ALAMEDA CORRIDOR
AIR QUALITY BENEFITS FINAL REPORT

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EXECUTIVE SUMMARY

The movement of goods and cargo through the Ports of Los Angeles and Long Beach has increased dramatically in the last several years, and the region has felt the impacts in terms of increased traffic congestion and the impacts on air quality due to emissions from port-related activities. The Ports and air pollution control authorities have embarked on numerous strategies to reduce emissions from port operations both to achieve air quality standards and to respond to the concerns of the community. These efforts have focused on reducing emissions from the sources of emissions such as marine vessels, cargo handling equipment, trucks and trains. However, much less attention has been focused on emission reductions that occur as the result of greater efficiency in the handling of cargo through the Ports. The most significant project in this region to address the efficient movement of port cargo is the Alameda Corridor, which began operation in April of 2002. This report addresses the benefits of the Alameda Corridor in terms of reducing traffic delays associated with the rail transport of freight from the Ports to downtown Los Angeles along the previous rail lines and to the Inland Empire, quantifying the reductions in emissions that have occurred since the Alameda Corridor began operation. The document also estimates the future air quality benefits from increased utilization of rail transport over transportation by truck.

The Alameda Corridor allows trains to move more efficiently from the Ports of Long Beach and Los Angeles through downtown and this increased efficiency produces a regional air quality benefit. Air quality benefits are realized by three means: consolidation of pre-existing rail lines with longer routes into a more direct route to downtown, allowing trains to operate at faster speeds; elimination of vehicular wait times and emission reductions at grade crossings; and increased rail capacity on a consolidated corridor which allow more cargo to be transported by rail rather than truck.

Table 1 summarizes the benefits to date associated with the Alameda Corridor. These emissions reductions were then projected into the future to determine whether the Corridor continues to produce benefits under future growth and emission control scenarios.

Table 1: Existing Emission Benefits from the Alameda Corridor

Emission Reductions (tons)

Year	ROG	CO	NOx	PM10	SOx
2002*-2004	253.9	2371.9	1170.2	48.4	20.4

*Benefits start in April 2002 with opening of the new Corridor and are not annualized. Detailed calculation methods are presented in an appendix to this report.

In future years (2005 and 2012) basin-wide air quality benefits are realized by the utilization of the Alameda Corridor as part of the rail transportation route from the Ports to either Cajon Summit or Beaumont Pass. The benefits represent the reductions in emissions over the emissions that would have occurred if rail freight had continued to be transported over the existing rail lines and the added truck trips that would have been required when the capacity of the existing lines was reached in 2004. Tables 2 and 3 summarize the emission benefits along the Corridor and in the Inland Empire within the South Coast Air Basin (SCAB).

Table 2: 2005 Basin-wide Emission Benefits from the Alameda Corridor

Emission Reductions (tons)

2005	ROG	CO	NOx	PM10	SOx
Corridor	17.4	34.5	338.8	12.4	3.6
Inland Empire	1.7	1.0	57.8	1.8	2.6
Cumulative	19.1	35.5	396.6	14.2	6.2

Table 3: 2012 Basin-wide Emission Benefits from the Alameda Corridor

Emission Reductions (tons)

2012	ROG	CO	NOx	PM10	SOx
Corridor	33.7	109.1	519.6	9.4	1.0
Inland Empire	67.7	195.1	1562.4	9.7	3.0
Cumulative	101.4	304.2	2082.0	19.1	4.0

From 2002 to 2012, comparing the movement of the same number of containers using locomotives as opposed to trucks, locomotives along the Corridor continue to produce between 2.4 and 4.5 times less NOx and between 2 and 3 times less PM10 than trucks in both current and future years, even as locomotives and trucks become cleaner.

Although NOx and PM10 from locomotives contribute only 2.4 and 0.3 percent of total emissions in the South Coast Air Basin, nevertheless it is important that all sources contribute to regional air quality improvement. Other current and future benefits of the Alameda Corridor include reduction of cancer risk, reduced risk of hazardous material (hazmat) release, and other mass transit improvements. Imposing prohibitively expensive control technologies on locomotives that cause an economic shift to truck transport will not contribute to regional air quality improvements. In fact, it could actually result in an increase in pollutant burden. The most prudent approach to achieving air quality benefits while accommodating growth in cargo transport in the SCAB is to increase the use of rail infrastructure.

1. INTRODUCTION:

In the 2003 Air Quality Management Plan (AQMP) for the SCAB region[1] locomotive emissions are classified under the major source category for off-road vehicles, which consist of more than one hundred equipment types, including ships, aircraft, locomotive, recreational vehicles, construction equipment, etc. In the summary of emissions by major source category for 2006 the AQMP predicts that off-road vehicles will contribute 31% or 106580 tons/year (Figure 1) of regional NOx emissions and 7% or 7665 tons/year (Figure 2) of regional PM emissions.

The California Air Resources Board[2] estimated for 2003 that within the South Coast Air Basin, NOx and PM10 locomotive emissions (road hauling and switching) make up approximately 2.4% and 0.3% respectively of the total 2003 annual emissions. Related to all off-road source emissions locomotives contribute 9.1% NOx and 3.6% PM respectively.

In a recent port-wide baseline air emissions inventory[3] prepared by Starcrest for the Port of LA, 2001 emissions related to transportation of cargo originating from the Port of LA within the SCAB Region were analyzed. The summary of emissions by major source category from this study indicates that emissions from locomotives contribute 13% or 2465.8 tons/year of total port-related NOx (Figure 3) and 6% or 60.1 tons/year of total port-related PM cargo transportation emissions (Figure 4).

Figure 1: Regional NOx Emissions By Major Source Category, 2006 Base Year (tons/year), Source: Final 2003 SCAB AQMP, Table 3-3B

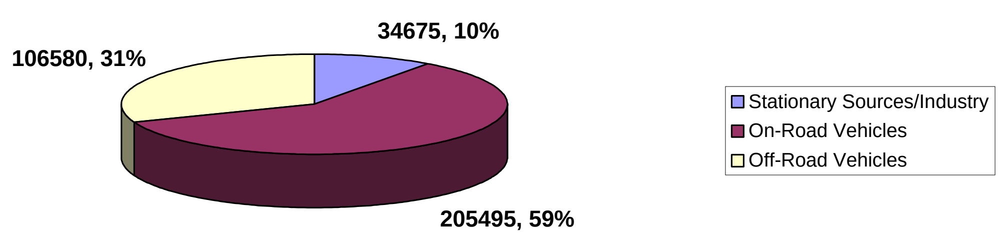


Figure 2: Regional PM10 Emissions By Major Source Category, 2006 Base Year (tons/year), Source: Final 2003 SCAB AQMP, Table 3-3B

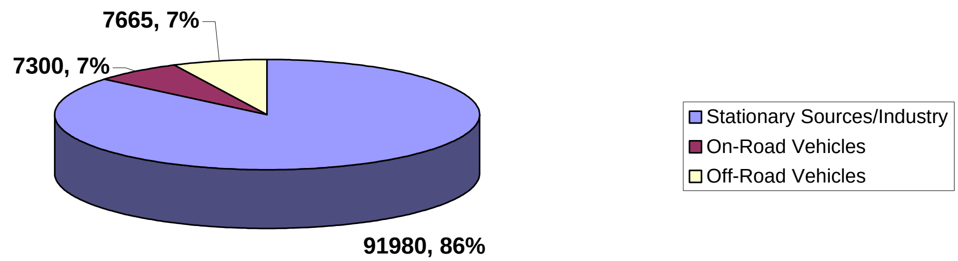


Figure 3: 2001 Emissions for NOx by Source Category related to transportation of Port-related cargo within the SCAB Region (tons/year)

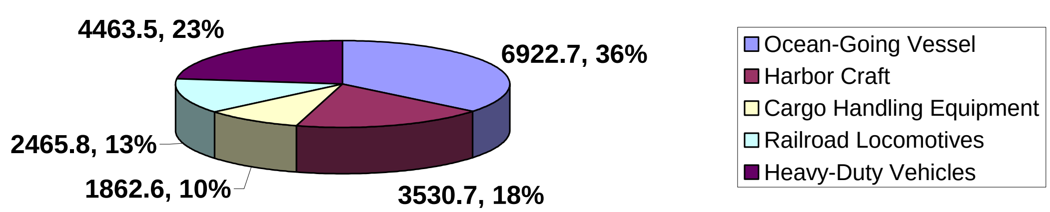
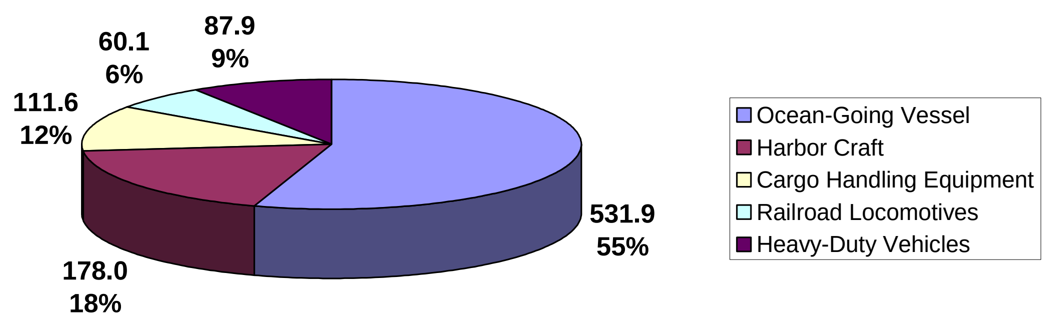


Figure 4: 2001 Emissions for PM10 by Source Category from transportation of Port-related cargo within the SCAB Region (tons/yr), Source: Starcrest, June 2004 for POLA



Locomotives transporting cargo contribute to the overall emissions in the SCAB and control measures for the reduction of these emissions need to be considered in air quality management planning. As a consequence, federal, state and local air quality planning documents have adopted the philosophy that all source categories must play a role in air quality improvement.

A variety of control measures have been proposed by various groups that could create disincentives for cargo handled by the Ports of Long Beach and Los Angeles from being conveyed along the Alameda Corridor. Among these measures are proposed tariffs on rail freight, demands for reduced rail traffic for environmental justice purposes and additional control technologies on locomotives that would make rail transport less attractive economically than conventional truck transport. For example, there are currently four legislative proposals that deal with locomotive emissions. These proposals include retrofit of rail yard diesel engines to accept alternative fuels, establishment of a remote sensing program to identify high-emitting locomotives, a locomotive emission mitigation program, and a joint resolution to EPA to implement locomotive engine controls nationwide. In considering any control measure it is important to understand that rail is a more efficient mode of cargo transport and this increased efficiency translates into air quality benefits to the South Coast Air Basin (SCAB).

When combined with other infrastructure improvements that increase the ability of cargo to be loaded directly to rail transportation systems, these air quality benefits become even more pronounced. These projects include expanded near-dock rail capacity and better utilization of existing on-dock rail facilities. Infrastructure improvement projects are rarely perceived as air quality control measures even though their benefits can be quantified. This study was commissioned to quantify both the direct air quality benefits of the Corridor, as well as the benefits of new infrastructure projects that would support more use of the Corridor and therefore create additional air quality benefits.

There are four main objectives to this study:

1. To educate the public on air quality principles as they relate to benefits from infrastructure improvements that facilitate cargo transport on trains;
2. To quantify the air quality benefits that the Alameda Corridor has produced to date;
3. To project the future air quality benefits of the Corridor given current growth projections and new infrastructure projects that will increase its use; and
4. To demonstrate the benefits of rail transportation over truck transportation and the need to avoid disincentives to rail transportation.

2. DESCRIPTION OF THE ALAMEDA CORRIDOR

The Alameda Corridor is located in southern Los Angeles County, California, running from the Ports of Long Beach and Los Angeles, 25 miles north to downtown Los Angeles, primarily along Alameda Street and the former Southern Pacific San Pedro branch right-of-way. The origin of the project can be traced to the Southern California Association of Governments[5] (SCAG) Ports Advisory Committee, whose study of rail access was completed in 1984. The study was conducted over mounting concern that projected train traffic associated with growth of commerce would have deleterious effects on communities north of the Ports and recommended consolidation of trains along an up-graded Southern Pacific San Pedro Branch right-of way. According to Cal EPA's "Goods Movement Action Plan" (2005) the Alameda Corridor was one of the first infrastructure projects in the country specifically built to address traffic congestion outside the Ports. The project EIR and EIS were certified in January of 1993 and March of 1996, respectively; construction was completed in April of 2002. Forty-four trains per day run along the Corridor currently.

The Schwarzenegger Administration recently expressed the following goals in its draft goods movement action plan:

- Generate jobs
- Increase mobility and relieve traffic congestion
- Improve air quality and protect public health
- Enhance public and port safety
- Improve California's quality of life

The Alameda Corridor operations have and will continue to meet all these goals. This report has been prepared to document that the Alameda Corridor has met and will continue to meet its objectives of reducing air quality effects on Port-adjacent communities.

Figure 5: The Alameda Corridor and Pre-Existing Rail Transportation Lines (Source: ACTA website)

3. CHARACTERIZATION OF AIR QUALITY BENEFITS

Direct air quality benefits from the Alameda Corridor are achieved through the consolidation of four 10 MPH rail lines into one 40 MPH rail line, and elimination of traffic delays associated with grade crossings along those rail lines and the Alameda Corridor. Indirect air quality benefits are achieved when more cargo is diverted from truck to rail transportation. The emission characterization approach presented in this section focuses on quantifying these direct and indirect benefits.

3.1 Existing Benefits of the Corridor

The Alameda Corridor consolidated four separate at-grade rail lines into a single grade separated rail corridor running from the Los Angeles and Long Beach Ports to downtown Los Angeles. By eliminating grade crossings, the Corridor allows trains to move through the area more safely and without causing vehicle delays at crossings. Compared to the pre-existing routes, the Corridor is also a more direct route, meaning fewer miles are traveled by a given train. In addition, the Corridor is only used for freight transportation. Prior to the Corridor, locomotive freight transport utilized the pre-existing low speed lines, thus increasing fuel consumption and the total travel time per train.

The operation of the Alameda Corridor decreases the amount of time taken by a given train to transport cargo from either Port through downtown Los Angeles from 2 hours to 45 minutes. This more efficient movement of trains results in a regional air quality benefit. Consequently, the Alameda Corridor was included as a control measure in the SCAQMD's 1991 AQMP - Transportation and Land Use Control Measure 11 and is mentioned as a Transit and System Management Measure in the 2002 Regional Transportation Improvement Program.

3.1.1 Locomotive Traffic Consolidation Benefits

Using actual locomotive traffic data, the emission reduction benefits of the Corridor were calculated, starting in April 2002 when the newly built Alameda Corridor was first opened until the end of the calendar year 2004. Annual emissions for the Corridor and emissions for trains along pre-existing routes were calculated for 2002, 2003 and 2004 and summarized in Table 4. The emission reductions were calculated by subtracting Alameda Corridor locomotive emissions (Project-Scenario) from the avoided emissions associated with traveling longer distances at slower speeds along pre-existing routes within the region (Null-Scenario).

In order to calculate benefits from 2002 – 2004 the locomotive emissions (lbs/day) were calculated by multiplying the daily power consumption with the corresponding emission factors, which were derived from the actual locomotive duty cycles. The daily power consumption was calculated by multiplying 39, 40 and 44 trains per day for the years 2002, 2003 and 2004, with average train-hours on pre-existing regional train routes (BNSF, SP, UP) and average locomotive cycle horsepower, assuming 4 locomotives per train. The daily locomotive emissions were then annualized (tons/year).

Table 4: Corridor Emission Reduction Benefits from Rail Efficiency (tons)

Year	ROG	CO	NOx	PM10	SOx
2002 Null*	27.8	32.2	877.8	21.7	46.4
2002 Project*	19.2	25.1	676.5	14.0	42.1
2002 Benefits*	**8.6 (-31%)**	**7.2 (-22%)**	**201.2 (-23%)**	**7.7 (-35%)**	**4.3 (-9%)**
2003 Null	40.2	46.5	1265.1	31.2	67.0
2003 Project	27.7	36.3	976.9	20.3	60.8
2003 Benefits	**12.4 (-31%)**	**10.2 (-22%)**	**288.2 (-23%)**	**11.0 (-35%)**	**6.2 (-9%)**
2004 Null	44.2	51.1	1391.6	34.3	73.5
2004 Project	30.7	40.0	1074.4	22.3	67.0
2004 Benefits	**13.5 (-31%)**	**11.1 (-22%)**	**317.2 (-23%)**	**12.0 (-35%)**	**6.6 (-9%)**
Cumulative Benefits	34.5	28.5	806.6	30.7	17.1

*Benefits start in April 2002 with opening of the new Corridor and are not annualized. Detailed calculation methods are presented in an appendix to this report.

The increased efficiency of running locomotives through a consolidated Corridor versus a variety of pre-existing rail line routes resulted in a NOx emission reduction of 201 tons in the year 2002 and 317 tons in 2004. Correspondingly, PM emissions were reduced by 8 tons in the year 2002 and 12 tons in 2004. Cumulative NOx and PM10 emission reductions from the implementation of the Alameda Corridor project were 807 and 31 tons, respectively. Emissions of all other criteria pollutants (ROG, CO, SOx) show corresponding reductions from 2002 to 2004 (Table 4).

3.1.2 Vehicle Delay Elimination Benefits

As noted in the previous section, the Alameda Corridor was constructed with grade separations. These grade separations also allow vehicular traffic (cars, trucks and buses) to travel unobstructed on surface streets along the length of the Corridor. Therefore, emissions of idling vehicles that previously were delayed at grade crossings waiting for trains to pass are eliminated with the operation of the Corridor. By placing the Corridor below grade, 34 grade crossings were eliminated. In addition, due to Corridor operation, 198 regional grade crossings are seldom frequented by freight trains.

In order to calculate the emission reductions associated with elimination of vehicle delay, the number of vehicles and delay times were estimated by Meyer Mohaddes from actual traffic count data scaled to account for growth factors and then translated into vehicular delay using standard algorithms. Using CARB EMFAC profiles for vehicle emissions for the years 2002, 2003 and 2004, idling emissions were then calculated for those delay times. Table 5 summarizes the annual emission reduction benefits attributed to the Alameda Corridor from the elimination of regional traffic delay.

Table 5: Corridor Emission Reduction Benefits from Traffic Delay Elimination (tons)

Year	ROG	CO	NOx	PM10	SOx
2002*	77.2	815.2	123.4	5.6	1.2
2003	71.8	768.1	119.2	5.8	1.0
2004	70.4	760.1	121.0	6.3	1.1
Cumulative	219.4	2,343.4	363.6	17.7	3.3

*Benefits start in April 2002 with opening of the new Corridor and are not annualized. Detailed calculation methods are presented in an appendix to this report. The emission reduction associated with elimination of traffic delay is 93% for every pollutant.

The elimination of traffic delay at grade crossings has resulted in a NOx emission reduction of 124 tons in the year 2002 and 121 tons in 2004. Correspondingly, PM emissions are reduced by 6 tons in the year 2002 and 6 tons in 2004. All other criteria pollutants (ROG, CO, SOx) show corresponding emission reductions within 2002 to 2004. It should be noted that the annual emission reduction benefits between 2002 and 2004 are slightly decreasing, since newer on-road vehicles are less polluting due to more stringent pollution standards. Cumulative emissions reductions in NOx and PM from 2002 to 2004 are 364 and 18 tons, respectively.

3.1.3 Overall Air Quality Benefits Realized 2002 -2004

The overall air quality benefits realized by the Corridor to date were calculated by adding rail efficiency and traffic delay elimination emission benefits presented in the previous sections. Overall benefits are summarized in Table 6. Cumulatively since April 2002, the project has reduced the pollutant burden of the South Coast Air Basin as follows: 254 tons of ROG; 2372 tons of CO; 1170 tons of NOx; 48 tons of PM; and 20 tons of SOx.

Table 6: Overall Emission Reductions 2002*-2004 (tons)

	ROG	CO	NOx	PM10	SOx
Rail Efficiency	34.5	28.5	806.6	30.7	17.1
Traffic Delay Elimination	219.4	2,343.4	363.6	17.7	3.3
Cumulative	253.9	2371.9	1170.2	48.4	20.4
Annualized Emission Reduction	85%	92%	45%	56%	23%

*Benefits start in April 2002 with opening of the new Corridor and emissions are not annualized. However emission reductions are presented on an annualized basis. Detailed calculation methods are presented in an appendix to this report.

It should be noted that, if there were no rail service at all between the Ports and downtown Los Angeles, the emissions generated by nearly the 7,000 equivalent truck trips that the Corridor now carries would far exceed the emissions generated by the current number of trains.

3.2 Future Benefits of the Corridor

In the future, demands for cargo transit will continue to increase. In response to this future demand, the Corridor will continue to provide more efficient and less polluting means of cargo transportation than truck transportation, thus producing future air quality benefits. There are two types of future air quality benefits to be realized; those directly related to the Corridor, and those related to the increased efficiency of cargo transport that can be achieved by hauling more freight by locomotive versus truck. To illustrate future regional benefits, 2005 and 2012 have been chosen as analysis years for transportation of cargo to either Cajon Summit or Beaumont Pass. The year 2005 represents benefits in the immediate future, whereas 2012 represents benefits in a future year when additional control measures that reduce the locomotive emissions profile will have been fully implemented. The following timeline (Table 7) outlines the assumptions regarding rail traffic and regulatory emission control measure implementation for trucks and trains between the years 2002 and 2012.

Table 7: Timeline of Assumptions for Future Benefits Calculations

Year	Project Status	Trains/ day	Train emission standards	Truck emission standards
2001	Only pre-existing routes on ATSF, SP and UP lines.		EPA Tier 0 standards apply to locomotives and engines manufactured from 1973-2001	New EPA diesel engine standards for all diesel vehicles over 8500 lbs.
2002	Alameda Corridor operations start in April 2002	39	EPA Tier 1 standards apply to locomotives and engines manufactured from 2002-2004	
2003		40		
2004	Pre-existing rail lines would reach maximum trains/day capacity (Null-Scenario)	44		
2005	3 train equivalents, beyond max. capacity of 44 trains/day on pre-existing rail lines, trucked from the Ports to the LA rail yards (Null-Scenario)	47	EPA Tier 2 standards apply to locomotives and engines manufactured from 2005 and later	
2006		50		
2007		52	California: Locomotive diesel fuels: 15 ppm sulfur, effective January 2007 Federal Non-road diesel fuels: 500 ppm sulfur effective June 2007	Additional diesel standards and test procedures: Sulfur in highway diesel reduced by 97% from 500 to 15 ppm. EPA-PM: 100% at 0.01 g/hp-hr.
2008		55		
2009		58		
2010		61	South Coast MOU: Early introduction of clean locomotives: fleet average to meet EPA Tier 2 standard	EPA-NOx: 100% at 0.20 g/hp-hr.
2011		63		
2012	22 train equivalents, beyond max. capacity of 44 trains/day on pre-existing rail lines, trucked from the Ports to the LA rail yards (Null-Scenario)	66	Federal Ultra low-sulfur diesel fuel (15 ppm Sulfur) regulation comes into effect starting Jan. 1, 2012	Reduction in sulfur content from 500 to 15 ppm (97% reduction)
2013 - Future			EPA Tier 3 and Tier 4 standards	

3.2.1 Benefits in 2005

In 2005 cargo train traffic from the Ports to downtown LA is projected to reach 47 trains per day. Future incremental benefits from the Corridor over 2004 emission reduction levels are primarily avoided truck trips. 2005 was chosen as an evaluation year since at this point the pre-existing rail lines formerly utilized by freight trains would no longer be capable of transporting additional freight, as they would have reached their limits in capacity with 44 trains per day (train counts provided by DIGICON). Thus, without the Corridor, the increases of 3 train equivalents in cargo from 2005 forward would have to be transported from the Ports by truck to a downtown rail yard and reloaded onto rail cars. Each additional train accommodated by the Corridor replaces 250 trucks that otherwise would have to transport the cargo on regional surface streets and freeways to downtown Los Angeles. Without the Corridor thousands of trucks per day would have been added to the already crowded thoroughfares in communities adjacent to the Ports. Therefore, the emission scenarios for future years without the Corridor would be 2004 train traffic to either Cajon Summit or Beaumont Pass, plus the difference in emissions from freight hauled by truck versus rail from the Ports to downtown Los Angeles for all projected train traffic above 2004 levels (44 trains per day).

For the 2005 Null Scenario (No Project) the locomotive emissions (tons/year) were calculated by multiplying the daily power consumption (average power requirements over all throttle settings) with the corresponding emission factors, which were derived from the actual locomotive duty cycles. The daily power consumption was calculated by multiplying 44 trains per day with average train-hours on pre-existing regional train routes and average locomotive cycle horsepower, assuming 4 locomotives per train.

The pre-existing rail lines accommodate up to 44 trains per day, therefore 3 train equivalents per day have to be transported from the Ports to the downtown rail yard by truck to meet the projected 2005 cargo transport demand of 47 trains per day. The Heavy Duty Diesel Truck (HDDT) emissions (tons/year) were calculated based on 3 train equivalents (one train equivalent represents 250 trucks carrying containers based on a standard 8,000 foot train). The 750 additional truck trips per day were multiplied by the vehicle miles traveled (VMT) from the Ports to the downtown rail yard with the corresponding emission factors, which were derived from EMFAC 2002[7] at average speeds of 35 mph and the combined Port of LA and Long Beach specific vehicle age distribution (Table 8) and assumptions for fleet replacement based on the Gateway Cities Clean Air Program[8].

A truck inventory for both Ports was compiled by the Port of Long Beach in 2002. In that year, the combined Port of LA and Long Beach truck fleet consisted of 7162 HDDT vehicles, with an age distribution ranging from 1965 to 2002. Within 2002-2012 a fleet turnover of 4% per year or 280 trucks per year is assumed, by replacing the oldest trucks in the fleet and distributing them evenly with trucks 10 years and newer (Table 8: Port of LA and Long Beach Fleet Age Distribution). Therefore a complete turnover of the fleet is reached within 25 years (EPA assumes 20-30 years to meet latest emission standards and Diesel Forum assumes 10-15 years for highway HDDT). The fleet turnover assumptions also include the impact of the current Gateway Cities Clean Air Program – Fleet Modernization – with replacement of 100 trucks per year within 2002-2006.

Table 8: Ports of LA and Long Beach HDDT Fleet Age Distribution

Manufacture	EMFAC	POLA/ POLB	Gateway City Buyback Program									
Year	**2002**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
2012	0	0	0	0	0	0	0	0	0	0	0	28
2011	0	0	0	0	0	0	0	0	0	0	28	56
2010	0	0	0	0	0	0	0	0	0	28	56	84
2009	0	0	0	0	0	0	0	0	28	56	84	112
2008	0	0	0	0	0	0	0	28	56	84	112	140
2007	0	0	0	0	0	0	18	46	74	102	130	158
2006	0	0	0	0	0	18	36	64	92	120	148	176
2005	0	0	0	0	18	36	54	82	110	138	166	194
2004	0	0	0	18	36	54	72	100	128	156	184	212
2003	0	0	18	36	54	72	90	118	146	174	202	230
2002	323	19	37	55	73	91	109	137	165	193	221	221
2001	302	26	44	62	80	98	116	144	172	200	200	200
2000	275	52	70	88	106	124	142	170	198	198	198	198
1999	314	67	85	103	121	139	157	185	185	185	185	185
1998	238	76	94	112	130	148	266	266	266	266	266	266
1997	224	188	206	224	242	360	360	360	360	360	360	360
1996	347	382	400	418	536	536	536	536	536	536	536	536
1995	459	514	532	650	650	650	650	650	650	650	650	650
1994	425	677	795	795	795	795	795	795	795	795	795	795
1993	370	664	664	664	664	664	664	664	664	664	664	664
1992	329	465	465	465	465	465	465	465	465	465	465	465
1991	376	495	495	495	495	495	495	495	495	495	495	495
1990	433	518	518	518	518	518	518	518	518	518	518	518
1989	504	610	610	610	610	610	610	610	610	610	499	219
1988	358	423	423	423	423	423	423	423	423	169	0	0
1987	311	313	313	313	313	313	313	306	26	0	0	0
1986	256	257	257	257	257	257	257	0	0	0	0	0
1985	264	443	443	443	443	296	16	0	0	0	0	0
1984	250	392	392	392	133	0	0	0	0	0	0	0
1983	93	132	132	21	0	0	0	0	0	0	0	0
1982	100	90	90	0	0	0	0	0	0	0	0	0
1981	103	73	73	0	0	0	0	0	0	0	0	0
1980	82	73	6	0	0	0	0	0	0	0	0	0
1979	92	60	0	0	0	0	0	0	0	0	0	0
1978	60	35	0	0	0	0	0	0	0	0	0	0
1977	39	26	0	0	0	0	0	0	0	0	0	0
1976	31	13	0	0	0	0	0	0	0	0	0	0
1975	28	18	0	0	0	0	0	0	0	0	0	0
1974	35	19	0	0	0	0	0	0	0	0	0	0
1973	25	12	0	0	0	0	0	0	0	0	0	0
1972	36	9	0	0	0	0	0	0	0	0	0	0
1971	12	8	0	0	0	0	0	0	0	0	0	0
1970	21	7	0	0	0	0	0	0	0	0	0	0
1969	19	0	0	0	0	0	0	0	0	0	0	0
1968	8	0	0	0	0	0	0	0	0	0	0	0
1967	8	0	0	0	0	0	0	0	0	0	0	0
1966	3	2	0	0	0	0	0	0	0	0	0	0
1965	3	0	0	0	0	0	0	0	0	0	0	0
1964	1	0	0	0	0	0	0	0	0	0	0	0
1963	1	0	0	0	0	0	0	0	0	0	0	0
1962	1	0	0	0	0	0	0	0	0	0	0	0
1961	1	0	0	0	0	0	0	0	0	0	0	0
1960	1	0	0	0	0	0	0	0	0	0	0	0
1959	1	1	0	0	0	0	0	0	0	0	0	0
1958	0	3	0	0	0	0	0	0	0	0	0	0
TOTAL	7162	7162	7162	7162	7162	7162	7162	7162	7162	7162	7162	7162

It should be noted that EMFAC 2002 usually calculates emission factors based on a HDDT fleet with replacement intervals of approximately 14 years. The HDDT fleet of the Ports is slightly older and therefore produces slightly higher emissions compared to truck emissions calculated with EMFAC 2002 without age distribution adjustments.

Tables 9 and 10 summarize the assumptions used to calculate projected emissions reductions from the Alameda Corridor in 2005. Table 9 simulates the "null" scenario with conditions as they would occur in 2005 without the Corridor – 44 trains on pre-existing routes and 3 train equivalents with 750 extra trucks on regional streets and freeways from the Ports to the downtown rail yard and from there reloaded onto rail cars to either Cajon Summit or Beaumont Pass. Table 10 simulates the "project" scenario with conditions for 2005 with the Corridor in operation – 47 trains transporting freight on the Corridor exclusively and then on existing rail lines to Cajon Summit or Beaumont Pass.

Table 9: 2005 NULL SCENARIO (NO PROJECT)

Railroad Carrier/ Segment		Routing Segments	Trains per day	miles	Average speed (mph)	Train-hours per Trip (1),(2)	Loco Cycle Horsepower (bhp)	Daily power-consumption (bhp-hr)	Locomotive Emissions (tons) ROG	CO	NOx	PM	SOx
BNSF	Ports to Redondo Jct	ATSF Harbor District	15.4	see NULL analysis		3.42	412	86,630	16.0	17.8	481.2	12.4	23.4
	Redondo to Colton Jct	BNSF Mainline	16.45	66.6	40	2.69	1084	191,548	28.9	40.3	890.4	20.3	51.7
	Colton Jct to Cajon Summit	BNSF Railline	16.45	28.3	25	1.83	1084	130,230	19.7	27.4	605.4	13.8	35.2
SP	Ports to Redondo Jct	SP San Pedro & Wilmington	4.4	see NULL analysis		1.79	439	13,844	2.5	2.7	75.5	2.0	3.7
	Redondo to Whittier	SP Mainline (former)	5.3	8.3	55	0.24	1084	5,594	0.8	1.2	26.0	0.6	1.5
	Ports to Whittier	via SP La Habra and Santa Ana	8.8	see NULL analysis		2.24	547	43,110	2.5	2.8	81.9	2.1	4.3
	Ports to Whittier	via SP La Habra and Santa Ana	8.8			2.24	547	43,110	4.3	4.7	139.5	3.6	7.3
	Whittier to Colton Jct	SP Mainline (former)	14.1	48.7	40	1.96	1084	120,056	18.1	25.3	558.1	12.7	32.4
	Colton Jct to Cajon Summit	(former SP & UP)	3.5	31.2	30	1.68	1084	25,638	3.9	5.4	119.2	2.7	6.9
	Colton Jct to Beaumont Pass	SP Mainline (former)	10.6	23.3	30	1.25	1084	57,440	8.7	12.1	267.0	6.1	15.5
UP	Ports to East LA Yard	UP San Pedro	15.4	see NULL analysis		1.96	484	58,246	9.9	10.8	308.9	8.0	15.7
	East LA Yard to Colton Jct	UP Mainline (former)	16.5	62.8	45	2.25	1084	160,550	24.3	33.8	746.3	17.0	43.3
	Colton Jctn to Cajon Summit	(former SP & UP)	4.1	31.2	30	1.68	1084	29,911	4.5	6.3	139.0	3.2	8.1
	Colton Jct to Beaumont Pass	UP Mainline (former)	12.3	23.0	30	1.24	1084	66,150	10.0	13.9	307.5	7.0	17.9

Truck Data for Additional Port Cargo			Train Equivalents	Distance per Trip (miles)		Trucks per Train	Truck Miles/Train Equivalent	Daily VMT	Heavy Duty Diesel Truck Emissions (tons) ROG	CO	NOx	PM	SOx
	Ports to LA Yards		3	25	35	250	6,250	18,750	6.7	25.9	117.3	3.0	1.4

(1) Train travel times outside of the mid-corridor are based on average train speeds and line-haul duty cycle assumptions with 38 % time-in-idle mode
(2) Train travel times for mid-corridor routes are based on analysis of SP, UP and BNSF operating parameters including time-in-notch while running and typical delay times

Locomotive and Truck Emissions (tons)	ROG	CO	NOx	PM	SOx
Alameda Corridor	**37.5**	**60.0**	**1064.8**	**27.5**	**48.5**
Inland Empire	**123.2**	**170.3**	**3798.6**	**86.9**	**219.8**
Cumulative	**160.8**	**230.3**	**4863.4**	**114.4**	**268.3**

Table 10: 2005 PROJECT SCENARIO (CORRIDOR CONSOLIDATION)

Railroad Carrier/ Segment		Routing Segments	Trains per day	miles	Average speed (mph)	Train-hours per Trip (1),(2)	Cycle Horsepower (bhp)	Daily power-consumption (bhp-hr)	Locomotive Emissions (tons) ROG	CO	NOx	PM	SOx
BNSF	Ports to North End of Corridor	Alameda Corridor	16.45	see CORRIDOR		0.65	1361	58,210	7.0	8.9	254.1	5.2	15.7
	North End of Corridor to Colton Jct	BNSF Mainline	16.45	66.6	40	2.69	1084	191,548	28.9	40.3	890.4	20.3	51.7
	Colton Jct to Cajon Summit	BNSF Line	16.45	28.3	25	1.83	1084	130,230	19.7	27.4	605.4	13.8	35.2
UP	Ports to end of Corridor	Alameda Corridor	30.55	see CORRIDOR		0.65	1361	108,104	13.0	16.5	471.9	9.7	29.2
	End of Corridor to Colton Jct (SP Route)	SP Mainline	14.1	58.4	40	2.35	1084	143,969	21.8	30.3	669.3	15.2	38.9
	End of Corridor to Colton Jct (UP Route)	UP Mainline	16.45	62.8	45	2.25	1084	160,550	24.3	33.8	746.3	17.0	43.3
	Colton Jct to Cajon Summit	SP Route (former)	7.6	31.2	30	1.68	1084	55,550	8.4	11.7	258.2	5.9	15.0
	Colton Jct to Beaumont Pass	UP/ SP (former) Route	22.9	23.0	30	1.24	1084	122,850	18.6	25.9	571.1	13.0	33.2

(1) Train travel times outside of the mid-corridor are based on average train speeds and line-haul duty cycle assumptions with 38 % time-in-idle mode
(2) Train travel times for mid-corridor routes are based on analysis of UP and BNSF operating parameters including time-in-notch while running and typical delay times

	ROG	CO	NOx	PM	SOx
Alameda Corridor	**20.1**	**25.4**	**726.0**	**15.0**	**44.9**
Inland Empire	**121.6**	**169.3**	**3740.8**	**85.2**	**217.2**
Cumulative	**141.7**	**194.8**	**4466.8**	**100.1**	**262.1**
Alameda Corridor Benefits	**17.4**	**34.5**	**338.8**	**12.5**	**3.6**
Inland Empire Benefits	**1.7**	**1.0**	**57.8**	**1.8**	**2.6**
Cumulative Benefits	**19.1**	**35.5**	**396.6**	**14.2**	**6.2**
Change	**12%**	**15%**	**8%**	**12%**	**2%**

Emissions were calculated for the "null" and "project" scenarios. The "project" emissions were then subtracted from the "null" emissions to quantify future emissions reductions of the Corridor in year 2005. The overall emission benefits of locomotive transit efficiency/utilization of additional trains versus truck were calculated for 2005 along the Corridor as well as the Inland Empire and summarized in Table 11. In 2005, the overall emission benefits of the Alameda Corridor operation are 19 tons of ROG, 36 tons of CO, 397 tons of NOx, 14 tons of PM and 6 tons of SOx.

Table 11: Basin-wide Emission Reduction Benefits from Rail Efficiency in 2005 (tons)*

SCENARIO	ROG	CO	NOx	PM10	SOx
NULL Corridor	37.5	60.0	1064.8	27.5	48.5
NULL Inland Empire	123.2	170.3	3798.6	86.9	219.8
NULL Cumulative	**160.8**	**230.3**	**4863.4**	**114.4**	**268.3**
PROJECT Corridor	20.1	25.4	726.0	15.0	44.9
PROJECT Inland Empire	121.6	169.3	3740.8	85.2	217.2
PROJECT Cumulative	**141.7**	**194.8**	**4466.8**	**100.1**	**262.1**
Corridor Benefits	17.4	34.5	338.8	12.5	3.6
Inland Empire Benefits	1.7	1.0	57.8	1.8	2.6
Cumulative Benefits	**19.1 (-12%)**	**35.5 (-15%)**	**396.6 (-8%)**	**14.2 (-12%)**	**6.2 (-2%)**

* Includes truck equivalent emissions from Ports to downtown Los Angeles for Null Scenario

3.2.2 Benefits by 2012

In 2012 cargo train traffic from the Ports to downtown LA is projected to reach 66 trains per day. Future incremental benefits from the Corridor in 2012 are primarily avoided truck trips. 2012 was chosen as an evaluation year because at that point it is expected that continued improvement in locomotive engine design, quality of fuel and commitments to PM control technologies for both trucks and locomotives will be realized (Table 7). By 2012, several infrastructure improvement projects will have been implemented within the Ports of Los Angeles and Long Beach that will shift of cargo from truck to rail. These projects include:

- Expanded near-dock capacity
- Better utilization of on-dock rail facilities

The additional trains anticipated to run along the Corridor as a result of these projects were included in the "project" assumptions for 2012. If short-haul shuttle trains were operated from the Ports to the Old Colton Yard in the City of Colton near the warehouses and distribution centers or other inter-modal rail terminals in the Inland Empire, these future benefits would be even greater than calculated here.

Using the control measure and infrastructure project assumptions described above, the derived locomotive and truck emission factors were used to simulate emission reductions for trains utilizing the consolidated Corridor and the continuation to Cajon Summit and Beaumont Pass in 2012. Similar to the methodology employed to simulate 2005 conditions, “null” and “project” cases were developed for 2012. Tables 10 and 11 present these assumptions. By 2012, 22 additional trains will be accommodated by the Corridor that would have not been possible with pre-existing corridors. In the 2012 null scenario these train equivalents will be trucked from the Ports to either Cajon Summit or Beaumont Pass on local freeways, because all railyards will be at capacity and Cajon Summit and Beaumont Pass are possible locations for new intermodal facilities.

The assumptions used to quantify control measure improvements are as follows: future year 2012 assumptions incorporate emission reductions based on Air Quality Management Plan control measure M-14, which assumes that cleaner locomotive engines (those compliant with federal Tier II standards) will be operating in California and in the South Coast Air Basin. As a result of M-14, CARB, the railroads and EPA signed a Memorandum of Understanding providing for early introduction of clean locomotive units and requiring that a fleet average equivalent to EPA’s Tier II standards be achieved by 2010. The emissions profile for future year locomotives also assumes the implementation of the California low-sulfur diesel fuel regulations (for which locomotives will have to comply by January 1, 2012).

Emission calculations for heavy-duty diesel trucks in 2012 incorporate implementation of both new emission standards and fuel programs. In December 2000, the EPA issued the final rule for the two-part strategy to reduce diesel emissions from heavy-duty trucks and buses. The EPA issued new diesel engine standards beginning in model year 2001 for all diesel vehicles over 8,500 pounds. Additional diesel standards and test procedures will begin in 2007. These standards are based on the use of high-efficiency advanced emissions controls. Because most PM control devices are damaged by sulfur, EPA is also initiating a program requiring cleaner diesel fuels. Refiners will be required to start producing diesel fuel for use in highway vehicles with a sulfur content of no more than 15 parts per million (ppm), beginning June, 2006. This concentration is reduced from the current level of 500 ppm, a 97 percent reduction. These two rules will be phased in between 2006 and 2010 in order to ensure a smooth transition (Table 7).

The following assumptions were used to calculate avoided truck emissions in 2012. The pre-existing rail lines accommodate up to 44 trains per day, therefore 22 train equivalents per day have to be transported from the Ports by truck to meet the projected 2012 cargo transport demand of 66 trains per day. The heavy duty diesel truck (HDDT) emissions (lbs/day) were calculated based on 22 train equivalents (5500 trucks) by multiplying the daily vehicle miles traveled (VMT) with the corresponding emission factors, which were derived from EMFAC 2002 at average speeds of 45 mph and a combined Port of LA and Long Beach specific vehicle age distribution and assumptions for fleet replacement based on the Gateway Cities Clean Air Program.

Emissions were calculated for the “null” and “project” scenarios. Tables 12 and 13 present both the underlying assumptions and results. The “project” emissions were then subtracted from the “null” emissions to quantify future emissions reductions of the Corridor in year 2012.

Locomotive emissions (lbs/day) were calculated by multiplying the daily power consumption with the corresponding emission factors, derived from the actual locomotive duty cycles, which are more efficient along the Corridor. The daily power consumption was calculated by multiplying 66 trains per day with average train-hours on the consolidated Corridor and then on existing rail lines to either Cajon Summit or Beaumont Pass and average locomotive cycle horsepower, assuming 4 locomotives per train. The daily locomotive emissions were then annualized (tons/year).

Table 12: 2012 NULL SCENARIO (NO PROJECT)

Railroad Carrier/ Segment		Routing Segments	Trains per day	miles	Average speed (mph)	Train-hours per Trip	Loco Cycle Horsepower (bhp)	Daily power-consumption(1) (bhp-hr)
BNSF	Ports to Redondo Jct	ATSF Harbor District	15.4	see NULL analysis		3.42	412	86,630
	Redondo to Colton Jct	BNSF Mainline	15.4	66.6	40	2.69	1084	179,322
	Colton Jct to Cajon Summit	BNSF Railline	15.4	28.3	25	1.83	1084	121,917
SP	Ports to Redondo Jct	SP San Pedro & Wilmington	4.4	see NULL analysis		1.79	439	13,844
	Redondo to Whittier	SP Mainline (former)	4.4	9.7	40	0.39	1084	7,462
	Ports to Whittier, along Alameda Corridor	via SP La Habra and Santa Ana	8.8	see NULL analysis		2.24	547	43,110
	Ports to Whittier, in the Inland Empire	via SP La Habra and Santa Ana	8.8	see NULL analysis		2.24	547	43,110
	Whittier to Colton Jct	SP Mainline (former)	13.2	48.7	40	1.96	1084	112,393
	Colton Jct to Cajon Summit	(former SP & UP)	3.3	31.2	30	1.68	1084	24,002
	Colton Jct to Beaumont Pass	SP Mainline (former)	9.9	23.3	30	1.25	1084	53,773
UP	Ports to East LA Yard	UP San Pedro	15.4	see NULL analysis		1.96	484	58,246
	East LA Yard to Colton Jct	UP Mainline (former)	15.4	62.8	45	2.25	1084	150,302
	Colton Jctn to Cajon Summit	(former SP & UP)	3.85	31.2	30	1.68	1084	28,002
	Colton Jct to Beaumont Pass	UP Mainline (former)	11.55	23.0	30	1.24	1084	61,928
Truck Data for Additional Port Cargo transported via Truck			Train Equivalents	Distance per Trip (miles)		Trucks per Train	Truck Miles/Train Equivalent	Daily VMT
	Ports to end of Corridor		22	25	35	250	6250	137,500
	Truck Traffic to Cajon Summit		11.275	79	45	250	19,750	222,681
	Truck Traffic to Beaumont Pass		10.725	88	45	250	22,000	235,950

Locomotive Emissions (tons)				
ROG	CO	NOx	PM	SOx
10.5	52.3	191.7	7.0	0.2
21.6	108.2	396.8	14.4	0.4
14.7	73.6	269.8	9.8	0.2
1.7	8.4	30.6	1.1	0.0
0.9	4.5	16.5	0.6	0.0
1.9	9.6	35.3	1.3	0.0
3.3	16.4	60.1	2.2	0.1
13.6	67.8	248.7	9.0	0.2
2.9	14.5	53.1	1.9	0.0
6.5	32.5	119.0	4.3	0.1
7.0	35.2	128.9	4.7	0.1
18.1	90.7	332.6	12.1	0.3
3.4	16.9	62.0	2.3	0.1
7.5	37.4	137.0	5.0	0.1
Heavy Duty Diesel Truck Emissions (tons)				
ROG	CO	NOx	PM	SOx
40.8	144.7	649.9	14.2	1.1
54.2	201.3	1149.4	18.9	1.8
57.4	213.3	1217.9	20.0	1.9
152.4	**559.3**	**3017.2**	**53.2**	**4.8**

	Locomotive and Truck Emissions (tons)				
	ROG	CO	NOx	PM	SOx
Alameda Corridor	**61.9**	**250.1**	**1036.5**	**28.3**	**1.5**
Inland Empire	**204.1**	**877.1**	**4063.0**	**100.6**	**5.2**
Cumulative	**266.0**	**1127.2**	**5099.4**	**128.9**	**6.7**

Table 13: 2012 PROJECT SCENARIO (CORRIDOR CONSOLIDATION)

Railroad Carrier/ Segment		Routing Segments	Trains per day	miles	Average speed (mph)	Train-hours per Trip	Cycle Horsepower (bhp)	Daily power-consumption(1) (bhp-hr)
BNSF	Ports to North End of Corridor	Alameda Corridor	23.1	see CORRIDOR analysis		0.65	1361	81,742
	North End of Corridor to Colton Jct	BNSF Mainline	23.1	66.6	40	2.69	1084	268,982
	Colton Jct to Cajon Summit	BNSF Line	23.1	28.3	25	1.83	1084	182,876
UP	Ports to end of Corridor	Alameda Corridor	42.9	see CORRIDOR analysis		0.65	1361	151,806
	End of Corridor to Colton Jct (SP Route)	SP Mainline	19.8	58.4	40	2.35	1084	202,169
	End of Corridor to Colton Jct (UP Route)	UP Mainline	23.1	62.8	45	2.25	1084	225,453
	Colton Jct to Cajon Summit	SP Route (former)	10.73	31.2	30	1.68	1084	78,006
	Colton Jct to Beaumont Pass	UP/ SP (former) Route	32.18	23.0	30	1.24	1084	172,513

	Locomotive Emissions (tons)				
	ROG	CO	NOx	PM	SOx
	9.9	49.3	180.9	6.6	0.2
	32.5	162.3	595.2	21.6	0.5
	22.1	110.4	404.7	14.7	0.4
	18.3	91.6	335.9	12.2	0.3
	24.4	122.0	447.4	16.3	0.4
	27.2	136.1	498.9	18.1	0.5
	9.4	47.1	172.6	6.3	0.2
	20.8	104.1	381.8	13.9	0.3
Alameda Corridor	**28.2**	**141.0**	**516.8**	**18.8**	**0.5**
Inland Empire	**136.4**	**682.0**	**2500.6**	**90.9**	**2.3**
Cumulative	**164.6**	**822.9**	**3017.4**	**109.7**	**2.7**

Alameda Corridor Benefits	**33.7**	**109.1**	**519.6**	**9.5**	**1.0**
Inland Empire Benefits	**67.7**	**195.1**	**1562.4**	**9.7**	**3.0**
Cumulative Benefits	**101.4**	**304.2**	**2082.0**	**19.1**	**3.9**
Change	**38%**	**27%**	**41%**	**15%**	**59%**

The overall benefits of locomotive efficiency and utilization of additional trains versus truck were calculated for 2012 and summarized in Table 14.

Table 14: Basin-wide Emission Reduction Benefits from Rail Efficiency in 2012 (tons)*

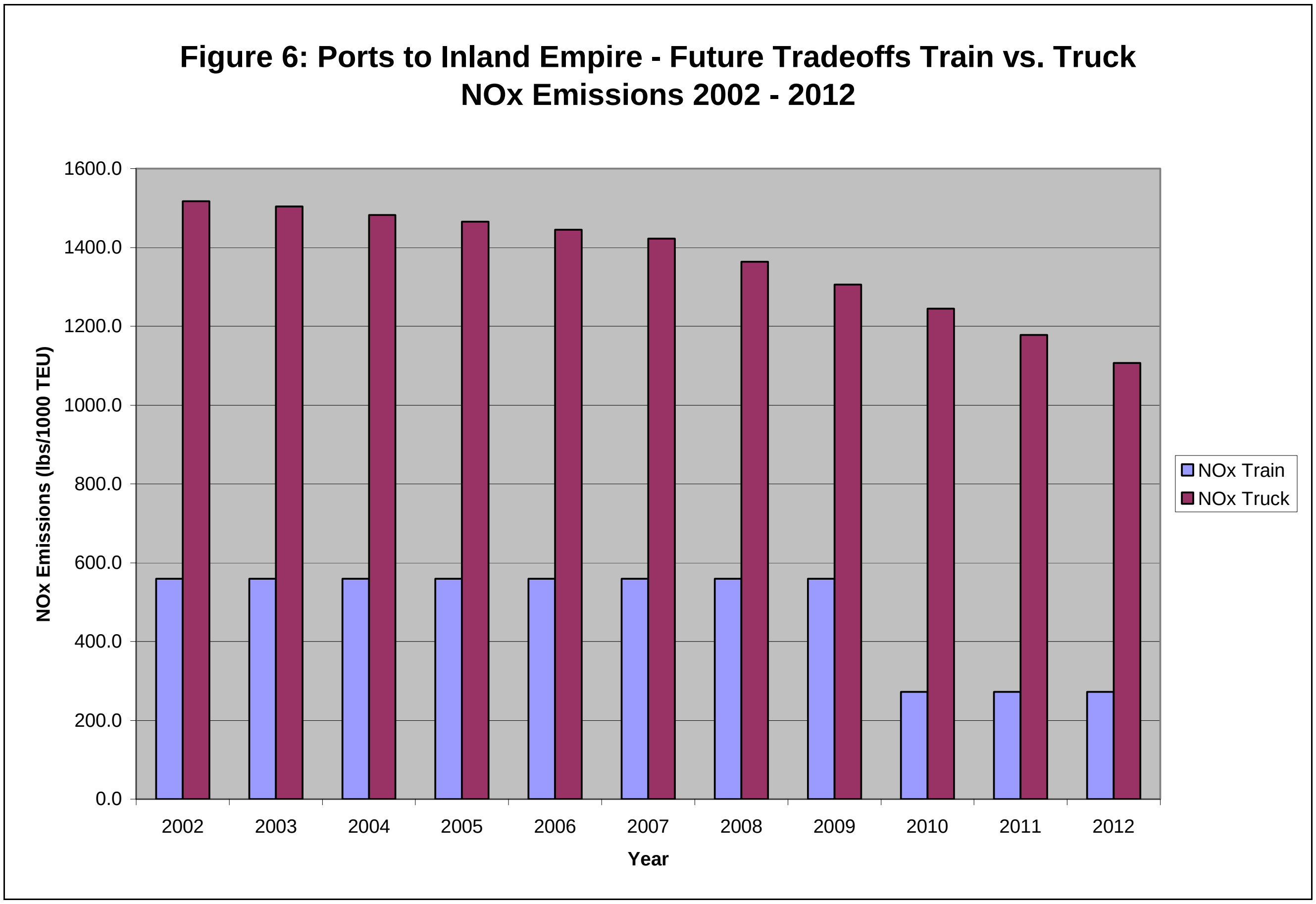
SCENARIO	ROG	CO	NOx	PM10	SOx
NULL Corridor	61.9	250.1	1036.5	28.3	1.5
NULL Inland Empire	204.1	877.1	4063.0	100.6	5.2
NULL Cumulative	**266.0**	**1127.2**	**5099.4**	**128.9**	**6.7**
PROJECT Corridor	28.2	141.0	516.8	18.8	0.5
PROJECT Inland Empire	136.4	682.0	2500.6	90.9	2.3
PROJECT Cumulative	**164.6**	**822.9**	**3017.4**	**109.7**	**2.7**
Corridor Benefits	33.7	109.1	519.6	9.5	1.0
Inland Empire Benefits	67.7	195.1	1562.4	9.7	3.0
Cumulative Benefits	**101.4 (-38%)**	**304.2 (-27%)**	**2082.0 (-41%)**	**19.1 (-15%)**	**3.9 (-59%)**

* Includes truck equivalent emissions for Null Scenario

In 2012, the overall benefits of Corridor operation are 101 tons of ROG, 304 tons of CO, 2082 tons of NOx, 19 tons of PM and 4 tons of SOx.

3.3 Future Air Quality Tradeoffs in Locomotive versus Truck Emissions:

There are air quality benefits to be realized by switching truck cargo to locomotive transport because trains can transport freight more efficiently than trucks. To illustrate this benefit, we compared emissions of trucks and trains on a lbs/1000 TEU basis from 2002 to 2012. Emissions from locomotives traveling from the Ports to Inland Empire were projected by year from 2002 to 2012. In Figure 6, the NOx emissions profile (lbs/1000 TEU) for locomotives traveling to Inland Empire is compared on a yearly basis from 2002 to 2012 with the emissions profile of the equivalent number of trucks traveling to the same destination. Figure 7 presents a similar comparison for the PM10 emissions profile of locomotives and trucks. It should be noted that NOx and PM emission control technologies are being implemented throughout the period of the analysis and therefore show reduction in NOx and PM emissions for both trains and trucks over time.

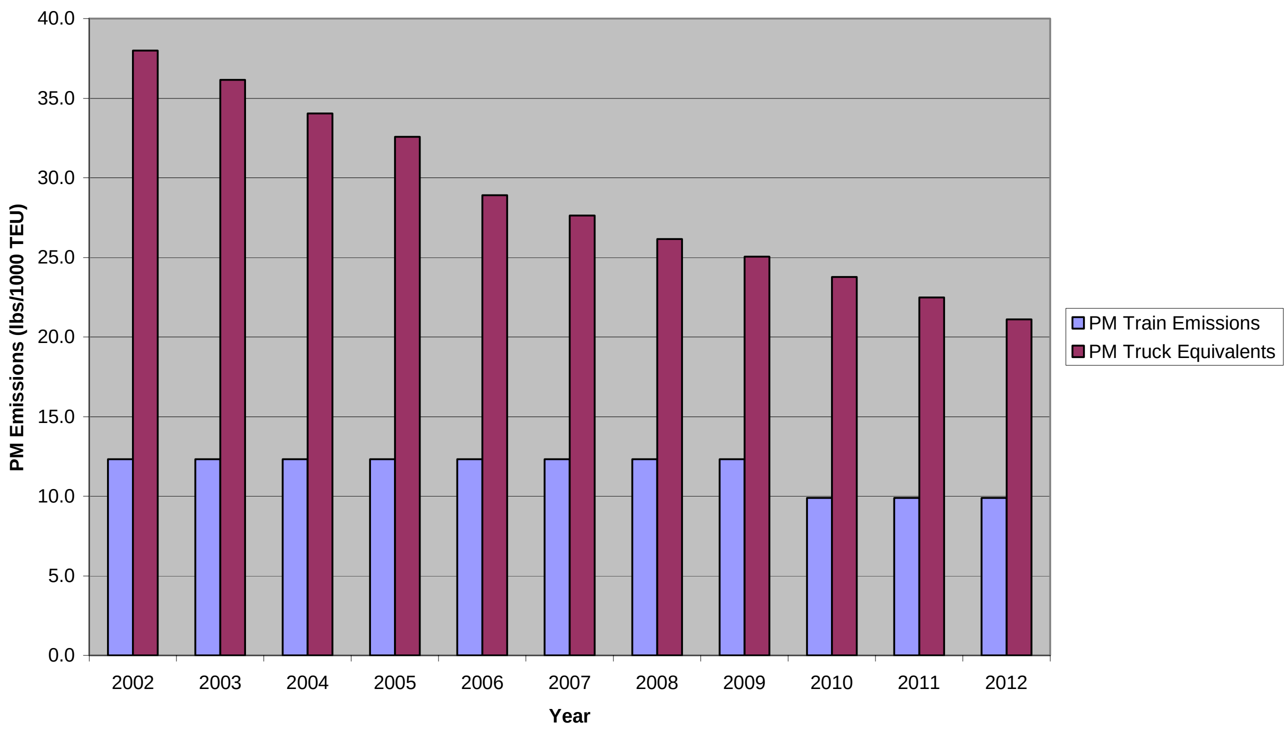


With respect to NOx, the emissions profile for locomotives decreases more dramatically than for trucks. The NOx reduction for locomotives in 2010 is related to the implementation of the Memorandum of Understanding (MOU) between railroads and EPA, providing for early introduction of clean locomotive units, requiring a fleet average equivalent to EPA's Tier II standards by 2010. The overall analysis for NOx trends shows that it is 2.4 to 4.5 times more efficient on an emissions basis to haul cargo by locomotive than by truck.

With respect to PM10 emissions, both locomotives and trucks show reductions over time. The PM10 reduction for locomotives in 2010 is related to the implementation of the EPA Tier II locomotive emissions standard. The analysis of PM10 emissions also shows that overall it is 2 to 3 times more efficient on an emissions basis to haul cargo by locomotive than by truck.

Therefore, it is important in any air quality planning effort to avoid any regulation that causes a shift from locomotive to truck transport. In fact, a shift from locomotive to truck transport will actually increase overall cargo transport emissions in the South Coast Air Basin.

Figure 7: Ports to Inland Empire - Future Tradeoffs Train vs. Truck PM Emissions 2002 - 2012



3.4 Other Current and Future Public Health Benefits:

The Alameda Corridor has and will continue to make other contributions to public health and safety both along the Corridor and within the SCAB. These benefits include reduction of regional cancer risk, reduced risk of hazardous material (hazmat) release, increased mass transit efficiencies, and development of additional future diesel risk mitigation strategies.

3.4.1 Reduction in Cancer Risk

The air quality benefits summarized above relate to reduced air emissions from combustion of diesel fuel by locomotives. The California EPA Office of Environmental Health Hazard Assessment has summarized health effects of diesel exhaust[11]. (Health Effects of Diesel Exhaust Fact Sheet, August 2002). The combustion products of this fuel contain compounds considered to be carcinogenic. Therefore, by reducing the amount of fuel burned per trip, operation of the Corridor has produced a regional reduction in cancer burden in the South Coast Air Basin.

3.4.2 Risk of Hazardous Material Release

The risk of hazardous materials releases from rail transportation was also reduced by construction of the Corridor. Reductions in risk occur due to the fact that grade separation removes the opportunity for trains and vehicles to come in physical contact and the depressed nature of the Corridor increases its ability to better contain any release that might occur. A transportation risk assessment[12] was conducted to evaluate the risk posed to the train crew on the Alameda Corridor with regards to the release of hazardous materials caused by train accidents. The risk assessment results were then compared to a previous risk assessment conducted on the former track. (ABSG Consulting, Inc., 2002)

The results of the study indicated that the grade separations facilitated a substantial improvement with regards to the ability to efficiently time traffic signals along the Alameda Corridor, resulting in reduced accident frequency and likelihood of hazardous materials release. More specifically, the study concluded:

- The frequency of a train accident in the Corridor is almost an order of magnitude smaller than that of the former track (probably because of the elimination of crossings, major track improvements and track upgrade from Class 2 to 4 (Federal Railroad Administration Standards).
- Hazmat release potential is approximately 4.5 times lower even though the speed of locomotives traveling along the Corridor is more than two times higher.
- The risk of fatality is lower by a factor of 2.5 than that of the former track, even though there are more trips per day along the Alameda Corridor.

Rail transport is generally safer than truck transport. Nationally in year 2002, a total of 1,055 releases occurred involving hazardous materials on the rails versus 14,964 on trucks. The industry's train accident rate has fallen 64% from 1980 to 2000 and during the 1990's railroads invested nearly $140 billion to maintain, improve and expand tracks and equipment, adding safety with each new investment.

3.4.3 Other Transit Improvement Benefits

There are other improvements in non-locomotive transit along the Corridor which contribute to public health benefits in adjacent communities:

- The Alameda Corridor decreases the total time a cargo train takes to reach its destination. Consequently, the railroads have been able to eliminate crew changes in downtown Los Angeles, eliminating the 30 to 45 minute idling time it would take to facilitate the change in personnel.
- Due to the elimination of vehicle delays at grade crossings, emergency response times are faster so people requiring emergency care are better served along the Corridor.
- Improvements in the MTA bus service have been realized. There has been an estimated savings of 15,000 hours of passenger delay per day for transit vehicles that used to wait at rail crossings. People using transit vehicles are able to get to their destination more quickly than before.
- Metro Rapid Bus Lines with newer lines, additional passenger stops and reduced delays have been added along the Corridor, increasing ridership levels.
- The grade separation of Redondo Junction constructed in 2001 has improved the performance of passenger trains along that route, allowing those trains to travel at higher speeds (increasing from 15 to 45 miles per hour) saving 5 to 7 minutes per trip.

These additional improvements also translate into additional regional air quality benefits for the South Coast District, although not specifically quantified in this report.

4. SUMMARY AND CONCLUSIONS

The Alameda Corridor has demonstrated significant air quality benefits since it opened for operation in April 2002. These benefits are realized through shorter routes, faster transit times, and the elimination of vehicle delay both along the Corridor and along pre-existing rail lines. Cumulatively since 2002, the project has reduced the pollutant burden of the South Coast Air Basin by 254 tons of ROG; 2372 tons of CO; 1170 tons of NOx; 48 tons of PM; and 20 tons of SOx.

Future basin-wide benefits from the Corridor are also projected. These benefits consist of the same types of benefits already realized by the Corridor as well as avoided truck trips due to the increased capacity of the Corridor via rail versus alternate truck routes. The overall emission reductions projected for 2005 are as follows: 19 tons of ROG; 36 tons of CO; 397 tons of NOx; 14 tons of PM and 6 tons of SOx.

Projected 2012 benefits from the Corridor take into account the imposition of control measures for both locomotives and trucks, as well as the implementation of several infrastructure projects within the Ports that will increase their ability to transfer cargo to trains. The overall emission reductions for 2012 are projected as follows: 101 tons of ROG; 304 tons of CO; 2082 tons of NOx; 19 tons of PM; and 4 tons of SOx. Projected benefits for 2012 would be even greater, if short-haul shuttle trains from the Ports to the Inland Empire and grade separations along Alameda Corridor East Program areas were implemented.

For the years 2002 to 2012 Corridor emissions benefits will remain relatively constant, even with significant growth in the number of trains per day. The overall emission profile for locomotive transport along the Corridor to the Inland Empire was compared to the emission profile for truck transport to the same destination. That comparison indicates that locomotives along the Corridor continue to produce between 2.4 and 4.5 times less NOx and between 2 and 3 times less PM10 than trucks in both current and future years, even as locomotives and trucks become cleaner.

Other current and future benefits include reduction of cancer risk, reduced risk of hazardous material (hazmat) release, and other mass transit improvements. Imposing prohibitively expensive control technologies on locomotives that cause an economic shift to truck transport will not contribute to regional air quality improvements. In fact, it could actually result in an increase in pollutant burden. The most prudent approach to achieving air quality benefits while accommodating growth in cargo transport in the SCAB is to continue to provide incentives to utilize consolidated locomotive freight transport corridors.

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