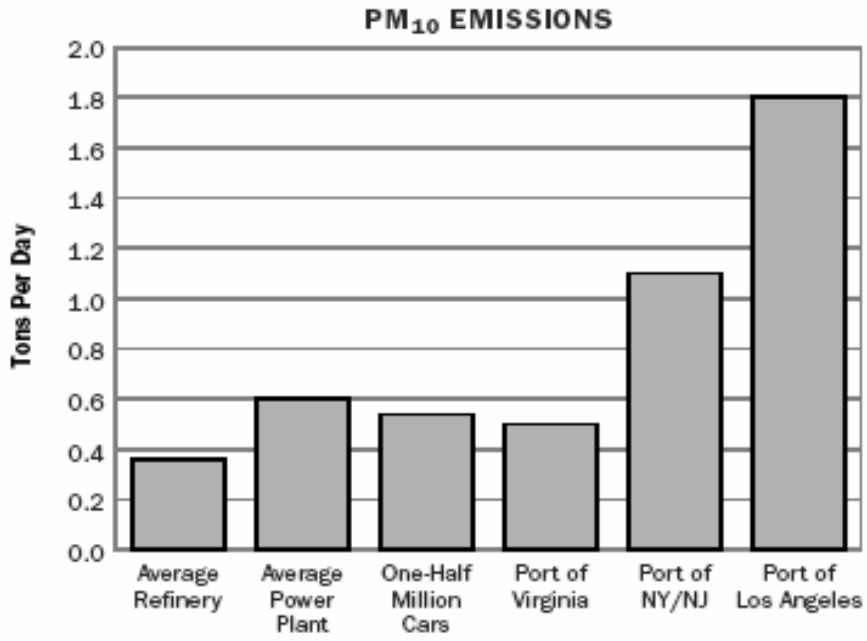
- HDDT major source of NOX, PM
- Health impacts of PM
  - Increased risk for heart attack, asthma & premature death
  - Diesel emissions responsible for 27,000 heart attacks & 2.4 million work loss days per year
  - California 2nd in nation for adult deaths associated with diesel PM, 5th for children
  - 4 of the top metro areas with the greatest health impacts due to diesel are in CA:
    - Los Angeles (2)
    - San Francisco-Oakland-Fremont (7)
    - San Diego-Carlsbad-San Marcos (21)
    - Riverside-San Bernardino-Ontario (25)

PLA Emissions: NO_2/PM_{10}

FIGURE E-1

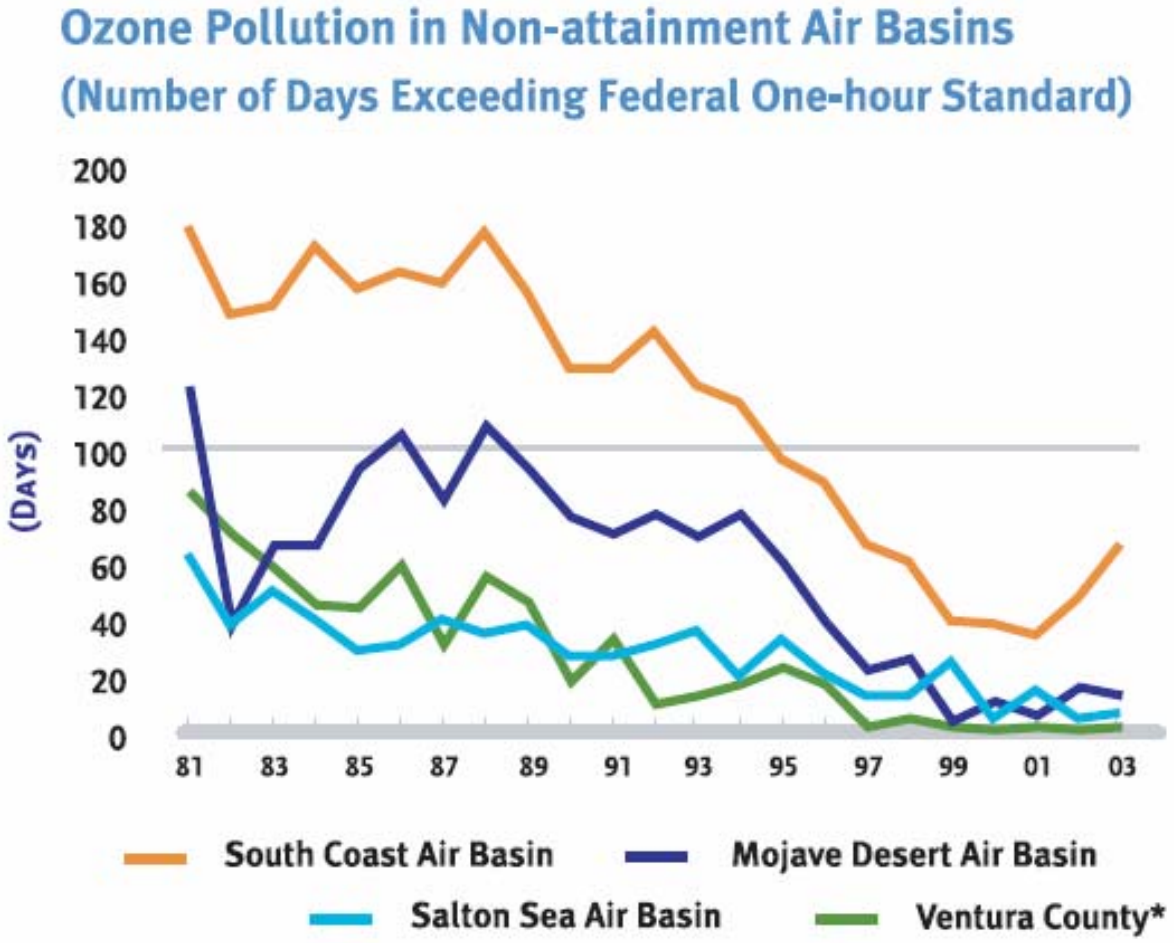
Nitrogen Oxides (NO_x) and Particulate Matter (PM_{10}) Pollution from Ports Compared to Refineries, Power Plants, and Cars





Sources: Seaports of the Americas, American Association of Port Authorities Directory (2002): 127. U.S. EPA, National Emission Trends, Average Annual Emissions, All Criteria Pollutants, 1970–2001, August 13, 2003. Energy Information Administration, Petroleum Supply Annual 1982, Volume 1, DOE/EIA-0340(82)/1 (June 1983, Washington, DC), pp. 97-103 and Petroleum Supply Annual 2000, Volume 1, DOE/EIA-0340(2000)/1 (Washington, DC, June 2001), Table 40. Energy Information Administration, Form EIA-861, "Annual Electric Utility Report." As posted at www.eia.doe.gov/cneaf/electricity/public/t01p01.txt, U.S. Dept of Transportation, Federal Highway Administration, 2000 Highway Statistics, State Motor-Vehicle Registrations.

Losing Ground



** Ventura County is part of the South Central Coast Air Basin*

Source: California Air Resources Board and South Coast Air Quality Management District

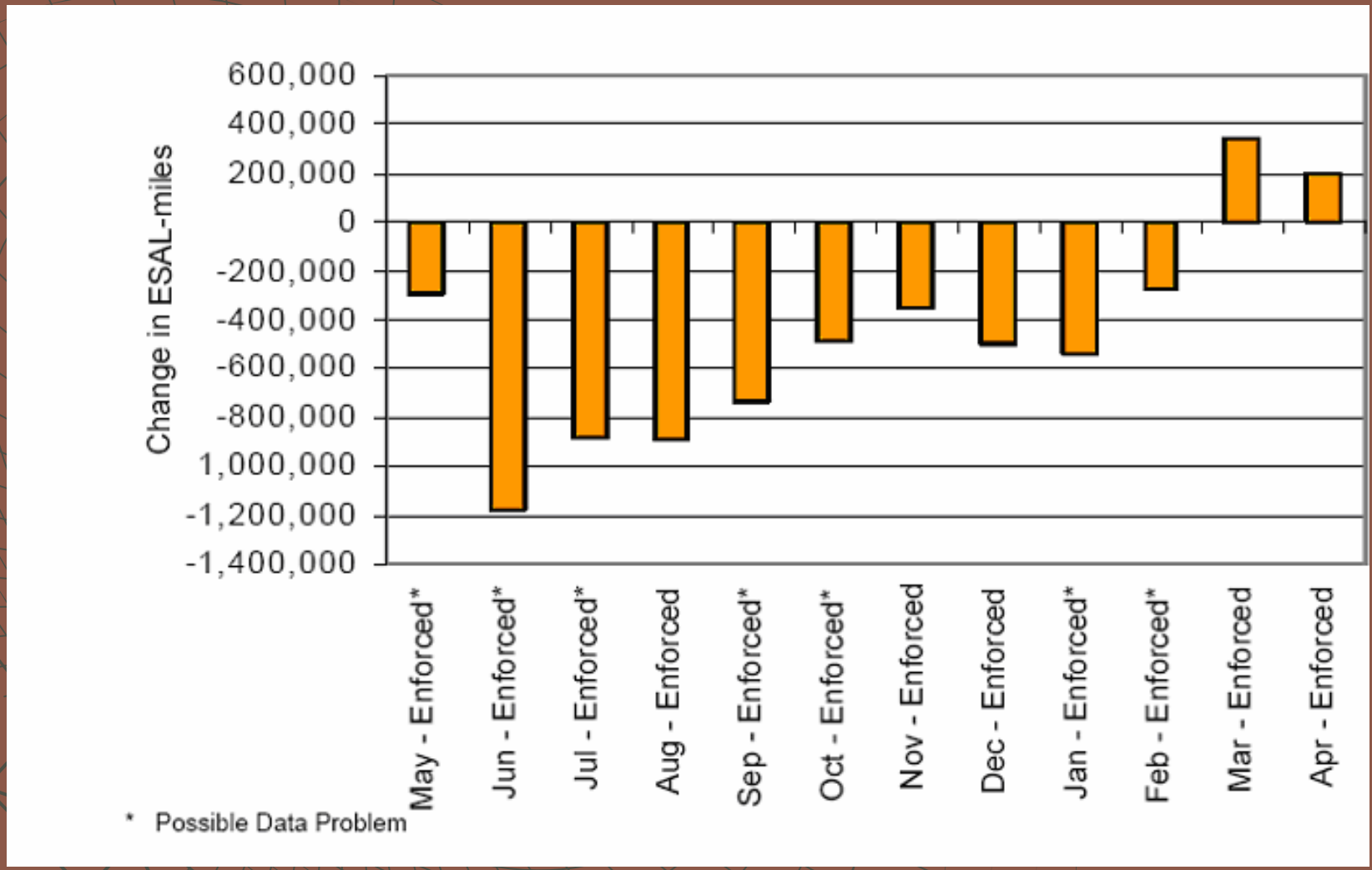
Air Quality (Rodier & Benjamin-Chung, 2006)

- Problems:
  - "Defeat devices" allow engines to surpass emissions standards at highway speeds
  - NAFTA and Mexico registered trucks
  - Truck idling
  - Truck emissions in neighborhoods
    - West Oakland (Port of Oakland)
    - Bayview Hunters Point in San Francisco
    - Mira Loma (near Riverside)

Pavement Damage: WIM Assessment (Santero et al., 2005)

- On average, 2.67% of axles are overweight & contribute to 5.74% of the pavement damage.
- Damage costs about $20-$30 million/year for maintenance and rehabilitation.
- 10 sites have greatest pavement damage due to overweight axles
  - Port of Long Beach (9), San Francisco International Airport (7) (no WIM site near Port of Oakland).
- Elimination of overweight trucks at these sites could extended pavement life by an average of 10.71%.

Potential Pavement Damage Savings from Enforcement



Source: Montana STAR Program

Security (Miller, 2006)

- Many Perceived Threats to Trucking Operations
  - Vehicles as instruments of terrorism; hijacking
  - Transport of dangerous, illegal materials
  - Cargo theft
  - Disruption of services and roadways
- Strategies
  - Procedural changes
  - Employee training, screening
  - Communications, information sharing
  - Physical security
- Monitoring/surveillance
  - Vehicle Monitoring, inspection
  - Cargo Detection, tracking
  - Access Control

Best Practices

- WIM applications
  - Maine: JOHO imaging system for monitoring
  - Kentucky-1-75: Static scale, ramp WIM & high-speed WIM for bypass
    - Significant time & fuel savings
  - Montana STARS: WIMs targeted enforcement
    - Significant decrease in overweight trucks & pavement reconstruction savings

Stakeholder Assessment

- General agreement re:
  - Need for more enforcement capacity
  - Use of technology to support human resources
  - Fully automated system seen as infeasible
- Issues
  - High cost of new CVEF, WIM facilities
  - Authority/accountability, CHP and Caltrans re maintenance, data sharing
  - WIM technology
    - Accuracy, reliability
    - Calibration and data processing outsourced

Next Steps

- Inventory of current capacity & performance
- Identification of alternatives
  - Technology & applications
- Preliminary alternative assessment
  - Costs & benefits
  - Legal & institutional issues