

DRAFT

**Draft Methodology for Estimating
Heavy-Heavy Duty Diesel Truck Activity
at the Ports of Los Angeles and Long Beach**

Prepared for:

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The following is a brief description of the analyses performed to develop the initial estimates of heavy-heavy-duty diesel truck activity and population for use in the San Pedro Bay Ports Clean Air Action Plan. Additional data is being collected from the terminals, which will be used periodically to refine these estimates.

Trip per Day Activity Analysis

In order to develop the truck trip per day activity estimate, Starcrest used a subset of vehicle license plate data collected through optical character recognition (OCR) technology provided by five container terminals. This subset was assumed to be a representative sub-sample of all fourteen of the combined Ports' container terminals and all data collected span the same 37 consecutive day period for all five terminals. While the terminals provided more than the 37 days of data, the terminals were not able to provide data covering the same time periods except for the 37 days.

The OCR data collected for this time period were first analyzed to identify unique license plates and to obtain a count for each unique plate (the number of times each plate showed up in the 37-day sample). This analysis yielded some 15,700 unique license plate readings covering over 253,000 trips. License plates and corresponding Port visits were eliminated from this sample if registration data were not available from the California Department of Motor Vehicles (DMV). Of the 15,700 license plates, approximately 3,700 of them, representing 24% of the sample, and some 9,000 trips (4% of the sample) were eliminated from the analysis using this criterion, leaving approximately 12,000 license plates on which to base the analysis.

The remaining truck and trip records were segregated into three separate groups for analysis:

- Frequent Callers were defined as those trucks that visited the terminals one or more time per day during the period of analysis (trips/days ≥ 1). Trips per day were determined by dividing the total number of trips for each truck by 37 days, the period of analysis.
- Semi-Frequent Callers were defined as those trucks that visited the terminals at least every other day, but less than once per day ($0.5 \leq \text{trips/days} < 1$).
- Non-Frequent Callers were defined as those trucks that visited the terminals less than once every other day (trips/days < 0.5).

Once segregated, the three groups were analyzed to determine their model year distribution (population of vehicles per model year) and average trip frequency. The table below presents the results of this analysis, where MY(pop) is the population-weighted average model year and MY(trip) is the trip-weighted average model year for each sub-group. On

average, the frequent caller trucks are older than the non-frequent caller trucks by less than one model year.

Table 1: Summary of Truck Trip Data Evaluation (37-day period)

Category	Unique Trucks	Total Trips for Period	Trips/Day per Truck	% of Total Trips	MY (pop)	MY (trip)
Frequent	1,946	123,220	1.7	50.4%	1993.6	1993.6
Semi-Frequent	2,844	74,156	0.70	30.3%	1993.8	1993.8
Non-Frequent	7,188	47,114	0.18	19.3%	1994.3	1994.4
Overall	11,978	244,490	0.55	100.0	1994.1	1993.8

The “trips/day/truck” figures in the previous table were calculated by dividing the total trips for the period by 37 (the number of days in the period) and dividing that by the number of unique trucks. For example, for frequent callers, $(123,220/37)/1,946 = 1.7$.

The following figures illustrate the model year distribution in terms of individual trucks and on a total call basis. As noted in the table above, the average model year in terms of individual trucks as well as total truck calls is around 1994. Of course, since model year is the basis of these figures, they represent only the license plates that were matched to model year by the DMV.

Figure 1 shows the population-weighted distribution of trucks on an individual basis (a total of 11,978 trucks counted once each regardless of their number of calls). The “percent of trucks” shown as the Y-axis is the percentage that each model year makes up of the population of each call-frequency group. This shows, for example, that the non-frequent caller trucks are made up of proportionally more new (model year 2002 and newer) trucks than semi-frequent and frequent callers.

Figure 2 shows the trip-weighted distribution of truck calls (individual trucks are counted for all 244,490 terminal visits in the dataset). In this figure, the Y-axis shows the percentage that each model year in each call-frequency group makes up of all truck calls. For example, model year 1996 frequent caller trucks make up about 5% of the terminal calls, and trucks of any frequency group that are newer than model year 2002 make up less than 1% of calls.

Figure 1: Model Year Population-Weighted Distribution, Percentage in Group

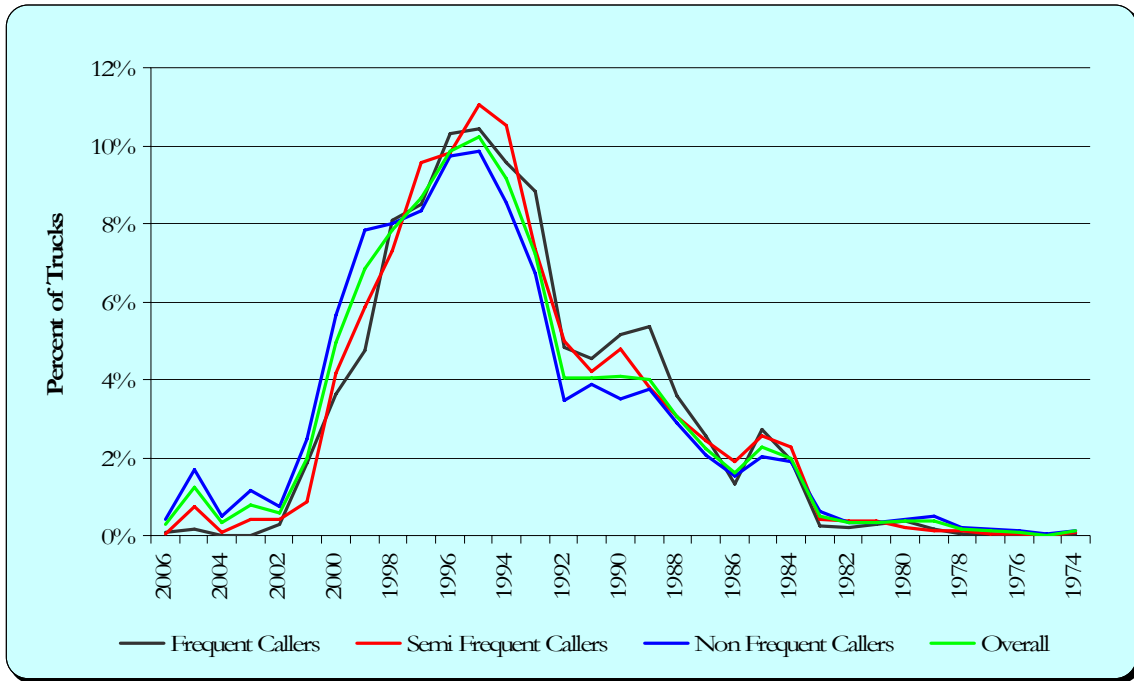


Figure 2: Model Year Call-Weighted Distribution, Percentage of All Calls

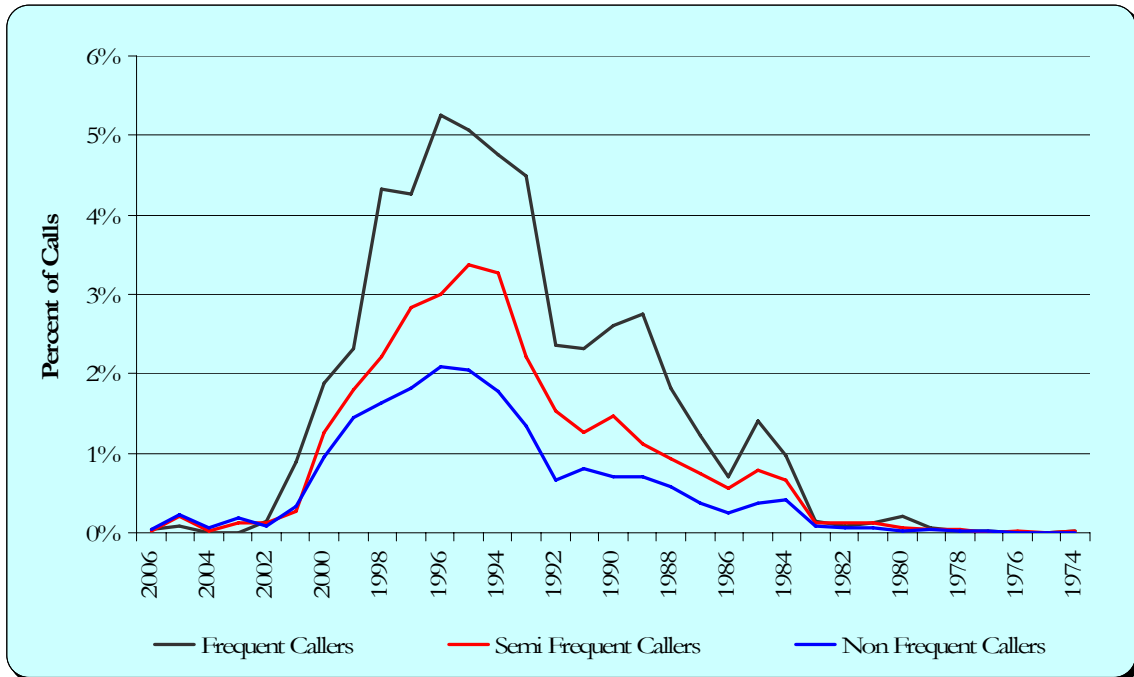


Table 2 summarizes the model year frequency data illustrated in the previous figures.

Table 2: Model Year Distribution Data Summary

Model Year	Unique DMV matches	Number of trips - all trucks	MY distribution - Unique plates	MY distribution - All trips	Unique frequent caller trucks	Frequent caller population distribution
2006	34	221	0.284%	0.090%	2	0.103%
2005	147	1,213	1.227%	0.496%	3	0.154%
2004	39	213	0.326%	0.087%	0	0.000%
2003	96	741	0.801%	0.303%	0	0.000%
2002	70	876	0.584%	0.358%	6	0.308%
2001	239	3,612	1.995%	1.477%	36	1.850%
2000	595	10,000	4.967%	4.090%	71	3.649%
1999	820	13,595	6.846%	5.561%	92	4.728%
1998	940	19,982	7.848%	8.173%	157	8.068%
1997	1,035	21,770	8.641%	8.904%	165	8.479%
1996	1,180	25,301	9.851%	10.348%	201	10.329%
1995	1,224	25,685	10.219%	10.506%	203	10.432%
1994	1,098	24,008	9.167%	9.820%	186	9.558%
1993	863	19,674	7.205%	8.047%	172	8.839%
1992	486	11,173	4.057%	4.570%	94	4.830%
1991	486	10,721	4.057%	4.385%	88	4.522%
1990	488	11,672	4.074%	4.774%	100	5.139%
1989	481	11,201	4.016%	4.581%	104	5.344%
1988	364	8,173	3.039%	3.343%	70	3.597%
1987	266	5,651	2.221%	2.311%	50	2.569%
1986	191	3,695	1.595%	1.511%	26	1.336%
1985	272	6,293	2.271%	2.574%	53	2.724%
1984	237	5,005	1.979%	2.047%	38	1.953%
1983	60	858	0.501%	0.351%	5	0.257%
1982	40	647	0.334%	0.265%	4	0.206%
1981	41	724	0.342%	0.296%	6	0.308%
1980	42	719	0.351%	0.294%	7	0.360%
1979	42	392	0.351%	0.160%	3	0.154%
1978	19	180	0.159%	0.074%	1	0.051%
1977	14	131	0.117%	0.054%	1	0.051%
1976	11	50	0.092%	0.020%	0	0.000%
1975	2	3	0.017%	0.001%	0	0.000%
1974	13	123	0.109%	0.050%	1	0.051%
pre-1974	43	188	0.359%	0.077%	1	0.051%
Total	11,978	244,490	100.0%	100.0%	1,946	100.0%

Extrapolation of Trips to All Terminals

Because the data used to determine the trip per day activity described above were analyzed for only the container terminals with the same 37 days of data, another source of information was sought to establish the total annual number trips for all fourteen container terminals at the Ports of Los Angeles and Long Beach. To this end, the total number of gate moves for calendar year 2005 for the Ports of Los Angeles and Long Beach container terminals was determined to be approximately 8.2 million for the two Ports combined.

Utilizing the estimate of 8.2 million gate moves and the activity characteristics of those trucks which service the Ports (described in the previous section) the total population of trucks was estimated in the following manner:

First, the daily number of truck trips was estimated, assuming gate moves and truck trips are equivalent:

$$8.2 \text{ million gate moves} / 365 \text{ days per year} = 22,466 \text{ trips per day.}$$

365 days per year was used as the basis for this estimate in order to be consistent with the OCR data. Even though the terminal gates may not be open 365 days per year, the OCR data for the 37-day period included days when the terminal gates were closed as well as open.

The numbers of trucks in each of the frequency categories discussed above were then estimated using the frequency analysis results summarized in Table 1 as follows:

Frequent Callers =

$$22,466 \text{ trips per day} \times 50.4\% \text{ of all truck trips} / 1.7 \text{ avg trips per truck per day} \\ = \mathbf{6,660} \text{ total trucks}$$

Semi-Frequent Callers =

$$22,466 \text{ trips per day} \times 30.3\% \text{ of all truck trips} / 0.7 \text{ avg trips per truck per day} \\ = \mathbf{9,725} \text{ total trucks}$$

Non-Frequent Callers =

$$22,466 \text{ trips per day} \times 19.3\% \text{ of all truck trips} / 0.18 \text{ trips per truck per day} \\ = \mathbf{24,089} \text{ total trucks}$$

Summing the three, the total heavy duty truck fleet servicing the Ports is estimated to be **40,474** using the methodology described above. A similar result was obtained using an alternative methodology based upon an evaluation of twenty-foot equivalent container unit (TEU) movements.

Notes

This methodology was reviewed and coordinated with staff of the California Air Resources Board (CARB), who also conducted their own evaluation of the license plate data. Due to methodological differences, the CARB evaluation indicated a lower number of semi-frequent

caller trucks than presented above, although the estimates of frequent caller trucks estimated by CARB and by the methodology described above are substantially similar (specifically, the CARB estimate is approximately 6,000 frequent caller trucks, *vs.* the estimate of 6,660 presented above). These preliminary estimates will be refined as more data becomes available, and revisions to the ports' estimates will be incorporated into subsequent updates to the Clean Air Action Plan.

Definition of a Trip

In general a truck trip, in the context of trucks that visit the ports, is defined as the entering and subsequent exiting of a truck from the boundary of a terminal at either of the ports.

OCR data

The number of times the license plate of an individual truck was identified within the span of the 37 consecutive days of analysis was treated as the number of truck trips.

Gate moves data

The number of gate moves was assumed to be equivalent to number of trucks trips.