

**MOBILE6 Model Development
Stakeholder Review Document**

- Draft -

**Development of Speed Correction Cycles
Prepared by Sierra Research, Inc.**

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sierra research



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Development of Speed Correction Cycles

prepared for:

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Development of Speed Correction Cycles

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1. SUMMARY

In response to a Work Assignment from EPA, Sierra Research (Sierra) has developed a new set of driving cycles that represent passenger car and light truck operation on a variety of roadway types under a variety of congestion levels and average speeds. Testing a representative sample of new vehicles on these cycles will provide EPA with the emissions data needed to improve the existing speed correction factors contained in its vehicle emission factor model, MOBILE5.

Eleven facility-specific cycles were developed to represent operation under the following conditions:

- high-speed freeway;
- freeway under congestion levels (i.e, LOS^{*}) A-C;
- freeway under LOS D;
- freeway under LOS E;
- freeway under LOS F;
- freeway under LOS “G”;^{**}
- freeway ramp;
- arterial under LOS A-B;
- arterial under LOS C-D;
- arterial under LOS E-F; and
- local roadways.

These cycles, which range from 4–12 minutes in length, were constructed to optimally match the observed speed-acceleration and specific power frequency distributions of chase car driving data collected over a range of facilities and congestion levels in Baltimore, Los Angeles and Spokane. As shown in Table 1, the average speeds of the cycles range from 13.1 to 63.2 mph.

*Level-of-Service (LOS) is a measure of traffic congestion developed by the Transportation Research Board and used by the Federal Highway Administration.

**Based on the definitions of LOS, travel under the most congested conditions is categorized as LOS F. In this study, Sierra also created a freeway cycle called LOS “G” to distinguish a subset of LOS F driving under the worst conditions routinely observed.

Table 1 New Facility-Specific Speed Correction Cycles					
Cycle	Average Speed (mph)	Maximum Speed (mph)	Maximum Accel Rate (mph/s)	Length (seconds)	Length (miles)
Freeway, High Speed	63.2	74.7	2.7	610	10.72
Freeway, LOS A-C	59.7	73.1	3.4	516	8.55
Freeway, LOS D	52.9	70.6	2.3	406	5.96
Freeway, LOS E	30.5	63.0	5.3	456	3.86
Freeway, LOS F	18.6	49.9	6.9	442	2.29
Freeway, LOS "G"	13.1	35.7	3.8	390	1.42
Freeway Ramps	34.6	60.2	5.7	266	2.56
Arterials/Collectors LOS A-B	24.8	58.9	5.0	737	5.07
Arterials/Collectors LOS C-D	19.2	49.5	5.7	629	3.36
Arterials/Collectors LOS E-F	11.6	39.9	5.8	504	1.62
Local Roadways	12.9	38.3	3.7	525	1.87

Some of the facility-specific cycles are used in conjunction with a new "non-freeway" cycle to create a new "area-wide" urban driving cycle. The area-wide cycle is a multi-segment driving trace that can be applied to represent travel in any city based on generally available weighting factors for that city. The individual segments are the new freeway cycles for LOS A-C, LOS D, LOS E, LOS F, and ramps added to a 22-minute non-freeway segment, which represents operation on arterials, collectors, and local roadways. Each of these cycles represents a segment that is weighted appropriately for each city of interest. Table 2 summarizes the basic characteristics of the new non-freeway portion of the composite area-wide urban cycle.

Table 2					
Non-Freeway Segment of New Area-Wide Speed Correction Cycle					
Cycle	Average Speed (mph)	Maximum Speed (mph)	Maximum Accel Rate (mph/s)	Length (seconds)	Length (miles)
Non-Freeway Urban Travel	19.4	52.3	6.4	1,348	7.25

A detailed statistical evaluation of the representativeness of facility-specific cycles and the area-wide cycle has been performed. A comparison of the primary statistics used to evaluate cycles indicated that the facility-specific cycles closely matched their intended joint speed and acceleration driving distributions. Using appropriate segment weighting factors, it was also determined that the new area-wide cycle better matches the chase car data collected in Los Angeles than the “LA92” cycle now being used by the California Air Resources Board (CARB) to represent area-wide operation in LA. The improved representation of urban driving provided by the new area-wide cycle is due to two factors. First, the current cycle development methodology contains refinements that increase the representativeness of the new cycles. Second, the total length of the new area-wide cycle is three times longer than the LA92, which made it easier to match the characteristics of the data set from which the cycle was developed.

Testing a representative sample of vehicles on both cycles is required to determine whether the difference in emissions is significant. Depending on the results of such tests, the LA92 cycle may still prove to be a cost-effective alternative to the development of area-wide emission estimates for large urban areas. However, data collected using the speed- and facility-specific segments like those contained in the new area-wide cycle will be needed to account for changes in traffic congestion between urban areas and over time.

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2. INTRODUCTION

Except in California, overall air quality planning and project-specific air quality analyses are conducted using one particular motor vehicle emissions simulation model, called “MOBILE5,” which was developed by the U.S. Environmental Protection Agency.* Currently within the MOBILE5 model, speed correction factors are used to adjust the emissions measured using the Federal Test Procedure (FTP) for light-duty vehicles to account for speeds that are different from the average speed of the “LA4” driving cycle used in the FTP, which is 19.6 mph. It is assumed that emissions measured using the FTP properly represent travel occurring at an average speed of 19.6 mph, regardless of the roadway type, or combination of roadway types, over which that speed occurs. The speed correction factors are based on the relationship between emissions measured on the FTP and emissions measured on several other cycles, called “speed correction cycles,” which have speeds that are higher and lower than the LA4 cycle.

There are three fundamental problems with the manner in which MOBILE5 is used to estimate emissions at various average speeds. First, recent research has shown that the base driving cycle (the LA4) does not adequately represent the range of speeds and acceleration rates occurring in customer service. As a result, the basic emission rates used in the MOBILE model are not accurate even when the average speed of vehicle operation is equal to the 19.6 mph speed of the LA4 driving cycle. Second, the speed correction cycles used to develop the current speed correction factors do not represent either facility-specific or area-wide travel in urban areas. Two of the speed correction cycles share the deficiencies of the LA4 cycle because they are subsets of the LA4. Other speed correction cycles are suspect because they were not developed from data representative of vehicle operation in urban areas. This is true for the so-called “Highway Cycle” and several variants of that cycle that have been used as speed correction cycles.** Third, there is no mechanism built into MOBILE for distinguishing between area-wide and facility-specific operation. It is assumed that the speed correction factors apply universally, regardless of the type of roadway, or combination of roadway types, over which the speed occurs. However, observations of travel on various types of roadways indicate that this assumption is invalid. For example, at an average speed of 35 mph, travel over surface streets is likely to be dominated by cruising in the vicinity of the speed limit at a low level

*The state of California uses its own model, called “EMFAC,” which, as far as speed correction factors are concerned, shares most of the deficiencies of MOBILE5 described herein.

**The so-called “Highway” cycle actually represents travel (highway plus non-highway) in non-urban areas where the 55 mph speed limit is strictly enforced.

of traffic congestion, while travel on a freeway at the same average speed results from a high congestion level and there is much less cruise operation.

To address the concerns summarized above, EPA issued a Work Assignment to Sierra Research during 1995 calling for the development of a methodology for generating new driving cycles for inventory development. The methodology recommended by Sierra^{1*} called for developing both facility-specific and area-wide driving cycles that match the speed-acceleration frequency distributions (SAFDs) of vehicles operating in customer service.

For facility-specific cycles, the proposed approach involved constructing cycles to match the SAFDs for a wide range of roadway types and congestion levels. These cycles were to be developed from “chase car” data, a data set containing second-by-second information regarding roadway type and congestion level.

For area-wide cycles, Sierra recommended a method involving the development of a “primary” cycle, representing overall average driving conditions, and at least two additional cycles, intended to represent areas with higher and lower average speeds. One option suggested for a higher speed composite cycle was to use data collected in an urban area with relatively low traffic congestion, like Spokane, Washington. It was also suggested that data collected in Baltimore, Los Angeles, and Atlanta during certain periods of the day could be used to construct cycles with different average speeds. For example, it was suggested that data collected only during the morning and afternoon commute periods could represent relatively high congestion levels and lower average speeds, while data collected during off-peak periods could represent lower congestion levels and higher speeds. It was noted, however, that further analysis would be required of differences in the fraction of area-wide VMT by facility-type between different urban areas and between peak and off-peak periods. Depending on the degree of variation observed, it was suggested that alternative cycle construction processes might be required. As discussed in Section 4, an alternative cycle construction technique was necessary.

Scope of Work

This report combines the results of two related Work Assignments (1-04 and 2-01), the second of which was a follow-on to the first. Under the initial scope, a Work Plan was developed to provide EPA with actual driving cycles intended to represent both facility-specific and area-wide vehicle operation. The Initial (1-04) Work Plan consisted of the four tasks described below.

Task 1, Development of Facility-Specific Driving Cycles - Facility-specific data regarding driving patterns in customer service are required for the development of facility-specific

*Superscripts denote references provided in Section 7.

cycles. Data collected by the chase car* in Baltimore, Spokane, and Los Angeles were used to develop 11 facility-specific cycles, to represent travel on freeways, ramps, arterials/collectors and local roadways. Target length for each cycle was established as approximately 10 minutes.

Task 2, Development of Area-Wide Driving Cycles - The original concept under Task 2 involved the development of a family of “composite” driving cycles to represent overall travel within an urban area, with each cycle representing different levels of average speed and congestion. However, during the initial phase of this task, in which driving data comparisons were performed by city and data type (i.e., chase car vs. instrumented), analysis indicated that average speed would not adequately define travel in a particular area. In addition, the question remained as to how area-wide cycles developed from data for specific cities in which the data collection was performed (Atlanta, Baltimore, Los Angeles and Spokane) could be extrapolated to represent driving in other U.S. urban areas. In consultation with the Work Assignment Manager, an approach was developed for a city-weighted area-wide driving cycle based on facility-specific “bags” and city-specific bag weighting factors that can be obtained from transportation planning model outputs.

Task 3, Evaluation of the Driving Cycles - During the course of facility-specific and area-wide cycle development, a detailed series of statistical tests were performed on each cycle. The characteristics of each cycle developed under Tasks 1 and 2 were compared to the data from which the cycle was constructed to show how well the cycle correlates with the “target” driving behavior recorded by instrumented vehicles and chase cars. The evaluation included comparisons of speed, acceleration, power, and other measures acceptable to the Work Assignment Manager. In performing the evaluation, Sierra utilized the statistical evaluation criteria recommended by EPA.² The following statistics were compared for each cycle and target driving population:

- time in acceleration;
- time in deceleration;
- time at cruise;
- time at idle;
- maximum speed;
- average speed;
- average or predominant speed during cruise (“subjective” cycle speed);
- maximum acceleration rate;
- maximum deceleration rate;
- maximum power;
- length (time and miles);
- stops per mile;

*Instrumented vehicle data are not suitable for the development of facility-specific cycles because facility type cannot be determined from the available data, except for uncongested freeway operation. However, instrumented vehicle data were compared to chase car data on an overall basis to evaluate the representativeness of the chase car data.

- average positive kinetic energy (PKE) change per mile and specific power; and
- detailed distributions of speed and acceleration.

Using the above-listed parameters, the characteristics of the composite cycle were compared to CARB's LA92 cycle (sometimes called the "Unified" cycle) to determine whether it is significantly different.

Task 4, Data Analysis and Reporting - Under this task, Sierra provided progress reports to EPA during the course of the project and prepared the draft final report and an electronic copy of the speed/time traces for each cycle developed under this effort.

Under the follow-on Work Plan developed under Work Assignment 2-01 (which was prepared after EPA's review of draft final results from the initial effort), several additional analytical tasks were added. These additional tasks are described below.

Task 1, Revisions to High-Speed Freeway Cycle - Under EPA's direction, a new high-speed freeway cycle was developed as a replacement for the high-speed cycle developed under the initial Work Plan to better represent the frequency of high power events found in the driving population for high-speed freeway operation.

Task 2, Evaluation of New High-Speed Freeway Cycle - In this task, statistical characteristics of the revised high-speed freeway cycle developed under Task 1 were compared to their "target" driving population to quantify how well the new cycle represented its intended driving patterns. The statistical measures compared were identical to those listed under Task 3 of the initial Work Plan, with key emphasis on ensuring a comparable "match" of high power events obtained for the other facility-specific driving cycles.

Task 3, Further Analysis of Surface Street Cycles - Under this task, the videotaped records of driving traces from arterial/collector and local roadway operation were reviewed to determine the extent to which portions of surface street driving are influenced by intersections. The actual traces from the arterial and local cycles as well as additional randomly selected traces from their driving populations were examined. Each second-by-second trace was marked (based on the video review) with flags that identified when the vehicle's operation was being influenced by approaching or departing intersections. Summaries of these data from the cycles and target populations were compared to determine the extent to which the new surface street speed correction cycles properly represent intersection activity and identify those sections of the cycle traces that represent intersection-influenced operation.

Task 4, Data Analysis and Reporting - Under this task, Sierra provided progress reports to EPA during the course of the project and prepared the draft final report and electronic copies of the second-by-second speed trace for the new high-speed cycle developed under Task 1 and second-by-second identification of intersections and their influence for surface street driving traces analyzed in Task 3.

Organization of the Report

Following this introduction, Section 3 provides a description of how the facility-specific cycles were constructed. Speed traces and basic statistics for each of the facility-specific cycles are also contained in Section 3. The rationale and methodology for the development of the city-weighted area-wide cycle are described in Section 4. Statistical comparisons of instrumented vs. chase car and city-by-city driving variations that led to the modified area-wide cycle approach are also presented in Section 4. Detailed statistical tests of all of the cycles developed under this effort against the driving behavior they are intended to represent are presented and discussed in Section 5. Included in this series of tests is a similar comparison of CARB's LA92 driving cycle against its intended driving behavior to compare the "fit" of cycles developed under this effort to that of the LA92. A comparison of the area-wide cycle to the LA92 is also presented in Section 5 to determine if they are significantly different. The analysis of the influence of intersections on surface street driving is documented in Section 6. Section 7 contains a list of references cited throughout the report.

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3. FACILITY-SPECIFIC CYCLE DEVELOPMENT

Different driving patterns on two different roadway types may exhibit the same average vehicle speed, but result in different vehicle emissions. Facility-specific driving cycles intended to represent driving behavior on specific roadway types under various congestion levels were generated in order to develop emission factors specific to each type of facility. This section describes the methodology and driving data used to create facility- and congestion-specific driving cycles, and provides basic statistics for each cycle.

Facility-Specific Cycle Construction Methodology

Selection of Driving Data - The facility-specific cycles were developed exclusively from chase car data. In the chase car studies,³ second-by-second recording of both facility type and congestion level was performed (using Level-of-Service [LOS] measures developed by the Transportation Research Board [TRB]⁴ and employed by the Federal Highway Administration [FHWA]). Public roadways were classified as either freeway, freeway ramp, arterial/collector, or local. “Freeways” were defined as multi-lane roadways with no signalized intersections and access limited to ramps that merge with a lane of traffic. “Ramps” were those sections of roadway that provide access to, or exit from, a freeway. “Arterials/collectors” were defined as non-freeway roads that link population centers and business centers, or serve as major corridors through urban areas. “Local” roadways were defined as non-freeway, non-arterial/collector roads providing access to residential areas, business parks, and other private property. Driving data collected under instrumented vehicle studies do not contain second-by-second representation of the type of roadway being driven and the congestion level. Under an earlier study for EPA,⁵ Sierra investigated whether the facility type and congestion level could be inferred from the instrumented data by screening the data with a series of statistical algorithms. It was determined that the facility type and congestion level could not be reliably inferred. Thus, the facility-specific cycles are based solely on chase car driving data.

Creation of “Target” Driving Populations - Prior to the generation of facility-specific cycles, the chase car data collected in Baltimore, Los Angeles and Spokane were combined into a single data set. Second-by-second data in this merged file were then divided into separate “segment” files for those facility type and LOS groupings from which cycles were subsequently developed. (In this study, the term “segment” refers to a continuous driving trace over the same facility type and at the same LOS and is explained in greater detail later in this section). The implicit assumption in this approach was that

driving data recorded for a given facility and LOS were not dependent on the city in which the driving was performed.

These facility/LOS groupings established for each cycle are discussed below. They were chosen on the basis of earlier analysis performed for EPA and defined under the scope of work (with exceptions for high-speed freeways and arterials/collectors as noted).

LOS-Based Freeway Cycles - For freeway operation, previous analysis of available chase car data showed similar speed/acceleration frequency distributions (SAFDs) for LOS A-C, indicating that this range of LOS could be represented by one cycle. Additional cycles were developed to represent LOS D, LOS E, and LOS F. It was also decided to develop a fifth cycle to represent driving under conditions that are more congested than LOS F. This type of operation, based on operation observed on the most congested freeway links in Los Angeles, was referred to as LOS "G."

High-Speed Freeway Cycle - In addition to the LOS-based freeway cycles, a "high speed" freeway cycle was developed to represent operation occurring under low congestion levels and speed limits higher than 55 mph (or lack of enforcement of a 55-mph speed limit). The driving "population" for this cycle was created from the combined driving segment files in the three-city chase car data set using the following criteria:

- freeway facility type;
- LOS A, B or C;
- segment length greater than 30 seconds; and
- minimum segment speed at or above 50 mph.*

Ramp Cycle - A separate cycle was developed to represent freeway ramp activity. The ramp activity includes driving on both on-ramps and off-ramps, as well as travel on "transitional" ramps (i.e., at freeway intersection interchanges where a vehicle must drive along a ramp to move from one freeway to the next).

Arterial/Collector Cycles - Under the initial scope of work, separate arterial/collector cycles were to be developed for each LOS from A through F. More detailed analysis of chase car data under this study indicated that travel on arterials and collectors should be represented by three ranges of observed congestion level: LOS A-B, C-D, and E-F. These groupings were based on the similarities in average speeds observed in the data set.

*These criteria reflect the definition of high-speed freeway operation for the revised high-speed cycle constructed under the 2-01 Work Plan. Under the initial (1-04) Work Plan, the minimum speed criterion of 55 mph was revised to 50 mph as listed above. The primary rationale for lowering the minimum speed cutoff was to increase the number of segments in the high-speed freeway driving population, thus enhancing the ability of a cycle to statistically match the "target" driving population. An evaluation of the additional segments added to driving population when lowering the minimum speed cutoff to 50 mph indicated that over 92% of these additional segments still had average speeds in excess of 55 mph.

Local Roadways Cycle - Because essentially all local roadway travel was observed to occur under a low level of congestion, only one cycle was required to represent travel over local roadways.

Segment-Based Candidate Cycle Construction Method - To construct a new family of facility-specific cycles, Sierra used a computerized “trial-and-error” approach to selecting combinations of trip “segments” that best matched the SAFD of the target data set (e.g., a particular facility type and congestion level). This approach ensured that the speed-time profiles of the cycles were constructed from real speed-time profiles that preserved the acceleration profiles and minor speed variations contained in customer service driving. The method used differed from previous cycle development efforts in that it did not attempt to use “microtrips” (speed traces that begin and end at rest). This change was necessary to develop cycles representative of roadway operation under which no stops occurred (e.g., uncongested freeway travel) and to accommodate the segment-based nature of driving data when grouped by facility and LOS. Under this revised approach, a trip “segment” was defined as a second-by-second speed trace whose endpoints were determined by either of the following conditions:

1. the vehicle came to rest (as at the end of a microtrip); or
2. the facility or LOS group changed (e.g., moving from a freeway onto an off-ramp or from LOS D to LOS E on a freeway).

After grouping the chase car data into separate files by facility type and LOS, the second condition was tested by searching for discontinuities greater than one second in the second-by-second time stamp field contained in the chase car data. For example, consider the following sample of second-by-second data in the “Freeway LOS D” file:

<u>Record Number</u>	<u>Time Stamp</u>	<u>Speed (mph)</u>
1	04/21/92 14:13:00	58.2
2	04/21/92 14:13:01	59.4
3	04/21/92 14:13:02	59.6
4	04/21/92 14:13:03	59.7
5	04/21/92 14:13:04	59.3
6	04/21/92 15:36:20	59.0
7	04/21/92 15:36:21	60.3
8	04/21/92 15:36:22	60.7
9	04/21/92 15:36:23	60.7
10	04/21/92 15:36:24	60.5

The discontinuity in the time stamp from Record 5 to Record 6 marks the end of one trip segment and the beginning of the next. As in this example, trip segments were identified within each of the facility/LOS group files.

The “Hybrid-Random/Incremental” cycle construction logic developed under previous work for EPA and CARB was then altered to generate candidate cycles from segments, rather than microtrips. Microtrips could easily be chained together since they began and ended at rest; after each microtrip was selected, the remaining microtrips were evaluated and another selected (either randomly or by “best incremental fit”). This microtrip selection process continued until the desired cycle time had been reached. To accommodate segments, instead of microtrips, the segment-selection process employed the following changes to the programming logic:

1. Once a segment was selected, its terminal speed and acceleration were identified.
2. The initial speed and acceleration of all the remaining segments were then tested against the terminal conditions of the current segment.
3. Those remaining segments whose initial speed and acceleration matched the terminal conditions of the current segment within allowed tolerances (± 0.5 mph for speed and ± 0.5 mph/sec for acceleration) were placed into a “Qualified Segment” subset from which the next segment was selected (again, either randomly or by best incremental fit).

Each time a new segment was selected, the Qualified Segment subset was re-determined and the above steps were repeated until the desired cycle time was reached.

Using varying constraints on the fraction of time that each candidate cycle used randomly selected segments, and using various methods of optimization (matching either the total, non-idle or non-cruise portions of each cycle against its target SAFD), the following number of candidate cycles were generated:

- 1,800 for each freeway/LOS group (A-C, D, E, F, G and High-Speed);
- 1,200 for ramps; and
- 1,000 for each arterial/collector/LOS group (A-B, C-D and E-F) and for local roadways.

In all, 16,000 candidate facility-specific cycles were generated using the segment-based Hybrid-Random/Incremental process described above.

“Best” Cycle Selection Process - Once the candidate cycles had been generated for each facility type and LOS group, a series of statistical tests were applied to each cycle in order to identify and select the cycle in each group that “best” matched its target driving population. Sierra’s earlier “best” cycle selection process consisted of ranking each candidate cycle’s “DiffSum” statistic (i.e., sum of differences between cycle and target joint speed and acceleration frequencies) and selecting the single cycle with the lowest DiffSum or best “fit” to the target population. At the request of EPA, the cycle selection process was modified to include an evaluation of the amount of operation in relatively high specific power modes (e.g., between 200-299 mph^2/sec and ≥ 300 mph^2/sec). Among the

10 cycles with the best fits to the overall SAFD of each target population (e.g., freeway operation at LOS F), the cycle that best matched the amount of operation in these high power modes was then chosen as the single best cycle representing that driving population.* This collection of cycles is referred to as the final *unedited* cycles.

Cycle Editing - The last step in the cycle development process involved manually editing the computer-generated final unedited cycles to improve their fit to the target SAFD. Editing was limited to *segment addition* and *segment shortening* using a procedure developed under previous work for EPA. Segment addition consists of inserting segments of the speed-time trace that begin and end with a speed within 0.5 mph of the speed at the insertion point. Segment shortening involves removing portions of the speed-time trace between two cruise speeds that are within 0.5 mph. The procedure avoids changes to the speed-time profile that alter the characteristics of any accelerations. During the editing, Sierra lengthened or shortened cruise operation until an optimum match to the speed-acceleration distribution of the target data set was achieved within the target cycle length.

Basic Characteristics of the Facility-Specific Cycles

Table 3 summarizes several characteristics of the new facility-specific cycles that were developed. As shown in the table, the six non-ramp, freeway cycles have average speeds ranging from 13.1 mph to 63.2 mph. The ramp cycle has an average speed of 34.6 mph. The three arterial/collector cycles have average speeds ranging from 11.6 mph to 24.8 mph. The cycle representing travel on local roadways has an average speed of 12.9 mph.

Cycle	Average Speed (mph)	Maximum Speed (mph)	Maximum Accel Rate (mph/s)	Length (seconds)	Length (miles)
Freeway, High Speed	63.2	74.7	2.7	610	10.72
Freeway, LOS A-C	59.7	73.1	3.4	516	8.55
Freeway, LOS D	52.9	70.6	2.3	406	5.96
Freeway, LOS E	30.5	63.0	5.3	456	3.86
Freeway, LOS F	18.6	49.9	6.9	442	2.29

* All of the “top-10” cycles in each target group generally exhibited nominally identical fits to their target SAFDs. DiffSums only varied in magnitude by 1-2% across each top-10 set of candidate cycles.

Table 3					
New Facility-Specific Speed Correction Cycles					
Cycle	Average Speed (mph)	Maximum Speed (mph)	Maximum Accel Rate (mph/s)	Length (seconds)	Length (miles)
Freeway, LOS "G"	13.1	35.7	3.8	390	1.42
Freeway Ramps	34.6	60.2	5.7	266	2.56
Arterials/Collectors LOS A-B	24.8	58.9	5.0	737	5.07
Arterials/Collectors LOS C-D	19.2	49.5	5.7	629	3.36
Arterials/Collectors LOS E-F	11.6	39.9	5.8	504	1.62
Local Roadways	12.9	38.3	3.7	525	1.87

Figures 1-11 show the speed-time traces for each of the facility-specific cycles. The scale of the axis is kept the same to facilitate comparisons between the cycles.

Figure 1

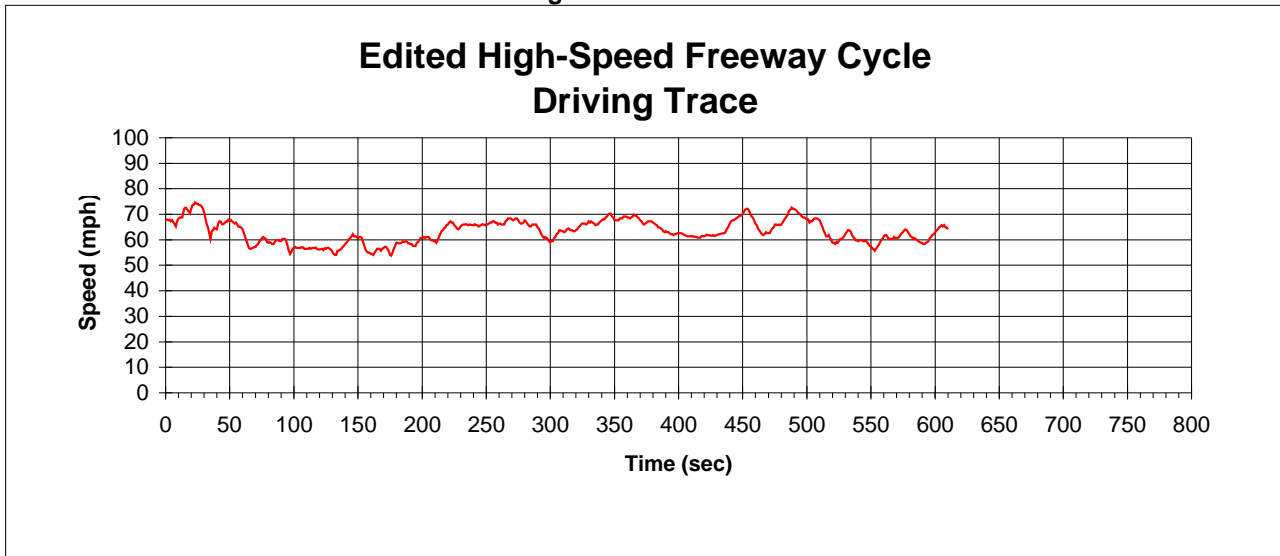


Figure 2

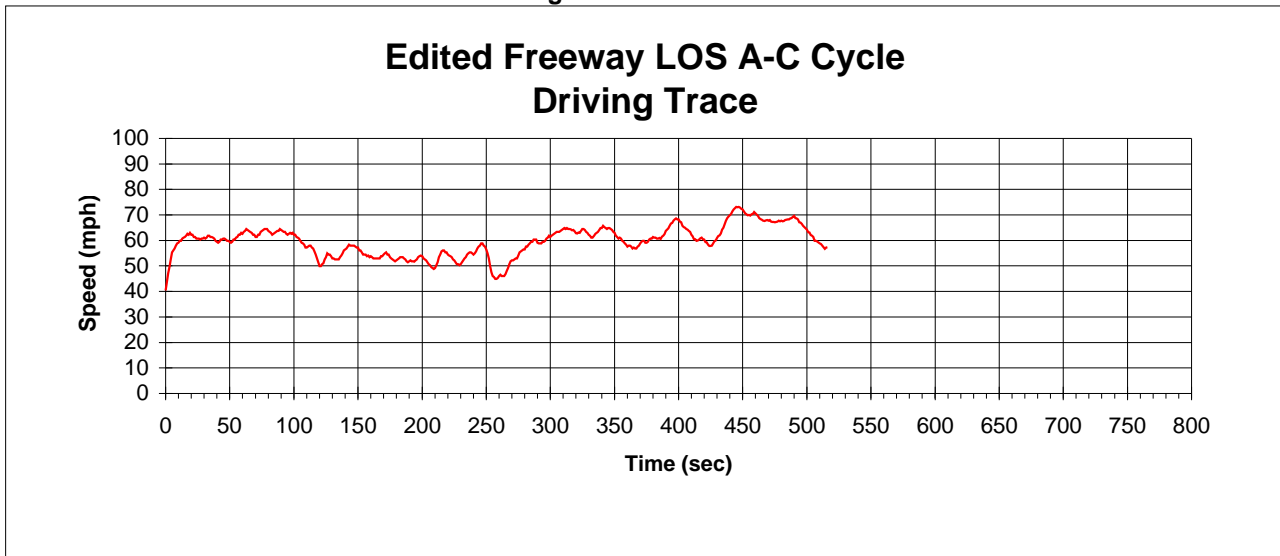


Figure 3

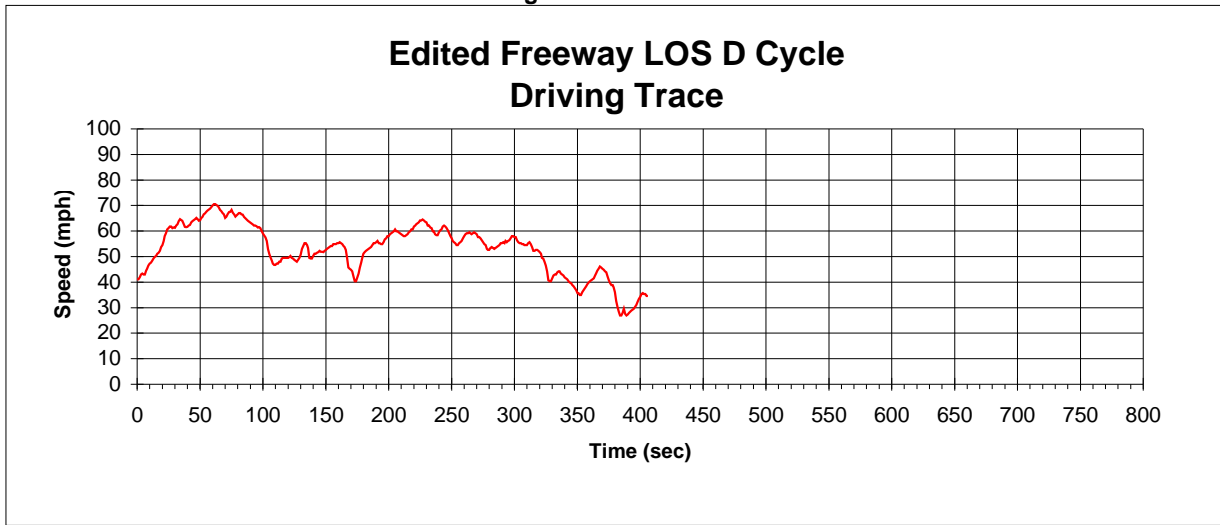


Figure 4

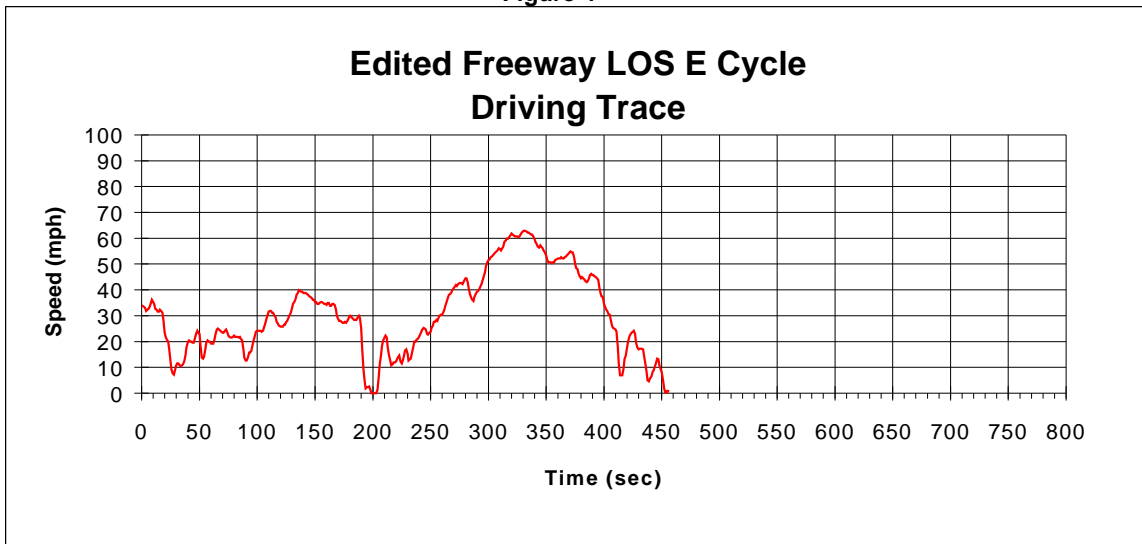


Figure 5

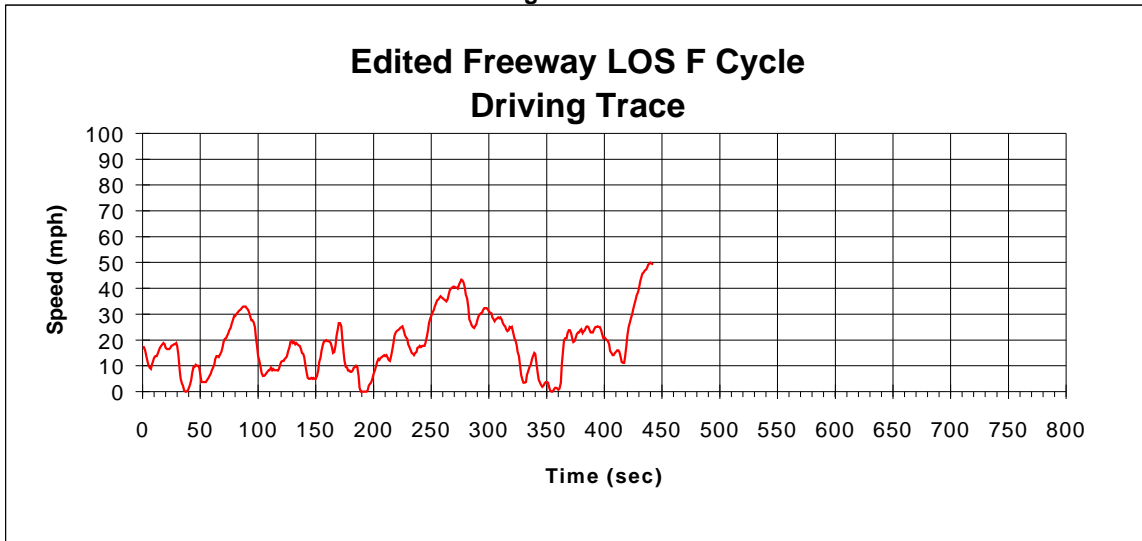


Figure 6

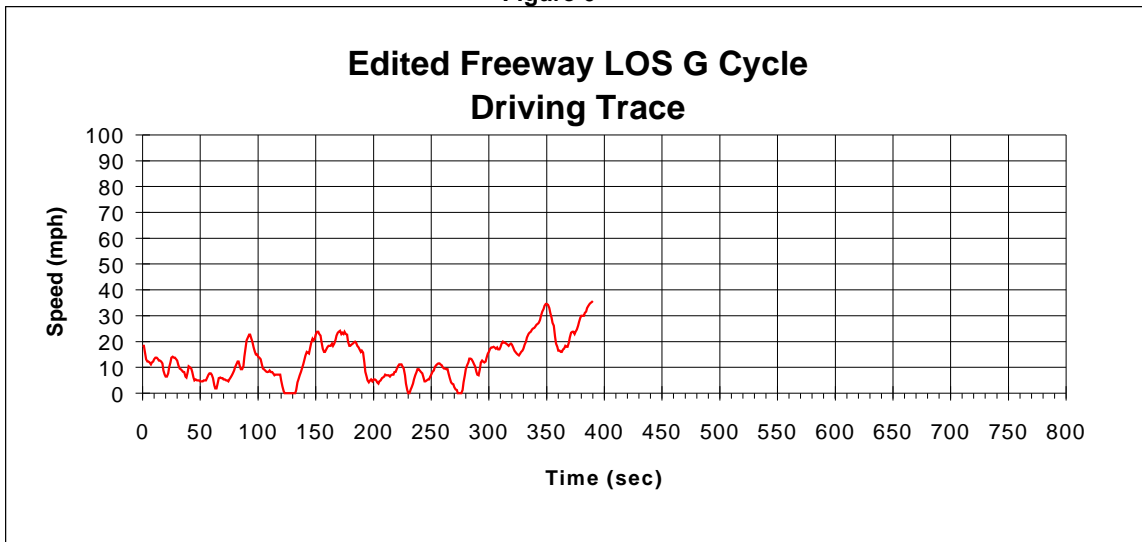


Figure 7

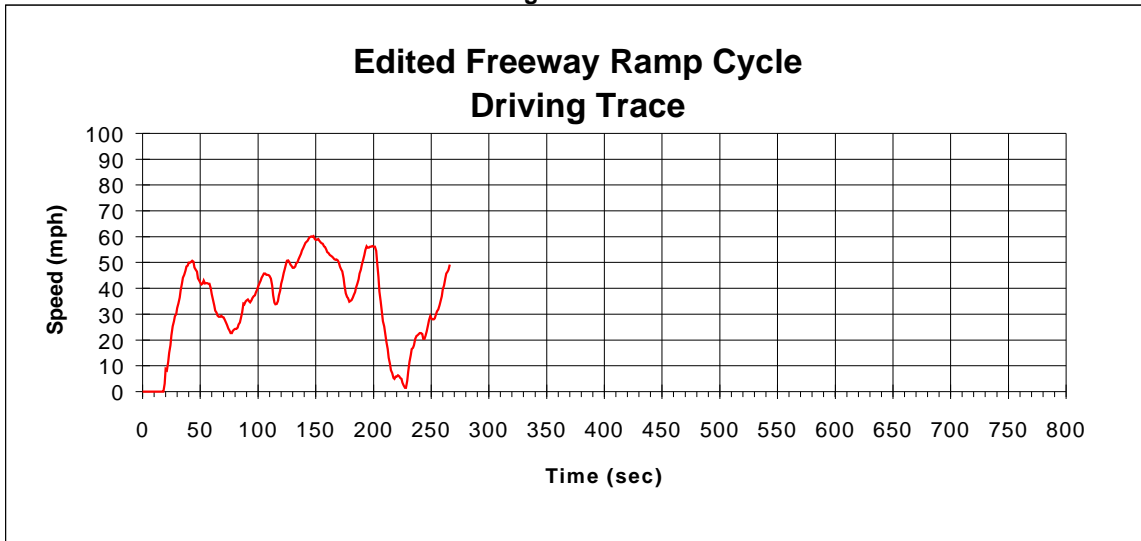


Figure 8

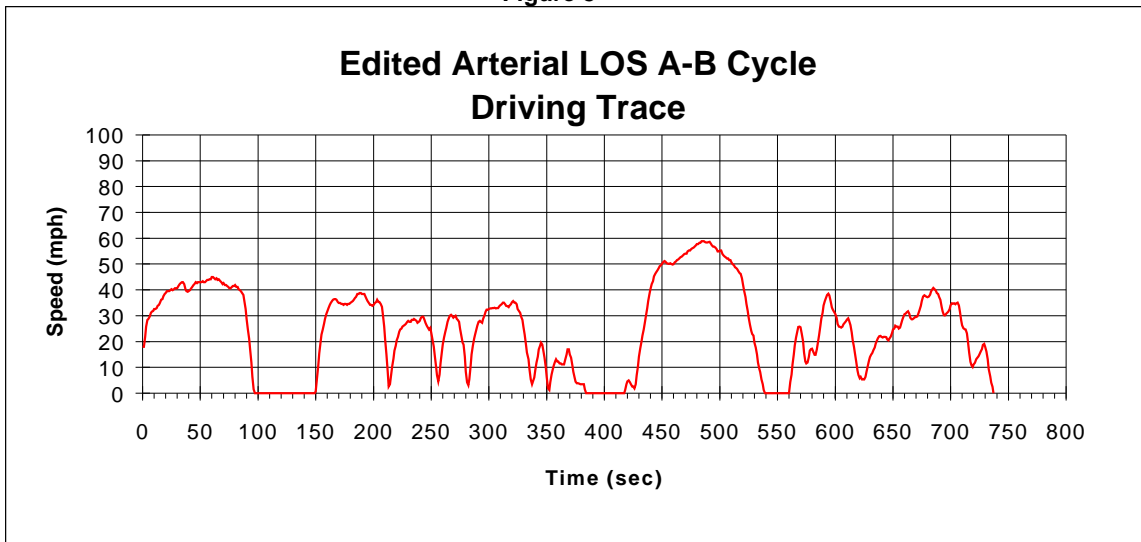


Figure 9

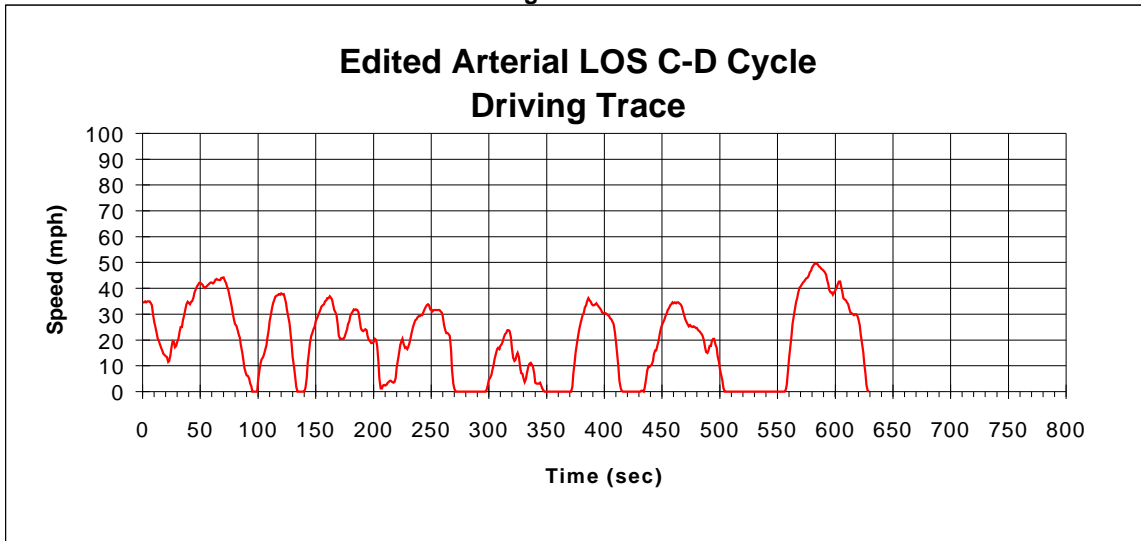


Figure 10

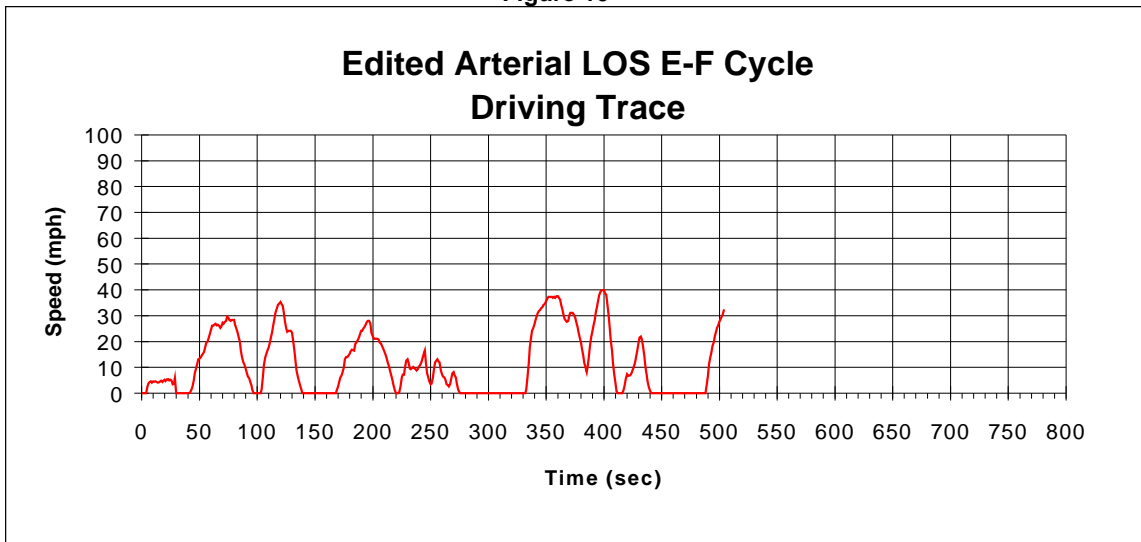
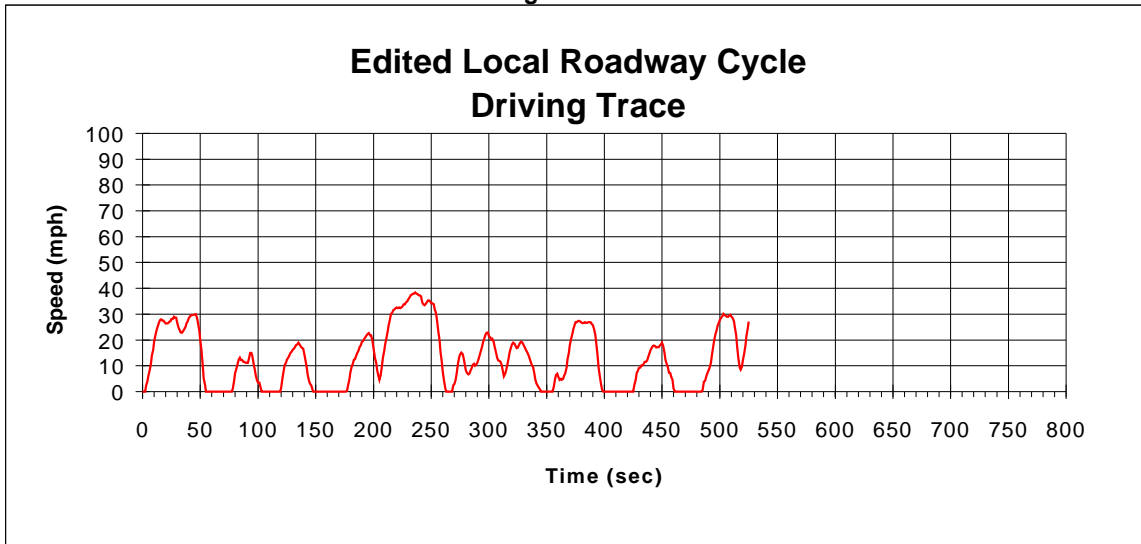


Figure 11



4. AREA-WIDE CYCLE DEVELOPMENT

As introduced earlier in Section 2, the original area-wide cycle concept was to develop a family of composite driving cycles to represent overall travel within urban areas with different levels of congestion and average speed. However, analysis of both instrumented vehicle and chase car data collected from various cities indicated that average speed would not adequately define travel within a particular area. Furthermore, the question remained as to how separate area-wide cycles developed from data for specific cities in which driving studies were conducted (Atlanta, Baltimore, Los Angeles and Spokane) could be extrapolated to represent driving in other U.S. urban areas. In consultation with EPA, an alternative approach was developed that identifies and separates the type of driving that does not vary appreciably from city-to-city from that which does. By applying this alternative methodology, an area-wide driving cycle composed of a series of speed traces (segments) was generated that can be used to represent operation within any urban area, given city-specific segment weighting factors that can be developed from transportation planning model outputs.

This section presents driving data comparisons that led to the development of this alternative approach to area-wide cycle development, as well as a detailed description of the methodology and the rationale behind it. It also summarizes the basic characteristics of the resulting area-wide driving cycle, as weighted for Baltimore driving conditions.

Initial Driving Data Comparisons

Prior to the development of area-wide “composite” driving cycles, a detailed investigation of the available driving data was conducted. A series of statistical comparisons were performed in order to determine which specific data should be used in the development of composite cycles intended to represent operation in metropolitan nonattainment areas. Before proceeding to a discussion of these comparisons, summaries of the driving data and their inherent biases are presented below.

Available Driving Data - Detailed driving data representing vehicle operation under current urban driving conditions were collected in field studies^{6,2} conducted in Baltimore, Los Angeles, Atlanta and Spokane using two different methods:

1. Instrumented Vehicle - direct second-by-second vehicle speed measurement obtained from an on-board instrumentation package installed on randomly selected vehicles in customer service (for one to two weeks per vehicle); and
2. Chase Car - remote determination of the second-by-second speed of randomly followed vehicles by a laser range finder-equipped “chase” car following a predesignated route.

Both instrumented vehicle and chase car data were collected in Baltimore and Spokane. Only chase car driving was performed in Los Angeles, and only instrumented vehicle data were collected in Atlanta.

Data Limitations and Inherent Biases - In evaluating driving data collected under these two methods, there are several important factors to consider. These factors are listed below.

1. Chase car driving was conducted over point-to-point urban routes selected from zone-to-zone “trips” output from transportation planning models. These models are known to under-represent short “intra-zonal” trips.
2. Facility-type and congestion (LOS) were not measured in instrumented driving.
3. Instrumented vehicle biases (which have been cited in previous studies) include the lack of representation of fleet vehicle operation and possible travel by instrumented vehicles outside the urban area.

Instrumented vehicle data, despite the biases cited and the lack of facility type and congestion level, are believed to be superior to chase car data in representing the entire range of urban vehicle operation because they include the short, intrazoned travel under-represented by the chase car surveys.

Driving Data Comparisons - A series of statistical comparisons were performed on both the instrumented and chase car driving data. These comparisons were then evaluated to guide the development of the area-wide cycle methodology. The following types of variations in the driving data were examined:

- instrumented vs. chase car differences;
- city-to-city differences;
- variation in facility and LOS distributions; and
- time of day variations.

The driving statistics generated included average speed, average specific power and specific power distributions, average trip length/time, detailed speed-acceleration frequency distributions (SAFDs) and DiffSums (sum of differences between cycle and target joint speed and acceleration frequencies). Detailed tabular summaries of these statistical comparisons are contained in Appendix A.

Not surprisingly, one of the primary differences observed in comparing data from city to city was the variation in the distribution of travel by facility type and LOS. Table 4 compares the travel distributions by facility type and LOS for each of the chase car cities (Baltimore, Los Angeles and Spokane). The distribution of freeway travel by LOS is also shown.

Table 4 Comparison of Chase Car Facility and LOS Travel Distributions by City			
Facility/LOS	Travel Frequency (% time)		
	Baltimore	Los Angeles	Spokane
Freeway Total	16.91	25.77	9.79
Ramp Total	3.47	5.11	1.55
Arterial Total	60.53	66.52	76.53
Local Total	16.38	2.27	10.03
Other Facilities Total	2.71	0.32	2.10
LOS A Total	50.64	32.92	62.49
LOS B Total	23.62	19.64	22.21
LOS C Total	15.30	19.84	12.17
LOS D Total	6.79	11.02	1.67
LOS E Total	2.13	7.49	0.38
LOS F Total	1.52	9.08	0.04
Freeway LOS A	23.76	2.51	39.04
Freeway LOS B	31.96	7.96	31.58
Freeway LOS C	23.82	25.17	26.15
Freeway LOS D	10.45	15.52	1.81
Freeway LOS E	3.06	18.10	1.42

Table 4 Comparison of Chase Car Facility and LOS Travel Distributions by City			
Freeway LOS F	6.96	30.74	0

As Table 4 illustrates, the freeway travel fraction in Spokane (9.79%) is lower than that in Baltimore (16.91%) and Los Angeles (25.77%), and the fraction of travel on arterials and collectors in Spokane exceeds that in Baltimore and Los Angeles. Table 4 also shows that the LOS distribution varies dramatically on freeways. The freeway travel under LOS D or worse on the congested Los Angeles freeway network totaled over 63% of the freeway driving time. Conversely, LOS D or worse accounted for a little over 3% of freeway driving in Spokane.

Despite these variations in the mix of travel by facility and congestion level, the overall average speeds of both chase car and instrumented vehicle data compared quite closely from city to city. For example, the average chase car speed for Spokane, Washington (26.9 mph) was comparable to that recorded in Los Angeles, California (26.3 mph). This comparison indicates that similarities in overall average speed can “mask” large differences in the amount of travel by type of roadway and by level of congestion. Detailed analysis of the chase car data suggested that most of the differences between overall travel in different cities were related to 1) the fraction of total travel that occurred on freeways, and 2) the mix of congestion levels associated with freeway travel.

Table 5 illustrates the differences in freeway and non-freeway travel between the three cities for which chase car data were available. The values shown in the table were calculated by summing the absolute value of the differences between the percent of operation in each cell of a 31×18 matrix (SAFD) of acceleration rates and speeds for facility-specific chase car data. (Appendix A contains the detailed matrices and the rest of the driving comparison statistics referenced above.) Each matrix was constructed by subtracting the frequency of operation recorded in the second city listed in the title of the table from the frequency of operation recorded in the first city.

Table 5 Comparison Of Chase-Car Freeway and Non-Freeway Driving Differences Between Cities (Sum of Differences in Percent Operation in 31 x 18 Speed-Accel Matrix; 200 = Maximum Difference)		
City-Pair	Total Difference	
	Freeway	Non-Freeway
LA vs. Baltimore	60.41	23.85
Spokane vs. Baltimore	42.16	25.27
Spokane vs. LA	73.45	29.60

By studying the detailed matrices, the differences in the freeway operation between the three cities become apparent. Los Angeles has more freeway travel at low speeds than either Baltimore or Spokane. Conversely, Los Angeles has less travel at free-flow speeds of 55-70 mph. However, as mentioned earlier, smaller differences between cities were observed for freeway operation at a particular level of service. For example, LOS A-C activity in Baltimore was similar to LOS A-C activity in Spokane and Los Angeles.* In contrast to the large differences in freeway travel, differences in non-freeway travel between the three cities are relatively small.

Area-Wide Cycle Construction Methodology

Based on the findings summarized above, it was determined that area-wide vehicle operation for different cities could be represented by a multi-segment driving cycle with city-specific weighting factors applied to each of the segments. The segments needed in the cycle are as follows:

1. freeway operation at LOS A-C;
2. freeway operation at LOS D;
3. freeway operation at LOS E;
4. freeway operation at LOS F;
5. freeway ramp operation; and
6. non-freeway operation.

*Large differences occur at the congestion levels when limited data are available for one of the cities.

The facility-specific cycles developed to represent freeway travel cover five of the six segments needed for the area-wide cycle. To complete the cycle, these five segments were strung together with a sixth cycle representing “non-freeway” operation. The application of the resultant cycle to individual cities would be as follows:

$$\begin{aligned} \text{Composite Emissions} = & WT_{FwyAC} \times Emissions_{FwyAC} + WT_{FwyD} \times Emissions_{FwyD} + \\ & WT_{FwyE} \times Emissions_{FwyE} + WT_{FwyF} \times Emissions_{FwyF} + \\ & WT_{FwyRamp} \times Emissions_{FwyRamp} + WT_{NonFwy} \times Emissions_{NonFwy} \end{aligned}$$

where each WT is a city-specific weighting factor representing the fraction of travel (in miles) for each operation group; these can be developed by transportation modeling agencies in each urban area.

Although chase car data collected in Los Angeles, Baltimore, and Spokane could have been used to construct a cycle representing non-freeway operation, analysis of differences in chase car and instrumented vehicle data indicated that the chase car method was under-representing short trips (< five minutes in length). Routes driven in chase car studies are based on trips estimated by an urban transportation planning model. Evidence indicates short “intrazonal” trips are not well-represented by transportation planning models. To compensate for this limitation, and to utilize the more robust instrumented vehicle data base, the following technique was used:

- Compute Initial Travel Mix - Freeway and non-freeway travel fractions were computed for the urban area of interest.
- Adjust Travel Mix - The initial freeway vs. non-freeway travel splits were adjusted to reflect the “short trip” bias not captured by transportation planning model or chase car data.
- Derive Non-Freeway Target Driving - The target SAFD for non-freeway driving was back-calculated by subtracting the chase-car-based freeway SAFD, weighted by the adjusted freeway travel fraction, from the full instrumented vehicle SAFD as follows:

$$SAFD_{NonFwy} = SAFD_{IV} - TF_{Fwy} \times SAFD_{FwyCC}$$

where $SAFD_{NonFwy}$ is the computed non-freeway target driving distribution, $SAFD_{IV}$ is the full instrumented vehicle driving distribution, TF_{Fwy} is the adjusted fraction of freeway travel, and $SAFD_{FwyCC}$ is the chase-car-based freeway driving distribution.

By itself, the resultant non-freeway target driving distribution was assumed to be city-independent.

- Develop Non-Freeway Driving Trace - Sierra then applied the microtrip-based Hybrid-Random/Incremental cycle development methodology (discussed in Section 3) to generate 12,000 candidate driving traces. The procedures for selecting and editing the “best” non-freeway area-wide cycle were identical to those described in Section 3. Unlike the facility-specific cycles, the candidate non-freeway area-wide cycles were developed exclusively from actual second-by-second instrumented vehicle driving data.
- Generate Composite Area-Wide Cycle - The non-freeway driving trace developed in the above step was then chained together with the facility-specific freeway cycles covering LOS A-F and the ramp cycle.

Appendix B contains a detailed description of the travel mix adjustment procedure and the adjusted mixes calculated for Baltimore, Spokane and Los Angeles.

The following weighting factors compiled for an individual city would then be applied to emission test results collected from each segment:

- freeway driving at LOS A-C travel fraction (mileage-based);
- freeway driving at LOS D travel fraction;
- freeway driving at LOS E travel fraction;
- freeway driving at LOS F fraction;
- freeway ramp travel fraction; and
- non-freeway driving travel fraction.

A set of city-specific fleet correction factors can then be compiled by combining city-specific travel fractions with the segment-specific emissions for a test fleet of vehicles, using either modal data collection or individual sample bags for each segment.

Characteristics of the Non-Freeway Area-Wide Segment

Table 6 summarizes several characteristics of the non-freeway portion of the new area-wide cycle. Figure 12 shows the speed-time profile for the non-freeway segment.

Cycle	Average Speed (mph)	Maximum Speed (mph)	Maximum Accel Rate (mph/s)	Length (seconds)	Length (miles)
Non-Freeway Urban Travel	19.4	52.3	6.4	1,348	7.25

Figure 12

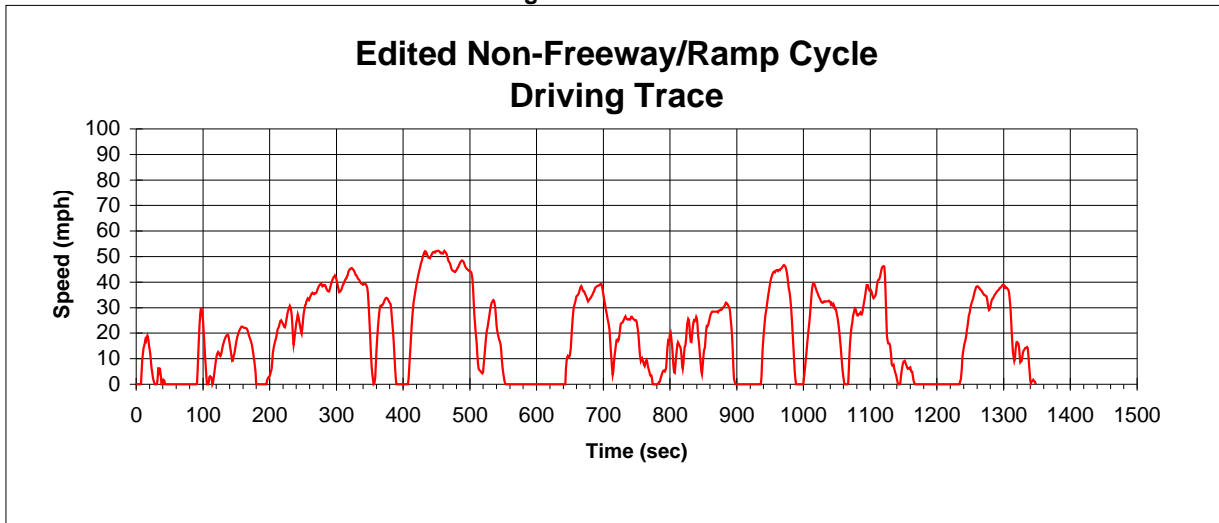
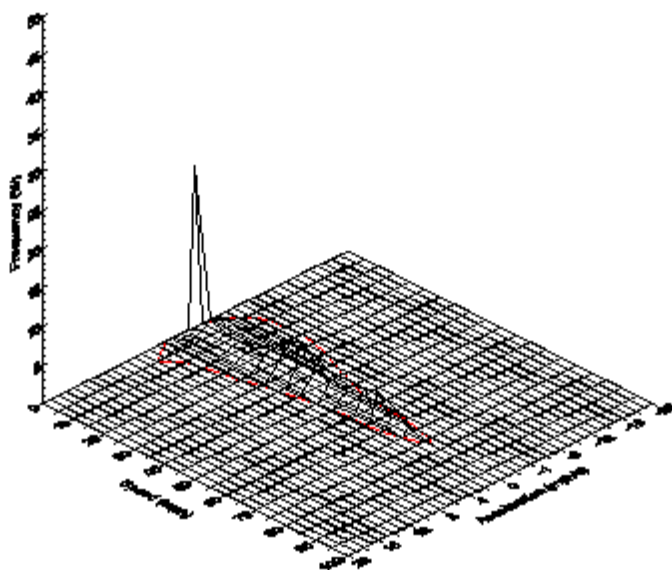


Figure 13 is a three-dimensional SAFD (Watson Plot) for the new area-wide cycle, with weighting factors applied to each of the segments based on chase car data collected in Baltimore. Figure 14 is a Watson Plot of the instrumented vehicle data collected in Baltimore. By comparing the two figures, it can be seen that the SAFD resulting from the application of appropriate weighting factors to the new area-wide cycle closely matches the SAFD generated from the instrumented vehicle data set.

Figure 13

Baltimore Instrumented Vehicle Driving SAFD (%)

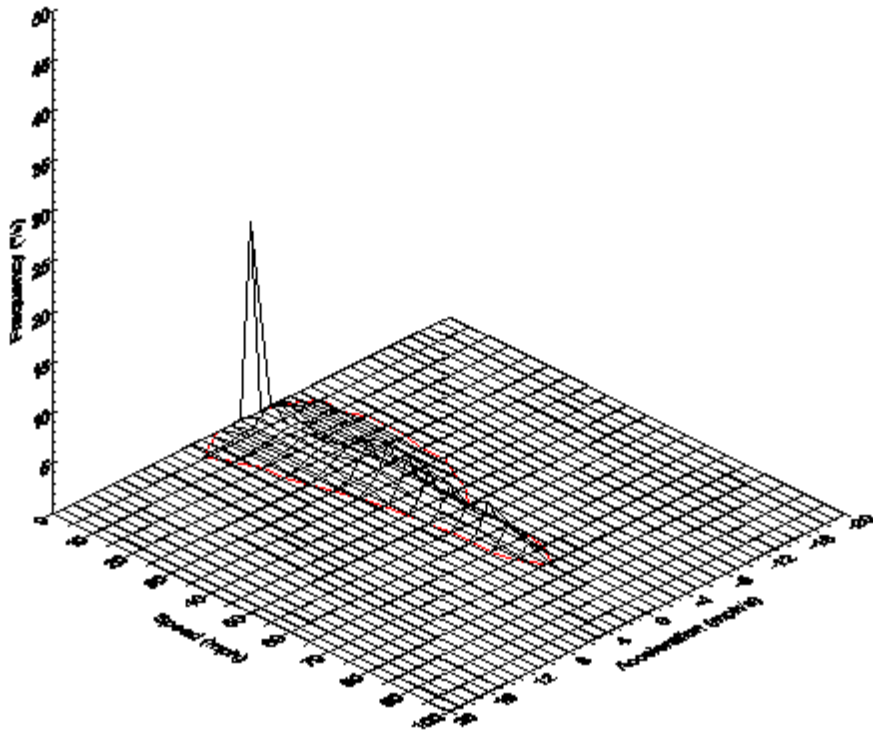


Note: Boundary line shows distribution 'envelope' at 0.1% frequency.

nObs = 3356480

Figure 14

Baltimore-Weighted Area-Wide Cycle SAFD (%)



Note: Boundary line shows distribution 'envelope' at 0.1% frequency.

NObs = 3434

5. EVALUATION OF DRIVING CYCLES

During the development of both the facility-specific and area-wide driving cycles, a comprehensive series of statistics were generated to test the representativeness of each individual cycle against the target driving population it was intended to match. This section provides an evaluation of each of the cycles developed under this study by summarizing these statistical comparisons. For perspective, a comparison of the same statistics for CARB's LA92 composite driving cycle and its target driving population is also provided. Finally, the entire multi-segment, area-wide driving cycle is compared to the LA92 cycle.

Facility-Specific Cycle Evaluation

Table 7 compares the key driving statistics for each of the facility-specific cycles with their respective target driving populations. The statistical tests for the cycles developed under this study can be compared to that of the Unified LA92 cycle, shown at the bottom of Table 7. As seen in the table, average speeds for each cycle match their target driving with 1-2 mph; however, speed and acceleration maximums for all of the cycles never reach the entire range contained in the target populations. Comparison of the critical DiffSum (sum of differences between cycle and target joint speed and acceleration frequencies) statistic (listed as "Total SAFD Difference" in the table) indicates that, with the exception of the ramp cycle,* each facility-specific cycles developed under this study matches the joint speed-acceleration frequencies of its target better than the LA92 cycle.

A detailed set of all cycle evaluation statistical comparisons stated in the Work Plan is presented in a series of tabular summaries contained in Appendix C. These detailed tables include the following statistics:

- time in acceleration;
- time in deceleration;

*Candidate ramp cycles proved difficult to develop using the segment-based Hybrid-Random/Incremental procedure. As they were being generated, segment building for many of the candidate ramp cycles was prematurely terminated before reaching the targeted cycle length. Due to the extreme transient nature of freeway ramp activity, segment endpoint matches could not always be found for currently selected segments, causing premature termination of the segment-building iterations. As a result, the match of best ramp cycle's SAFD against target ramp driving proved to be inferior to that of the other cycles.

Driving Cycle	Mean Speed (mph)		Maximum Speed (mph)		Maximum Accel Rate (mph/sec)		Total SAFD Difference (%)	High-Power Difference (%)
	Cyc.	Pop.	Cyc.	Pop.	Cyc.	Pop.		
Freeway High-Speed*	63.2	62.7	74.7	80.9	2.7	5.8	9.41	0.16
Freeway LOS A-C	59.7	59.2	73.1	83.2	3.4	6.8	12.12	0.39
Freeway LOS D	52.9	52.0	70.6	75.8	2.3	6.1	15.10	0.35
Freeway LOS E	30.5	32.1	63.0	71.3	5.3	8.5	25.17	0.18
Freeway LOS F	18.6	19.9	49.9	69.5	6.9	9.6	23.83	0.06
Freeway LOS G	13.1	14.4	35.7	49.1	3.8	5.7	18.80	0.10
Freeway Ramp	34.6	35.4	60.2	79.1	5.7	9.3	42.74	0.99
Arterial LOS A-B	24.8	25.2	58.9	74.9	5.0	14.9	17.04	0.40
Arterial LOS C-D	19.2	18.9	49.5	71.3	5.7	10.4	16.86	0.21
Arterial LOS E-F	11.6	12.0	39.9	56.8	5.8	10.2	17.86	0.24
Local Roadways	12.8	14.6	38.3	62.7	3.7	12.5	21.80	0.11
LA92 Cycle	24.6	26.3	67.2	80.3	6.9	10.4	30.27	0.19

- time at cruise;
- time at idle;
- maximum speed;
- average speed;
- average or predominant speed during cruise (“subjective” cycle speed);
- average non-idle speed;
- average positive acceleration rate;
- average negative deceleration rate;
- maximum acceleration rate;
- maximum deceleration rate;
- maximum power;
- length (time and miles);

*The first high-speed freeway cycle had an average speed of 64.2 mph, with a population average speed of 64.0 mph. Its Total SAFD and High-Power differences were 8.62% and 0.95%. As demonstrated in Table 7, the revised high-speed cycle exhibits a far superior match of high power events (0.16% vs. 0.95%) than the original high speed cycle, which is well in line with the high-power matches obtained for the other facility-specific cycles.

- stops per mile;
- average PKE;
- average total specific power;
- average non-zero specific power; and
- detailed distributions of speed and acceleration frequencies (SAFDs).

The statistical summary tables for each cycle in Appendix C are ordered as follows: 1) cycle statistics, 2) target driving population statistics, and 3) difference between cycle and target statistics.

Area-Wide Cycle Evaluation

Table 8 compares key statistics for the non-freeway segment of the area-wide cycle. (As before, statistics for the Unified LA92 cycle are also listed for comparison.) The average and maximum speeds of the non-freeway segment closely match that of its target instrumented vehicle-based driving. The non-freeway segment's DiffSum (total SAFD difference) and high-power summed difference compare favorably to those of the LA92 cycle.

Driving Segment/Cycle	Mean Speed (mph)		Maximum Speed (mph)		Maximum Accel Rate (mph/sec)		Total SAFD Difference (%)	High-Power Difference (%)
	Cyc.	Pop.	Cyc.	Pop.	Cyc.	Pop.		
Non-Freeway Area-Wide Segment	19.4	19.6	52.3	52.5	6.4	12.0	8.79	0.11
LA92 Cycle	24.6	26.3	67.2	80.3	6.9	10.4	30.27	0.19

A second series of statistical tests of the entire six-segment composite area-wide cycle was developed by generating driving distributions using segment-weighting factors for Los Angeles. These statistics for the LA-weighted cycle were then compared to both the LA92 cycle and the Los Angeles chase car driving data population. The results, summarized in Table 9, indicate that the 34.21% total SAFD difference between the two composite cycles (area-wide vs. LA92) exceeds that of each of the cycles developed under this study when compared to their target driving distributions. The area-wide cycle is compared against the 1992 Los Angeles chase car driving population in the second row of Table 9. Both the total SAFD difference and the high power difference of the

Table 9		
Comparison of the Los Angeles-Weighted Area-Wide Cycle Against the Unified LA92 Composite Cycle and Los Angeles Chase Car Data		
Data Comparison	Total SAFD Difference (%)	High-Power Difference (%)
Area-Wide Cycle vs. Unified LA92 Cycle	34.21	0.05
Area-Wide Cycle vs. LA Chase Car Data	18.85	0.14
LA92 Cycle vs. LA Chase Car Data	30.27	0.19

Los Angeles-weighted area-wide cycle, 18.85% and 0.14%, respectively, are exceeded by the differences between the LA92 cycle and the target driving population (30.27% and 0.19%).

Appendix D provides detailed tabular statistical comparisons performed in evaluating the area-wide cycle from which the results in Tables 8 and 9 are based.

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6. INTERSECTION INFLUENCE ANALYSIS

Driving cycles based on vehicle operation over surface streets (as opposed to freeways) can be heavily affected by the influence of intersections. This section first discusses several considerations in identifying “intersection influence.” It then describes the methodology used to analyze and quantify the influence of intersections on the speed traces of the arterial and local roadways driving cycles described earlier. It also includes an evaluation of the representativeness of the level of “intersection influence” in these cycles to that in their respective target driving populations.

In analyzing the effect of intersection influence, only signalized (e.g., traffic lights, stop signs) intersections were addressed. Intersections for which no traffic signal affected the direction of travel for the chase car were ignored. In conjunction with second-by-second emissions data collected on the new speed correction cycles, the analysis presented herein may allow the cycles to be used to evaluate the effect of changes in signalization strategies and intersection density.

Considerations for Identifying Intersection Influence

Driving cycles based on vehicle operation over surface streets (as opposed to freeways) can be heavily affected by the influence of intersections. Using straight-line travel on an arterial/collector as an example, under low congestion levels, decel-idle-accel and decel-accel (no idle) sequences would be expected to occur in the vicinity of intersections when the traffic signal is red; quasi-steady cruise operation would be expected through “green light” intersections and between intersections. To the extent that information is available on how changes in signalization affects the frequency of encountering “red light” intersections, second-by-second emissions data collected on the speed correction cycles could be re-weighted to project the effect of alternative signalization strategies. The effect of signalization strategies that reduce the frequency of decel-idle-accel and decel-accel sequences could be estimated by applying a weighting factor of less than 1.0 to the portions of the speed correction cycle that represent these sequences.

As increased congestion levels are encountered, the extent to which speed-time profiles are influenced by intersections becomes more complicated. Under high levels of congestion, 100% of the travel *between* intersections can still be influenced by the subsequent intersection. This situation can occur whenever the traffic density is such that the queue of vehicles waiting at a red light does not clear during the green light.

Depending on the length of the remaining queue and the distance between intersections, free-flow speed may not be achieved between intersections. The speed-time profile of vehicles approaching the intersection is affected regardless of whether the signal is red or green.

Turns are another activity that influences the speed-time profile in the vicinity of intersections. Even under uncongested green light conditions, decel-accel sequences occur during virtually all 90° turns. This pattern of activity typifies operation on “local” roadways.

Based on the expected pattern of intersection influences described above, it would be tempting to associate all decel-idle-accel and decel-accel sequences occurring during surface street travel with turns and red lights; however, numerous other factors cause similar sequences to occur in real driving. Vehicles entering and leaving parking locations (e.g., at roadside businesses) are one example; vehicles slowing down during lane changes are another. *Because of the variety of conditions that can lead to decel-accel sequences, the actual conditions that caused such sequences in the speed-time segments used to construct the speed correction cycles may not be representative of the conditions that cause such sequences in overall operation.* The pattern of activity incorporated into the new speed correction cycles for arterials/collectors and local roadways reflects the amount of decel-idle-accel and decel-accel sequences associated with the combination of intersection density and traffic signalization strategies encountered during the chase car operation, *but the specific conditions that caused decel-accel sequences in the new speed correction cycles may not represent the conditions that cause such sequences in overall operation.*

Methodology Used to Quantify Intersection Influence

Portions of the videotape archives of all of the three-city chase car driving were reviewed to classify second-by-second driving traces of the three arterial cycles and the single local roadways cycle into one of the following categories:

1. Signal Influenced Straight Flow or Right Turns;
2. Signal Influenced Left Turns; and
3. Non-Signal Influenced Operation.

Given the relatively short length of these speed correction cycles (compared to the amount of driving in each of their target driving populations), a representative occurrence of each of these conditions compared to those in the larger target driving populations is not ensured. To determine the representativeness of the intersection influenced behavior in each of the four surface street cycles, a series of segment traces from each cycle’s driving population were randomly selected. These random segment traces were then video reviewed as resources permitted under the Work Assignment.

Date/time stamps were included in both the driving data and on the forward-view video tapes on a second-by-second basis. Date/time stamps for each of the cycle traces and randomly selected driving population traces were used to identify the proper sections of video footage for review. These portions of the tapes were watched by an observer equipped with a multi-position switch box connected to a data logger similar to that actually used to record second-by-second information during the chase car studies. While viewing the videotape, second-by-second “markings” of intersection influence and the positions where intersections were crossed were identified and computerized.

Results

Table 10 summarizes second-by-second data files containing markings of the presence of absence of intersection influence for each of the surface street cycles (arterials A-B, C-D, E-F and local). Both distance- and time-based distributions are provided as well as the density of signalized intersections encountered per mile. As expected, the influence of intersections is greater for the more congested Arterial E-F cycle than the uncongested Arterial A-B cycle.

Table 10				
Distribution of Signalized Intersection Influence Within Surface Street Driving Cycles				
	Arterial A-B	Arterial C-D	Arterial E-F	Local
Time-Based Distributions (% of time)				
Intersection Influenced, Left Turn	8.0%	5.4%	16.8%	7.6%
Intersection Influenced, Straight/Right Turn	29.5%	54.1%	66.5%	23.6%
Non-Intersection Influenced	62.5%	40.5%	16.6%	68.8%
Distance-Based Distributions (% of dist.)				
Intersection Influenced, Left Turn	3.4%	4.7%	7.5%	6.2%
Intersection Influenced, Straight/Right Turn	14.6%	26.5%	47.4%	19.6%
Non-Intersection Influenced	82.0%	68.8%	45.1%	74.2%
# of Intersections	13	17	7	5
Intersections/Mile	2.6	5.1	4.3	2.7

To provide an assessment of the representativeness of the intersection influence contained in these cycles, Table 11 shows similarly compiled results for a series of randomly selected segment traces from each cycle's "target" driving population.

Table 11 Distribution of Signalized Intersection Influence Within Random Surface Street Driving Segments				
	Arterial A-B	Arterial C-D	Arterial E-F	Local
Time-Based Distributions (% of time)				
Intersection Influenced, Left Turn	14.5%	22.1%	32.2%	16.2%
Intersection Influenced, Straight/Right Turn	32.8%	34.9%	55.0%	3.2%
Non-Intersection Influenced	57.7%	42.9%	12.7%	80.6%
Distance-Based Distributions (% of dist.)				
Intersection Influenced, Left Turn	2.6%	4.3%	5.2%	15.2%
Intersection Influenced, Straight/Right Turn	19.6%	19.3%	42.2%	1.9%
Non-Intersection Influenced	77.8%	76.4%	52.6%	82.9%
# of Intersections	17	21	9	2
Intersections/Mile	3.5	5.2	9.7	2.1

As shown in Table 11, the distributions and trends (from congested to uncongested driving) are similar for the arterial driving groups to the results given for the cycle traces in Table 10. The local roadways distributions for the random segments do not generally agree with the distribution of intersection influence for the local driving cycle. However, caution should be exercised in comparing the results in Tables 10 and 11. Because of the effort required to perform the video review, only small random samples of the driving populations for each cycle could be reviewed. For example, the random local roadways segments reviewed represented less than 0.5% of the entire population of local roadways driving.

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7. REFERENCES

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Appendix A

Detailed Driving Data Statistics

BALTIMORE SELF-WEIGHTING CHASE CAR DATA
TRAVEL STATISTICS BY FACILITY TYPE AND LOS

	# OF OBS	%FREQ	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
			%VMT								%FREQ	%FREQ	%FREQ	%FREQ
ALL	212,918	100.000	100.000	0.00	28.23	80.91	-21.1	14.9	25.24	56.425	36.060	6.585	0.768	0.163
FACILITY														
OTHER	491	0.231	0.053	0.00	6.45	23.00	-3.4	4.9	8.33	63.747	35.438	0.815	-	-
PRIVATE	5,294	2.486	0.769	0.00	8.73	55.20	-6.3	9.5	10.99	64.299	34.530	1.020	0.132	0.019
LOCAL	34,870	16.377	8.089	0.00	13.94	62.70	-12.1	12.5	15.24	59.943	37.944	1.990	0.118	0.006
ART/COLL	128,872	60.527	52.461	0.00	24.46	74.50	-21.1	14.9	25.06	56.894	35.508	6.793	0.677	0.128
RAMP	7,395	3.473	4.947	0.00	40.20	72.69	-9.1	9.3	38.06	52.725	32.454	12.238	2.150	0.433
FREEWAY	35,996	16.906	33.681	0.00	56.23	80.91	-14.3	9.7	35.25	50.836	37.185	10.026	1.547	0.406
FACILITY LOS														
OTHER	164	0.077	0.021	0.00	7.72	18.95	-3.3	4.3	9.20	58.537	41.463	-	-	-
A	324	0.152	0.032	0.00	5.85	23.00	-3.4	4.9	7.96	66.049	32.716	1.235	-	-
B	3	0.001	0.000	0.00	1.93	4.00	-2.2	0.0	0.00	100.000	-	-	-	-
PRIVATE	4,442	2.086	0.637	0.00	8.61	55.20	-6.3	8.5	10.93	64.903	33.814	1.126	0.158	-
B	424	0.199	0.066	0.00	9.38	31.99	-5.8	9.5	12.14	60.613	38.208	0.943	-	0.236
C	320	0.150	0.047	0.00	8.90	27.50	-3.9	4.3	10.72	62.813	37.188	-	-	-
D	108	0.051	0.019	0.00	10.33	22.20	-3.9	4.3	9.78	58.333	41.667	-	-	-
LOCAL	1	0.000	0.000	25.80	25.80	25.80	0.8	0.8	40.64	-	100.000	-	-	-
A	32,958	15.479	7.751	0.00	14.13	62.70	-12.1	12.5	15.33	59.588	38.309	1.978	0.118	0.006
B	1,382	0.649	0.272	0.00	11.83	43.40	-9.6	5.8	15.21	65.919	30.897	3.039	0.145	-
C	383	0.180	0.062	0.00	9.71	34.40	-6.7	5.0	11.90	61.880	38.120	-	-	-
D	146	0.069	0.004	0.00	1.76	25.00	-4.4	3.3	3.26	78.767	21.233	-	-	-
ART/COLL	125	0.059	0.023	0.00	10.92	34.40	-4.3	5.0	17.18	69.600	24.000	6.400	-	-
A	58,048	27.263	28.254	0.00	29.25	74.50	-15.3	14.9	26.15	54.998	37.224	6.970	0.679	0.129
B	34,666	16.281	13.192	0.00	22.87	65.00	-15.4	10.5	25.60	57.907	33.889	7.347	0.730	0.127
C	22,301	10.474	7.359	0.00	19.83	63.15	-21.1	9.2	24.05	58.728	33.895	6.493	0.731	0.152
D	9,884	4.642	2.861	0.00	17.40	71.29	-9.1	10.4	22.25	57.628	36.180	5.554	0.536	0.101
E	3,359	1.578	0.679	0.00	12.15	56.77	-8.0	10.2	17.08	64.305	31.230	4.168	0.238	0.060
F	489	0.230	0.093	0.00	11.47	43.20	-4.9	6.2	16.52	57.669	38.855	3.272	0.204	-
RAMP	3,221	1.513	2.257	0.00	42.11	69.80	-8.7	9.3	39.25	50.078	34.492	13.443	1.894	0.093
B	2,306	1.083	1.522	0.00	39.67	71.15	-9.1	9.1	39.32	51.865	32.827	12.359	2.298	0.650
C	996	0.468	0.705	0.00	42.54	68.52	-6.0	4.0	38.75	53.815	30.823	12.249	2.410	0.703
D	556	0.261	0.410	0.00	44.36	72.69	-5.9	3.4	36.28	58.273	29.317	8.633	2.518	1.259
E	74	0.035	0.035	15.31	28.50	47.60	-5.4	3.8	32.21	55.405	29.730	13.514	1.351	-
F	242	0.114	0.017	0.00	4.31	42.40	-3.3	4.7	13.21	78.099	16.529	2.893	2.479	-
FREEWAY	8,553	4.017	8.468	0.00	59.50	80.91	-14.3	6.8	33.33	51.619	37.694	9.131	1.216	0.339
A	11,503	5.403	11.374	0.00	59.42	77.30	-7.1	5.6	36.35	51.274	36.304	10.076	1.834	0.513
B	8,575	4.027	8.479	0.00	59.42	75.84	-5.1	4.6	36.03	50.496	37.259	10.321	1.574	0.350
C	3,760	1.766	3.555	0.00	56.83	75.80	-5.5	5.0	37.30	50.585	35.771	11.569	1.676	0.399
D	1,101	0.517	0.814	0.00	44.42	71.03	-5.8	5.1	42.15	46.685	36.966	13.715	1.907	0.727
E	2,504	1.176	0.992	0.00	23.82	69.47	-6.7	9.7	28.01	49.521	41.454	7.907	0.919	0.200

LOS ANGELES SELF-WEIGHTING CHASE CAR DATA
TRAVEL STATISTICS BY FACILITY TYPE AND LOS

FACILITY	# OF OBS	%FREQ	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
			%VMT							%FREQ	%FREQ	%FREQ	%FREQ	%FREQ
ALL	110,909	100.000	100.000	0.00	26.34	80.30	-15.0	10.4	25.22	55.839	36.770	6.786	0.465	0.140
FACILITY														
OTHER	67	0.060	0.012	0.00	5.27	18.95	-3.3	4.3	7.01	65.672	34.328	-	-	-
PRIVATE	290	0.261	0.059	0.00	5.99	18.95	-3.5	4.3	6.89	68.280	31.720	-	-	-
LOCAL	2,515	2.268	1.041	0.00	12.09	37.20	-6.9	6.3	13.85	61.113	37.893	0.994	-	-
ART/COLL	73,779	66.522	49.640	0.00	19.65	63.10	-15.0	10.4	23.98	57.957	34.790	6.815	0.340	0.098
RAMP	5,671	5.113	2.342	0.00	28.55	67.09	-11.2	8.5	34.16	56.004	30.682	10.316	2.504	0.494
FREEWAY	28,586	25.774	43.705	0.00	44.66	80.30	-11.2	7.8	27.87	49.752	43.021	6.605	0.430	0.192
HOV LANE	1	0.001	0.001	26.56	26.56	26.56	0.5	0.5	0.00	100.000	-	-	-	-
FACILITY														
OTHER	67	0.060	0.012	0.00	5.27	18.95	-3.3	4.3	7.01	65.672	34.328	-	-	-
PRIVATE	186	0.168	0.031	0.00	4.94	18.95	-3.5	4.3	6.89	68.280	31.720	-	-	-
LOCAL	54	0.049	0.015	0.00	8.14	18.95	-3.5	4.3	10.22	61.111	38.889	-	-	-
ART/COLL	50	0.045	0.013	0.00	7.55	18.95	-3.3	3.9	7.90	62.000	38.000	-	-	-
RAMP	2,512	2.265	1.040	0.00	12.09	37.20	-6.9	6.3	13.86	61.107	37.898	0.995	-	-
FREEWAY	2	0.002	0.000	0.00	0.00	0.00	0.0	0.0	0.00	100.000	-	-	-	-
HOV LANE	1	0.001	0.001	35.70	35.70	35.70	0.8	0.8	28.40	-	100.000	-	-	-
FACILITY														
OTHER	4	0.004	0.002	0.00	16.23	32.60	0.0	0.3	17.63	50.000	50.000	-	-	-
PRIVATE	32,169	29.005	21.136	0.00	19.19	61.10	-15.0	10.1	23.75	58.193	34.822	6.624	0.274	0.087
LOCAL	18,141	16.357	13.562	0.00	21.84	63.10	-12.3	8.3	25.73	56.816	35.103	7.491	0.469	0.121
ART/COLL	13,466	12.141	9.388	0.00	20.36	59.10	-9.6	10.4	24.13	57.939	34.546	7.003	0.401	0.111
RAMP	6,746	6.082	4.194	0.00	18.16	53.00	-9.6	9.1	22.80	58.227	35.073	6.359	0.237	0.104
FREEWAY	2,552	2.301	1.132	0.00	12.96	47.69	-8.8	8.0	19.37	62.108	32.053	5.525	0.313	-
HOV LANE	701	0.632	0.226	0.00	9.41	38.80	-11.2	6.3	14.12	59.344	37.090	3.566	-	-
FACILITY														
OTHER	1	0.001	0.001	38.40	38.40	38.40	1.5	1.5	142.31	-	100.000	-	-	-
PRIVATE	857	0.773	0.884	0.00	30.15	61.10	-11.2	6.5	40.11	56.243	26.021	14.002	3.501	0.233
LOCAL	1,310	1.181	1.438	0.00	32.06	64.50	-8.9	7.7	47.03	51.374	29.389	14.046	4.504	0.687
ART/COLL	1,294	1.167	1.282	0.00	28.95	66.80	-10.4	8.0	34.13	59.274	26.971	10.587	2.318	0.850
RAMP	1,043	0.940	0.950	0.00	26.61	67.09	-10.4	8.5	23.52	62.224	29.626	6.520	1.246	0.384
FREEWAY	584	0.527	0.652	0.00	32.59	63.70	-5.9	6.9	28.47	59.247	30.479	8.390	1.712	0.171
HOV LANE	582	0.525	0.334	0.00	16.78	49.20	-7.9	6.9	21.06	44.502	50.859	4.467	-	0.172
FACILITY														
OTHER	716	0.646	1.411	32.60	57.55	76.36	-2.3	2.6	36.39	48.464	42.179	8.659	0.419	0.279
PRIVATE	2,275	2.051	4.912	40.30	63.07	76.00	-3.8	5.9	30.99	50.725	39.868	8.440	0.659	0.308
LOCAL	7,196	6.488	15.026	0.00	60.99	80.30	-9.2	5.8	28.96	53.446	38.994	6.587	0.598	0.375
ART/COLL	4,438	4.001	8.484	0.00	55.84	73.97	-11.2	4.1	28.74	54.214	37.201	7.886	0.541	0.158
RAMP	5,175	4.666	6.874	0.00	38.80	69.50	-10.0	7.8	30.13	48.947	42.493	8.000	0.386	0.174
FREEWAY	8,786	7.922	6.999	0.00	23.27	66.00	-8.5	7.1	23.71	44.799	50.455	4.507	0.205	0.034
HOV LANE	1	0.001	0.001	26.56	26.56	26.56	0.5	0.5	0.00	100.000	-	-	-	-

COMBINED SELF-WEIGHTING CHASE CAR DATA (LA92,BALT,SPKN)
TRAVEL STATISTICS BY FACILITY TYPE AND LOS

FACILITY	# OF OBS	%FREQ	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
			%VMT							%FREQ	%FREQ	%FREQ	%FREQ	%FREQ
ALL FACILITY	523,864	100.000	100.000	0.00	27.32	83.15	-21.1	14.9	23.39	57.222	36.361	5.770	0.521	0.126
OTHER	558	0.107	0.025	0.00	6.31	23.00	-3.4	4.9	8.17	63.978	35.305	0.717	-	-
PRIVATE	9,784	1.868	0.506	0.00	7.40	55.20	-6.3	9.5	9.38	65.720	33.504	0.695	0.072	0.010
LOCAL	57,445	10.966	5.861	0.00	14.60	62.70	-12.1	12.5	15.12	60.937	37.037	1.915	0.104	0.007
ART/COLL	355,742	67.907	58.462	0.00	23.52	74.90	-21.1	14.9	22.94	57.977	35.625	5.870	0.430	0.098
RAMP	16,171	3.087	4.002	0.00	35.43	79.10	-11.2	9.3	37.29	54.734	30.511	11.842	2.474	0.439
FREEWAY	84,163	16.066	31.144	0.00	52.97	83.15	-14.3	9.7	29.99	50.939	40.474	7.437	0.871	0.279
HOV LANE	1	0.000	0.000	26.56	26.56	26.56	0.5	0.5	0.00	100.000	-	-	-	-
FACILITY LOS														
OTHER	164	0.031	0.009	0.00	7.72	18.95	-3.3	4.3	9.20	58.537	41.463	-	-	-
A	391	0.075	0.016	0.00	5.75	23.00	-3.4	4.9	7.80	65.985	32.992	1.023	-	-
B	3	0.001	0.000	0.00	1.93	4.00	-2.2	0.0	0.00	100.000	-	-	-	-
PRIVATE	8,702	1.661	0.440	0.00	7.23	55.20	-6.3	8.5	9.25	66.054	33.142	0.724	0.080	-
B	513	0.098	0.033	0.00	9.14	34.90	-5.8	9.5	11.65	61.014	38.012	0.780	-	0.195
C	461	0.088	0.026	0.00	7.99	34.60	-5.8	4.3	9.30	66.377	33.406	0.217	-	-
D	108	0.021	0.008	0.00	10.33	22.20	-3.9	4.3	9.78	58.333	41.667	-	-	-
LOCAL	1	0.000	0.000	25.80	25.80	25.80	0.8	0.8	40.64	-	100.000	-	-	-
A	55,268	10.550	5.691	0.00	14.74	62.70	-12.1	12.5	15.16	60.769	37.215	1.903	0.105	0.007
B	1,644	0.314	0.141	0.00	12.32	43.40	-9.6	5.8	15.54	64.903	32.056	2.920	0.122	-
C	386	0.074	0.027	0.00	9.85	35.70	-6.7	5.0	12.09	61.399	38.601	-	-	-
D	146	0.028	0.000	0.00	1.76	25.00	-4.4	3.3	3.26	78.767	21.233	-	-	-
ART/COLL	274	0.052	0.014	0.00	7.55	34.40	-4.3	5.0	11.89	71.533	25.547	2.920	-	-
A	181,748	34.694	32.805	0.00	25.84	74.90	-15.3	14.9	22.91	57.987	35.846	5.680	0.401	0.086
B	89,953	17.171	14.968	0.00	23.82	69.50	-15.4	10.5	24.26	57.404	35.401	6.555	0.516	0.125
C	54,415	10.387	7.449	0.00	19.59	63.15	-21.1	10.4	22.50	58.245	35.340	5.857	0.447	0.112
D	21,296	4.065	2.549	0.00	17.13	71.29	-9.6	10.4	21.25	57.861	36.401	5.297	0.362	0.080
E	6,488	1.238	0.577	0.00	12.74	56.77	-8.8	10.2	17.82	62.223	32.922	4.578	0.247	0.031
F	1,568	0.299	0.100	0.00	9.11	43.20	-11.2	6.3	13.05	61.926	35.204	2.806	0.064	-
RAMP	1	0.000	0.000	38.40	38.40	38.40	1.5	1.5	142.31	-	100.000	-	-	-
A	5,902	1.127	1.595	0.00	38.67	79.10	-11.2	9.3	39.57	53.931	29.736	13.606	2.592	0.136
B	4,421	0.844	1.150	0.00	37.23	71.15	-9.1	9.1	42.92	51.210	31.690	13.504	2.918	0.679
C	2,766	0.528	0.668	0.00	34.59	68.52	-10.4	8.0	36.33	57.701	27.838	11.063	2.675	0.723
D	1,599	0.305	0.366	0.00	32.79	72.69	-10.4	8.5	27.96	60.851	29.518	7.255	1.689	0.688
E	658	0.126	0.148	0.00	32.13	63.70	-5.9	6.9	28.89	58.815	30.395	8.967	1.672	0.152
F	824	0.157	0.076	0.00	13.12	49.20	-7.9	6.9	18.75	54.369	40.777	4.005	0.728	0.121
FREEWAY	16,914	3.229	7.158	0.00	60.58	83.15	-14.3	6.8	28.91	52.164	40.056	6.793	0.745	0.242
B	19,961	3.810	8.291	0.00	59.46	77.30	-7.1	5.9	31.65	52.016	38.400	7.940	1.257	0.386
C	20,891	3.988	8.665	0.00	59.37	80.30	-9.2	5.8	30.68	51.874	39.385	7.515	0.890	0.335
D	8,553	1.633	3.360	0.00	56.23	75.80	-11.2	5.0	32.04	52.449	37.063	9.213	1.017	0.257
E	6,554	1.251	1.825	0.00	39.87	71.03	-10.0	7.8	32.03	48.322	42.035	8.743	0.641	0.259
F	11,290	2.155	1.845	0.00	23.39	69.47	-8.5	9.7	24.67	45.846	48.459	5.261	0.363	0.071
HOV LANE	1	0.000	0.000	26.56	26.56	26.56	0.5	0.5	0.00	100.000	-	-	-	-

BALTIMORE SELF-WEIGHTING CHASE CAR DATA
TRAVEL STATISTICS BY DAY-OF-WEEK AND TIME-OF-DAY

	# OF OBS	%FREQ	DIST		CSPD		CACL		POWER		PWR			
			%VMT	MIN	MEAN	MAX	MIN	MAX	MEAN	0	1-99	100-199	200-299	300+
ALL	212,918	100.000	100.000	0.00	28.23	80.91	21.1	14.9	25.24	56.425	36.060	6.585	0.768	0.163
PERIOD														
NIGHT	39,989	18.781	18.525	0.00	27.84	75.84	14.5	10.9	24.47	56.048	36.978	6.237	0.600	0.138
AM PEAK	33,405	15.689	15.781	0.00	28.39	73.89	14.1	9.7	25.87	56.530	35.617	6.759	0.925	0.168
MIDDAY	85,491	40.152	43.517	0.00	30.59	80.91	15.4	12.5	26.95	55.544	36.132	7.237	0.895	0.192
PM PEAK	54,033	25.377	22.177	0.00	24.67	73.48	21.1	14.9	22.70	58.031	35.539	5.702	0.596	0.131
DAY TYPE														
PERIOD														
NIGHT	39,989	18.781	18.525	0.00	27.84	75.84	14.5	10.9	24.47	56.048	36.978	6.237	0.600	0.138
AM PEAK	33,405	15.689	15.781	0.00	28.39	73.89	14.1	9.7	25.87	56.530	35.617	6.759	0.925	0.168
MIDDAY	85,491	40.152	43.517	0.00	30.59	80.91	15.4	12.5	26.95	55.544	36.132	7.237	0.895	0.192
PM PEAK	54,033	25.377	22.177	0.00	24.67	73.48	21.1	14.9	22.70	58.031	35.539	5.702	0.596	0.131

SPOKANE SELF-WEIGHTING CHASE CAR DATA
TRAVEL STATISTICS BY DAY-OF-WEEK AND TIME-OF-DAY

	# OF OBS	%FREQ	DIST		CSPD		CACL		POWER		PWR			
			%VMT	MIN	MEAN	MAX	MIN	MAX	MEAN	0	1-99	100-199	200-299	300+
ALL	200,037	100.000	100.000	0.00	26.91	83.15	-13.8	9.7	20.42	58.837	36.455	4.341	0.288	0.079
PERIOD														
NIGHT	9,585	4.792	4.081	0.00	22.92	72.60	-8.5	9.0	20.28	59.322	35.796	4.538	0.230	0.115
AM PEAK	22,946	11.471	10.849	0.00	25.45	74.90	-10.4	8.9	20.50	59.265	35.902	4.441	0.309	0.083
MIDDAY	117,954	58.966	59.317	0.00	27.07	83.15	-13.8	9.7	20.23	58.582	36.875	4.193	0.270	0.079
PM PEAK	49,552	24.771	25.753	0.00	27.98	78.30	-11.9	9.2	20.85	59.150	35.837	4.607	0.333	0.073
DAY TYPE														
PERIOD														
NIGHT	9,585	4.792	4.081	0.00	22.92	72.60	-8.5	9.0	20.28	59.322	35.796	4.538	0.230	0.115
AM PEAK	22,946	11.471	10.849	0.00	25.45	74.90	-10.4	8.9	20.50	59.265	35.902	4.441	0.309	0.083
MIDDAY	117,954	58.966	59.317	0.00	27.07	83.15	-13.8	9.7	20.23	58.582	36.875	4.193	0.270	0.079
PM PEAK	49,552	24.771	25.753	0.00	27.98	78.30	-11.9	9.2	20.85	59.150	35.837	4.607	0.333	0.073

COMBINED SELF-WEIGHTING CHASE CAR DATA (IA92,BALT,SPKN)
TRAVEL STATISTICS BY DAY-OF-WEEK AND TIME-OF-DAY

	# OF OBS	%FREQ	DIST		CSPD		CACL		POWER		PWR			
			%VMT	MIN	MEAN	MAX	MIN	MAX	MEAN	0	1-99	100-199	200-299	300+
ALL	523,864	100.000	100.000	0.00	27.32	83.15	-21.1	14.9	23.39	57.222	36.361	5.770	0.521	0.126
PERIOD														
NIGHT	70,094	13.380	13.271	0.00	27.10	76.00	-14.5	10.9	24.24	56.399	36.748	6.219	0.506	0.128
AM PEAK	74,612	14.243	13.897	0.00	26.66	80.11	-14.1	9.7	24.12	57.248	35.876	6.116	0.627	0.133
MIDDAY	238,001	45.432	47.451	0.00	28.54	83.15	-15.4	12.5	23.53	57.188	36.418	5.723	0.532	0.139
PM PEAK	141,157	26.945	25.381	0.00	25.74	78.30	-21.1	14.9	22.36	57.673	36.329	5.446	0.453	0.100
DAY TYPE														
PERIOD														
NIGHT	70,094	13.380	13.271	0.00	27.10	76.00	-14.5	10.9	24.24	56.399	36.748	6.219	0.506	0.128
AM PEAK	74,612	14.243	13.897	0.00	26.66	80.11	-14.1	9.7	24.12	57.248	35.876	6.116	0.627	0.133
MIDDAY	238,001	45.432	47.451	0.00	28.54	83.15	-15.4	12.5	23.53	57.188	36.418	5.723	0.532	0.139
PM PEAK	141,157	26.945	25.381	0.00	25.74	78.30	-21.1	14.9	22.36	57.673	36.329	5.446	0.453	0.100

COMBINED 3-CITY INSTRUMENTED VEHICLE DATA TRAVEL STATISTICS BY
 DAY-OF-WEEK AND TIME-OF-DAY

22:19 Wednesday, August 14, 1996

	# OF OBS	%FREQ	DIST		CSPD			CACL			POWER		PWR			
			%VMT	MIN	MEAN	MAX	MIN	MAX	MIN	MAX	MEAN	MAX	0	1-99	100-199	200-299
ALL	9,111,532	100.000	100.000	0.00	25.94	96.50	16.7	20.18	59.428	35.272	4.904	0.366	0.029			
PERIOD																
NIGHT	2,289,951	25.132	27.037	0.00	27.91	96.50	14.6	20.14	58.798	36.014	4.765	0.388	0.034			
AM PEAK	1,283,788	14.090	14.100	0.00	25.96	89.90	14.5	20.47	60.272	34.201	5.096	0.402	0.030			
MIDDAY	3,344,686	36.708	35.504	0.00	25.09	95.30	16.7	20.20	59.413	35.227	4.981	0.353	0.026			
PM PEAK	2,193,107	24.070	23.360	0.00	25.18	94.50	15.9	20.04	59.613	35.193	4.820	0.344	0.030			
DAY TYPE																
PERIOD																
WEEKDAY																
NIGHT	1,645,369	18.058	19.041	0.00	27.35	96.50	14.6	20.36	58.811	35.877	4.867	0.407	0.039			
AM PEAK	1,169,954	12.840	12.677	0.00	25.61	89.90	14.5	20.39	60.435	34.072	5.066	0.398	0.029			
MIDDAY	2,440,357	26.783	25.549	0.00	24.75	95.30	15.4	20.36	59.374	35.177	5.066	0.357	0.026			
PM PEAK	1,691,849	18.568	17.241	0.00	24.09	94.50	15.9	20.09	59.898	34.849	4.863	0.357	0.032			
NIGHT	644,582	7.074	7.995	0.00	29.32	90.10	12.1	19.57	58.766	36.363	4.507	0.340	0.024			
AM PEAK	113,834	1.249	1.423	0.00	29.54	79.90	13.6	21.28	58.599	35.530	5.404	0.436	0.031			
MIDDAY	904,329	9.925	9.955	0.00	26.02	82.40	16.7	19.77	59.520	35.361	4.753	0.341	0.025			
PM PEAK	501,258	5.501	6.119	0.00	28.85	84.30	13.2	19.87	58.649	36.355	4.675	0.299	0.022			

ATLANTA INSTRUMENTED VEHICLE DATA TRAVEL STATISTICS
 BY DAY-OF-WEEK AND TIME-OF-DAY

16:34 Wednesday,

August 14, 1996 1

	# OF OBS	%FREQ	DIST		CSPD			CAACL			POWER		PWR				
			%VMT	%FREQ	MIN	MEAN	MAX	MIN	MAX	MEAN	0	1-99	100-199	200-299	300+		
ALL PERIOD	3,664,872	100.000	100.000	0.00	28.80	96.50	-18.6	16.7	22.86	58.355	34.919	6.174	0.515	0.037			
NIGHT	1,026,796	28.017	30.229	0.00	31.07	96.50	-18.6	14.6	22.27	57.686	36.050	5.732	0.497	0.035			
AM PEAK	507,828	13.857	13.515	0.00	28.09	89.90	-13.1	14.5	23.70	58.236	34.564	6.596	0.575	0.028			
MIDDAY	1,310,170	35.749	34.370	0.00	27.69	95.30	-13.4	16.7	23.16	58.788	34.164	6.467	0.538	0.042			
PM PEAK	820,078	22.377	21.886	0.00	28.17	90.90	-18.6	13.1	22.59	58.572	34.930	5.997	0.463	0.037			
DAY TYPE																	
WEEKDAY	741,228	20.225	21.590	0.00	30.74	96.50	-18.6	14.6	22.43	57.712	35.918	5.803	0.526	0.041			
NIGHT	467,288	12.750	12.101	0.00	27.33	89.90	-13.1	14.5	23.67	58.386	34.428	6.591	0.567	0.029			
AM PEAK	977,862	26.682	25.281	0.00	27.29	95.30	-12.7	13.4	23.38	58.706	34.126	6.575	0.547	0.045			
MIDDAY	607,320	16.571	15.337	0.00	26.65	90.90	-18.6	12.1	22.98	58.788	34.444	6.242	0.486	0.040			
PM PEAK	285,568	7.792	8.639	0.00	31.93	90.10	-14.3	11.5	21.87	57.619	36.393	5.547	0.421	0.020			
WEEKEND	40,540	1.106	1.414	0.00	36.81	79.90	-11.2	11.7	24.11	56.512	36.142	6.663	0.661	0.022			
NIGHT	332,308	9.067	9.090	0.00	28.87	82.40	-13.4	16.7	22.50	59.030	34.276	6.149	0.512	0.034			
AM PEAK	212,758	5.805	6.549	0.00	32.49	84.30	-14.1	13.1	21.47	57.957	36.315	5.301	0.398	0.028			
MIDDAY																	
PM PEAK																	

BALTIMORE INSTRUMENTED VEHICLE DATA TRAVEL STATISTICS
BY DAY-OF-WEEK AND TIME-OF-DAY

	# OF OBS	%FREQ	DIST			CSPD			CAACL			POWER			PMR					
			%VMT	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	%FREQ	MEAN	%FREQ	MAX	%FREQ	MEAN	%FREQ	MAX
ALL	3,365,481	100.000	100.000	0.00	24.50	94.50	-19.5	15.1	19.25	60.116	35.209	4.354	0.299	0.023						
PERIOD																				
NIGHT	838,218	24.906	25.577	0.00	25.16	89.40	-14.7	13.9	18.74	60.164	35.420	4.089	0.302	0.026						
AM PEAK	515,101	15.305	15.690	0.00	25.11	83.70	-19.5	12.9	19.55	60.941	34.206	4.504	0.319	0.029						
MIDDAY	1,194,571	35.495	35.162	0.00	24.27	80.60	-12.6	15.1	19.16	59.710	35.712	4.296	0.268	0.014						
PM PEAK	817,591	24.293	23.570	0.00	23.77	94.50	-11.8	14.7	19.72	60.138	34.889	4.615	0.329	0.029						
DAY TYPE																				
PERIOD																				
NIGHT	599,929	17.826	17.641	0.00	24.24	89.40	-14.7	13.9	19.13	60.160	35.216	4.272	0.322	0.031						
AM PEAK	470,651	13.985	14.351	0.00	25.14	83.70	-19.5	12.9	19.43	61.104	34.106	4.435	0.323	0.032						
MIDDAY	851,217	25.293	24.404	0.00	23.64	80.60	-12.0	15.1	19.21	59.771	35.605	4.346	0.265	0.012						
PM PEAK	635,833	18.893	17.777	0.00	23.05	94.50	-11.8	14.7	19.78	60.330	34.660	4.609	0.367	0.035						
NIGHT	238,289	7.080	7.937	0.00	27.46	81.20	-12.9	12.1	17.75	60.174	35.932	3.630	0.251	0.013						
AM PEAK	44,450	1.321	1.339	0.00	24.84	74.10	-11.8	12.7	20.84	59.213	35.269	5.237	0.281	-						
MIDDAY	343,354	10.202	10.758	0.00	25.83	80.10	-12.6	14.9	19.03	59.560	35.977	4.170	0.275	0.018						
PM PEAK	181,758	5.401	5.794	0.00	26.28	83.10	-11.4	13.2	19.49	59.465	35.690	4.637	0.199	0.009						

SPOKANE INSTRUMENTED VEHICLE DATA TRAVEL STATISTICS
 BY DAY-OF-WEEK AND TIME-OF-DAY

	# OF OBS	%FREQ	DIST		CSPD			CACL			POWER		PWR			
			%VMT	MIN	MEAN	MAX	MIN	MAX	MEAN	MIN	MAX	MEAN	0	1-99	100-199	200-299
ALL	2,081,177	100.000	100.000	0.00	23.24	77.50	-15.4	15.9	16.98	60.205	35.995	3.560	0.214	0.027		
PERIOD																
NIGHT	424,937	20.418	22.558	0.00	25.68	77.20	-13.7	12.2	17.73	58.792	37.097	3.764	0.297	0.049		
AM PEAK	260,859	12.534	12.665	0.00	23.49	77.50	-13.6	12.0	16.00	62.914	33.482	3.344	0.227	0.033		
MIDDAY	839,944	40.359	38.561	0.00	22.21	77.20	-15.4	14.6	17.06	59.966	36.195	3.639	0.184	0.017		
PM PEAK	555,437	26.689	26.216	0.00	22.83	73.90	-13.3	15.9	16.74	60.375	36.031	3.385	0.189	0.021		
DAY TYPE																
WEEKDAY																
NIGHT	304,212	14.617	15.868	0.00	25.23	75.00	-13.7	12.2	17.73	58.828	37.079	3.759	0.287	0.048		
AM PEAK	232,015	11.148	11.080	0.00	23.10	77.50	-11.4	12.0	15.76	63.203	33.285	3.275	0.211	0.026		
MIDDAY	611,277	29.372	28.086	0.00	22.23	75.20	-15.4	14.6	17.10	59.888	36.263	3.654	0.180	0.016		
PM PEAK	448,695	21.560	20.480	0.00	22.08	73.90	-13.3	15.9	16.60	60.789	35.665	3.359	0.169	0.018		
NIGHT	120,725	5.801	6.690	0.00	26.81	77.20	-12.3	11.6	17.72	58.702	37.143	3.777	0.325	0.053		
AM PEAK	28,844	1.386	1.585	0.00	26.59	73.40	-13.6	11.6	17.98	60.588	35.071	3.893	0.357	0.090		
MIDDAY	228,667	10.987	10.475	0.00	22.16	77.20	-13.2	14.3	16.94	60.174	36.012	3.600	0.194	0.021		
PM PEAK	106,742	5.129	5.736	0.00	25.99	73.00	-10.2	12.2	17.33	58.637	37.567	3.493	0.271	0.032		

SELF-WEIGHTING CHASE CAR DATA
TRAVEL STATISTICS BY FACILITY GROUP

CITY BALTIMORE

	# OF OBS	%TIME	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
FACILITY GROUP	43,391	20.379	38.629	0.00	53.50	80.91	-14.3	9.7	35.73	51.158	36.379	10.403	1.650	0.410
F/R	169,527	79.621	61.371	0.00	21.76	74.50	-21.1	14.9	22.55	57.773	35.978	5.607	0.543	0.099

CITY LOS ANGELES

	# OF OBS	%TIME	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
FACILITY GROUP	34,257	30.887	49.247	0.00	41.99	80.30	-11.2	8.5	28.91	50.787	40.978	7.219	0.774	0.242
F/R	76,652	69.113	50.753	0.00	19.34	63.10	-15.0	10.4	23.57	58.098	34.889	6.592	0.327	0.094

CITY SPOKANE

	# OF OBS	%TIME	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
FACILITY GROUP	22,686	11.341	23.609	0.00	56.03	83.15	-7.3	7.7	25.84	53.456	40.443	5.232	0.670	0.198
F/R	177,351	88.659	76.391	0.00	23.19	74.90	-13.8	9.7	19.72	59.525	35.945	4.227	0.240	0.064

SELF-WEIGHTING CHASE CAR DATA
TRAVEL STATISTICS BY FACILITY GROUP

ALL

	# OF OBS	DIST		CSPD		CACL		POWER	PWR									
		%VMT	MIN	MEAN	MAX	MIN	MAX		MEAN	0	1-99	100-199	200-299	300+				
FACILITY GROUP																		
F/R	100,334	19.153	35.146	0.00	50.14	83.15	-14.3	9.7	31.17	51.551	38.868	8.147	1.129	0.305				
NON-F/R	423,530	80.847	64.854	0.00	21.92	74.90	-21.1	14.9	21.55	58.565	35.767	5.207	0.377	0.084				

SELF-WEIGHTING CHASE CAR DATA
 FREEWAY/RAMP TRAVEL STATISTICS BY LOS

CITY BALTIMORE

LOS	# OF OBS	%TIME	DIST			CSPD			CACL			POWER	PWR		
			%VMT	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MAX		MEAN	%TIME	%TIME
A	11,774	27.135	27.764	0.00	54.74	80.91	-14.3	9.3	34.95	51.198	36.818	10.311	1.401	0.272	
B	13,809	31.825	33.384	0.00	56.12	77.30	-9.1	9.1	36.85	51.372	35.723	10.457	1.912	0.536	
C	9,571	22.058	23.775	0.00	57.67	75.84	-6.0	4.6	36.31	50.841	36.590	10.521	1.661	0.387	
D	4,316	9.947	10.266	0.00	55.22	75.80	-5.9	5.0	37.17	51.576	34.940	11.191	1.784	0.510	
E	1,175	2.708	2.198	0.00	43.42	71.03	-5.8	5.1	41.53	47.234	36.511	13.702	1.872	0.681	
F	2,746	6.329	2.614	0.00	22.10	69.47	-6.7	9.7	26.71	52.039	39.257	7.465	1.056	0.182	

CITY LOS ANGELES

LOS	# OF OBS	%TIME	DIST			CSPD			CACL			POWER	PWR		
			%VMT	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MAX		MEAN	%TIME	%TIME
A	1	0.003	0.003	38.40	38.40	1.5	1.5	142.31	-	100.000	-	-	-		
B	1,573	4.592	4.660	0.00	42.62	76.36	-11.2	6.5	38.42	52.702	33.376	11.570	2.098	0.254	
C	3,585	10.465	12.893	0.00	51.74	76.00	-8.9	7.7	36.85	50.962	36.039	10.488	2.064	0.446	
D	8,490	24.783	33.116	0.00	56.11	80.30	-10.4	8.0	29.74	54.335	37.161	7.197	0.860	0.448	
E	5,481	16.000	19.156	0.00	50.28	73.97	-11.2	8.5	27.74	55.738	35.760	7.626	0.675	0.201	
F	5,759	16.811	15.281	0.00	38.17	69.50	-10.0	7.8	29.96	49.991	41.275	8.040	0.521	0.174	
	9,368	27.346	14.891	0.00	22.87	66.00	-8.5	7.1	23.55	44.780	50.480	4.505	0.192	0.043	

SELF-WEIGHTING CHASE CAR DATA
 FREEWAY/RAMP TRAVEL STATISTICS BY LOS

CITY SPOKANE

	# OF OBS	%TIME	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
LOS														
A	9,469	41.739	42.587	0.00	57.16	83.15	-7.3	7.7	26.45	54.377	38.758	5.872	0.855	0.137
B	6,988	30.803	30.759	73.83	55.95	73.83	-6.2	4.6	25.83	53.320	40.655	5.180	0.601	0.243
C	5,596	24.667	24.208	0.00	54.98	70.70	-6.9	5.1	25.25	52.788	41.833	4.610	0.500	0.268
D	355	1.565	1.533	31.57	54.89	60.04	-2.3	1.5	17.74	50.141	49.014	0.845	-	-
E	278	1.225	0.912	24.95	41.72	55.70	-3.8	2.3	27.30	43.165	53.597	2.878	0.360	-

ALL

	# OF OBS	%TIME	DIST	CSPD			CACL			POWER	PWR			
				MIN	MEAN	MAX	MIN	MAX	MEAN		0	1-99	100-199	200-299
LOS														
0	1	0.001	0.001	38.40	38.40	38.40	1.5	1.5	142.31	-	-	100.000	-	-
A	22,816	22.740	24.903	0.00	54.91	83.15	-14.3	9.3	31.66	52.621	37.386	8.555	1.223	0.215
B	24,382	24.301	26.862	0.00	55.43	77.30	-9.1	9.1	33.69	51.870	37.183	8.949	1.559	0.439
C	23,657	23.578	26.555	0.00	56.47	80.30	-10.4	8.0	31.34	52.555	38.035	7.930	1.099	0.380
D	10,152	10.118	10.602	0.00	52.54	75.80	-11.2	8.5	31.40	53.773	35.875	8.905	1.123	0.325
E	7,212	7.188	5.614	0.00	39.16	71.03	-10.0	7.8	31.74	49.279	40.973	8.763	0.735	0.250
F	12,114	12.074	5.464	0.00	22.69	69.47	-8.5	9.7	24.26	46.426	47.936	5.176	0.388	0.074

SELF-WEIGHTING CHASE CAR DATA
NON-FREEWAY/RAMP TRAVEL STATISTICS BY LOS

CITY BALTIMORE

LOS	# OF OBS	DIST			CSPD			CACL			POWER			PWR					
		%VMT	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
0	290	0.171	0.00	34.40	9.16	34.40	-4.3	5.0	12.75	63.103	34.138	2.759	-	-	-	-	-	-	-
A	95,772	56.494	0.00	74.50	23.01	74.50	-15.3	14.9	21.66	57.074	37.424	4.962	0.459	0.080	0.459	0.080	0.459	0.080	0.080
B	36,475	21.516	0.00	22.29	22.29	65.00	-15.4	10.5	25.05	58.245	33.823	7.109	0.699	0.123	0.699	0.123	0.699	0.123	0.123
C	23,004	13.570	0.00	19.51	19.51	63.15	-21.1	9.2	23.66	58.838	34.011	6.295	0.709	0.148	0.709	0.148	0.709	0.148	0.148
D	10,138	5.980	0.00	17.10	17.10	71.29	-9.1	10.4	21.85	57.940	36.023	5.415	0.523	0.099	0.523	0.099	0.523	0.099	0.099
E	3,359	1.981	0.00	12.15	12.15	56.77	-8.0	10.2	17.08	64.305	31.230	4.168	0.238	0.060	0.238	0.060	0.238	0.060	0.060
F	489	0.288	0.00	11.47	11.47	43.20	-4.9	6.2	16.52	57.669	38.855	3.272	0.204	-	0.204	-	0.204	-	-

CITY LOS ANGELES

LOS	# OF OBS	DIST			CSPD			CACL			POWER			PWR					
		%VMT	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
0	4	0.005	0.00	32.60	16.23	32.60	0.0	0.3	17.63	50.000	50.000	-	-	-	-	-	-	-	-
A	34,934	45.575	0.00	61.10	18.58	61.10	-15.0	10.1	22.92	58.470	35.026	6.172	0.252	0.080	0.252	0.080	0.252	0.080	0.080
B	18,197	23.740	0.00	26.751	21.79	63.10	-12.3	8.3	25.68	56.834	35.110	7.468	0.467	0.121	0.467	0.121	0.467	0.121	0.121
C	13,517	17.634	0.00	20.32	20.32	59.10	-9.6	10.4	24.07	57.949	34.564	6.976	0.399	0.111	0.399	0.111	0.399	0.111	0.111
D	6,746	8.801	0.00	18.16	18.16	53.00	-9.6	9.1	22.80	58.227	35.073	6.359	0.237	0.104	0.237	0.104	0.237	0.104	0.104
E	2,553	3.331	0.00	12.96	12.96	47.69	-8.8	8.0	19.36	62.123	32.041	5.523	0.313	-	0.313	-	0.313	-	-
F	701	0.915	0.00	9.41	9.41	38.80	-11.2	6.3	14.12	59.344	37.090	3.566	-	-	3.566	-	-	-	-

SELF-WEIGHTING CHASE CAR DATA
NON-FREEWAY/RAMP TRAVEL STATISTICS BY LOS

CITY SPOKANE

LOS	# OF OBS	%TIME	DIST			CSPD			CACL			POWER	PWR		
			%VMT	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX		MEAN	%TIME	%TIME
0	145	0.082	0.016	0.00	4.40	21.10	-4.2	4.3	7.17	73.793	26.207	-	-	-	
A	115,403	65.070	66.204	0.00	23.59	74.90	-13.8	9.0	19.15	60.567	35.226	3.929	0.230	0.049	
B	37,441	21.111	23.289	0.00	25.58	69.50	-11.9	9.7	22.26	57.245	36.965	5.331	0.337	0.123	
C	18,741	10.567	8.517	0.00	18.69	56.68	-9.2	9.5	19.40	57.996	37.549	4.253	0.139	0.064	
D	4,666	2.631	1.711	0.00	15.08	53.40	-8.6	8.4	16.87	57.823	38.791	3.215	0.171	-	
E	577	0.325	0.213	0.00	15.21	34.50	-7.0	8.2	15.21	50.607	46.620	2.773	-	-	
F	378	0.213	0.051	0.00	5.51	36.90	-4.7	5.0	6.61	72.222	26.984	0.794	-	-	

ALL

LOS	# OF OBS	%TIME	DIST			CSPD			CACL			POWER	PWR		
			%VMT	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX		MEAN	%TIME	%TIME
0	439	0.104	0.036	0.00	7.65	34.40	-4.3	5.0	10.95	66.515	31.663	1.822	-	-	
A	246,109	58.109	60.060	0.00	22.66	74.90	-15.3	14.9	20.66	58.910	36.053	4.649	0.322	0.065	
B	92,113	21.749	23.348	0.00	23.53	69.50	-15.4	10.5	24.04	57.560	35.354	6.457	0.506	0.123	
C	55,262	13.048	11.566	0.00	19.43	63.15	-21.1	10.4	22.31	58.335	35.346	5.769	0.440	0.110	
D	21,550	5.088	3.945	0.00	16.99	71.29	-9.6	10.4	21.07	58.005	36.325	5.234	0.357	0.079	
E	6,489	1.532	0.890	0.00	12.74	56.77	-8.8	10.2	17.81	62.228	32.917	4.577	0.247	0.031	
F	1,568	0.370	0.154	0.00	9.11	43.20	-11.2	6.3	13.05	61.926	35.204	2.806	0.064	-	

Combined 3-City Chase Car Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
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Totals	15.252	8.980	6.105	6.580	6.431	7.364	9.216	9.377	6.680	4.308	4.038	5.253	5.636	3.297	1.279	0.172	0.030	0.002				100.000

Summary Statistics	Avg Speed	27.33 mph	Modal Region Frequencies	Total Idle	15.25%	Outside LA-4 Frequencies	Above LA-4 Accel	2.22%	Specific Power Distribution	0 mph2/sec	57.22%
	Avg Trip Length	6.94 miles	Total Cruise	35.23%		Below LA-4 Decel	3.60%			>0 - <100 mph2/sec	36.36%
	Avg Trip Time	15.24 min	Total Accel	26.50%		Above LA-4 Speed	10.42%			100 - <200 mph2/sec	5.77%
	Avg Non-Zero Power	54.68 mph2/s	Total Decel	23.02%		Total Beyond LA-4	16.24%			200 - <300 mph2/sec	0.52%
	Total 1-Sec Obs	523864								>=300 mph2/sec	0.13%

Combined 3-City Instrumented Vehicle Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19						0.000																0.000
-18						0.000																0.000
-17																						
-16																						
-15																						
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Totals	19.045	8.819	5.712	6.041	6.104	7.276	9.517	9.829	6.771	4.622	3.556	3.763	4.169	2.891	1.419	0.379	0.070	0.015	0.003	0.000	100.000	

Summary Statistics	Avg Speed	25.91 mph	Modal Region Frequencies	Total Idle	19.05%	Outside LA-4 Frequencies	Above LA-4 Accel	2.12%	Specific Power Distribution	0 mph2/sec	59.43%
	Avg Trip Length	4.94 miles	Total Cruise	38.35%		Below LA-4 Decel	3.21%		>0 - <100 mph2/sec	35.27%	
	Avg Trip Time	11.47 min	Total Accel	22.04%		Above LA-4 Speed	8.95%		100 - <200 mph2/sec	4.90%	
	Avg Non-Zero Power	49.66 mph2/s	Total Decel	20.57%		Total Beyond LA-4	14.28%		200 - <300 mph2/sec	0.37%	
	Total 1-Sec Obs	9111550							>=300 mph2/sec	0.03%	

Combined 3-City Instrumented Vehicle Weekend Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
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-1																						
0	17.253	2.241	1.181	1.056	1.140	2.085	1.410	5.845	4.474	3.154	2.747	3.419	4.416	4.416	3.219	1.524	0.589	0.087	0.002	0.000	0.000	58.843
1	0.220	1.111	0.736	0.866	0.922	1.347	1.684	1.565	1.137	0.774	0.529	0.411	0.374	0.211	0.092	0.033	0.004	0.000	0.000	0.000	0.000	11.958
2	0.077	0.679	0.602	0.808	0.820	0.761	0.564	0.342	0.179	0.090	0.046	0.026	0.015	0.007	0.003	0.001	0.000	0.000	0.000	0.000	0.000	5.019
3	0.043	0.518	0.480	0.563	0.482	0.282	0.146	0.066	0.024	0.010	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.620
4	0.032	0.375	0.266	0.219	0.160	0.069	0.025	0.009	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.158
5	0.021	0.236	0.096	0.051	0.030	0.015	0.008	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.458
6	0.009	0.114	0.027	0.010	0.006	0.003	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.066
7	0.006	0.053	0.005	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027
8	0.002	0.024	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012
9	0.001	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006
10	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
11	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
12	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Totals	17.665	8.622	5.476	5.628	5.592	6.669	8.972	9.723	7.134	4.906	3.931	4.325	5.132	3.702	1.744	0.674	0.101	0.002	0.001	0.000	0.000	100.000

Summary Statistics	Avg Speed	27.88 mph	Modal Region Frequencies	Total Idle	17.67%	Outside LA-4 Frequencies	Above LA-4 Accel	2.01%	Specific Power Distribution	0 mph2/sec	59.05%
	Avg Trip Length	5.21 miles	Total Cruise	41.59%		Above LA-4 Decel	3.10%		>0 - <100 mph2/sec	35.90%	
	Avg Trip Time	11.24 min	Total Accel	21.09%		Above LA-4 Speed	11.36%		100 - <200 mph2/sec	4.70%	
	Avg Non-Zero Power	48.39 mph2/s	Total Decel	19.66%		Total Beyond LA-4	16.47%		200 - <300 mph2/sec	0.34%	
	Total 1-Sec Obs	2164010							>=300 mph2/sec	0.02%	

Atlanta Instrumented Vehicle Weekend Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
-18																						
-17																						
-16																						
-15				0.000																		0.000
-14				0.000																		0.000
-13																						0.000
-12																						0.000
-11			0.000																			0.000
-10			0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-9			0.000	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
-8			0.000	0.006	0.007	0.008	0.004	0.004	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031
-7		0.001	0.005	0.021	0.028	0.025	0.016	0.009	0.005	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.113
-6		0.004	0.029	0.059	0.072	0.065	0.045	0.024	0.014	0.006	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.320
-5		0.021	0.108	0.157	0.159	0.141	0.106	0.065	0.032	0.014	0.006	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.873
-4		0.116	0.251	0.275	0.270	0.241	0.188	0.129	0.076	0.040	0.017	0.005	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.611
-3		0.393	0.379	0.362	0.355	0.306	0.272	0.219	0.153	0.093	0.043	0.017	0.005	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	2.601
-2		0.951	0.476	0.413	0.354	0.355	0.365	0.374	0.319	0.229	0.129	0.068	0.043	0.025	0.014	0.006	0.001	0.000	0.000	0.000	0.000	4.123
-1		1.768	0.702	0.556	0.478	0.549	0.697	0.941	1.094	1.015	0.909	0.584	0.481	0.418	0.230	0.038	0.020	0.001	0.000	0.000	0.000	10.443
0	16.064	2.551	1.165	0.916	0.763	1.061	1.655	2.713	3.709	4.121	3.820	3.519	5.067	5.402	3.289	1.488	0.231	0.005	0.001	0.000	0.000	57.541
1	0.191	1.199	0.714	0.741	0.703	0.947	1.234	1.505	1.588	1.294	0.883	0.606	0.469	0.377	0.185	0.074	0.011	0.001	0.000	0.000	0.000	12.702
2	0.075	0.681	0.535	0.690	0.685	0.707	0.649	0.499	0.320	0.166	0.076	0.035	0.019	0.009	0.004	0.003	0.001	0.000	0.000	0.000	0.000	5.155
3	0.038	0.484	0.432	0.519	0.479	0.341	0.221	0.116	0.040	0.014	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.698
4	0.028	0.344	0.261	0.214	0.178	0.093	0.034	0.013	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.172
5	0.018	0.210	0.096	0.055	0.031	0.016	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.434
6	0.009	0.092	0.024	0.008	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.140
7	0.006	0.041	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020
8	0.002	0.016	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
9	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
10	0.000	0.005																				0.005
11	0.002																					0.002
12	0.000																					0.000
13	0.000																					0.000
14																						0.000
15																						0.000
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19																						0.000
20																						0.000
Totals	16.432	8.895	5.185	4.995	4.568	4.861	5.493	6.616	7.336	6.997	5.792	4.838	6.088	6.235	3.725	1.669	0.265	0.007	0.002	0.000	0.000	100.000

Summary Statistics	Avg Speed	31.15 mph
	Avg Trip Length	6.22 miles
	Avg Trip Time	11.99 min
	Avg Non-Zero Power	52.9 mph ² /s
	Total 1-Sec Obs	871177
Modal Region Frequencies	Total Idle	16.43%
	Total Cruise	41.48%
	Total Accel	22.02%
	Total Decel	20.07%
Outside LA-4 Frequencies	Above LA-4 Accel	2.01%
	Below LA-4 Decel	3.60%
	Above LA-4 Speed	17.99%
	Total Beyond LA-4	23.60%
Specific Power Distribution	0 mph ² /sec	58.19%
	>0 - <100 mph ² /sec	35.55%
	100 - <200 mph ² /sec	5.77%
	200 - <300 mph ² /sec	0.46%
	>=300 mph ² /sec	0.03%

Baltimore Chase Car Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100	
-20																							
-19																							
-18																							
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Totals	15.860	8.438	6.100	6.282	6.141	6.870	7.859	7.706	5.939	5.314	5.444	5.944	6.826	3.932	1.197	0.140	0.007						100.000

Summary Statistics	Avg Speed	28.23 mph	Modal Region Frequencies	Total Idle	15.86%	Outside LA-4 Frequencies	Above LA-4 Accel	2.24%	Specific Power Distribution	0 mph2/sec	56.43%
	Avg Trip Length	7.59 miles	Total Cruise	32.76%		Below LA-4 Decel	3.46%		>0 - <100 mph2/sec	36.06%	
	Avg Trip Time	16.13 min	Total Accel	26.94%		Above LA-4 Speed	12.10%		100 - <200 mph2/sec	6.59%	
	Avg Non-Zero Power	57.92 mph2/s	Total Decel	24.44%		Total Beyond LA-4	17.80%		200 - <300 mph2/sec	0.77%	
	Total 1-Sec Obs	212918				>=300 mph2/sec	0.16%				

Baltimore-Exeter Instrumented Vehicle Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
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-2																						
-1																						
0	23.628	2.181	1.100	1.244	1.694	2.875	4.481	5.033	3.263	2.167	1.853	2.465	1.845	0.969	0.237	0.031	0.001	0.000				
1	0.243	1.139	0.828	1.118	1.421	1.946	2.026	1.546	0.898	0.572	0.399	0.325	0.222	0.118	0.033	0.006	0.001	0.000				
2	0.091	0.798	0.773	1.070	1.089	0.873	1.070	0.514	0.257	0.121	0.062	0.040	0.027	0.013	0.008	0.003	0.000	0.000				
3	0.066	0.639	0.610	0.680	0.484	0.223	0.090	0.034	0.018	0.008	0.006	0.003	0.001	0.000								
4	0.047	0.466	0.328	0.224	0.124	0.042	0.015	0.006	0.002	0.001	0.000											
5	0.031	0.279	0.107	0.047	0.024	0.009	0.004	0.001	0.000													
6	0.019	0.132	0.026	0.008	0.003	0.001	0.001	0.000														
7	0.009	0.060	0.007	0.002	0.000	0.000	0.000															
8	0.004	0.029	0.002	0.000	0.000																	
9	0.001	0.015	0.001	0.000																		
10	0.000	0.007	0.000	0.000																		
11	0.000	0.003	0.000																			
12	0.000	0.001	0.000																			
13	0.000	0.000	0.000																			
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Totals	24.140	9.602	6.231	6.981	7.476	8.607	9.510	8.674	5.355	3.466	2.766	3.206	2.354	1.256	0.325	0.048	0.002	0.000				100.000

Summary Statistics	Avg Speed	20.93 mph	Modal Region Frequencies	Total Idle	24.14%	Outside LA-4 Frequencies	Above LA-4 Accel	2.19%	Specific Power Distribution	0 mph2/sec	60.98%
	Avg Trip Length	3.95 miles		Total Cruise	31.44%		Below LA-4 Decel	3.20%		>0 - <100 mph2/sec	34.78%
	Avg Trip Time	11.35 min		Total Accel	23.02%		Above LA-4 Speed	3.99%		100 - <200 mph2/sec	3.99%
	Avg Non-Zero Power	47.32 mph2/s		Total Decel	21.40%		Total Beyond LA-4	9.38%		200 - <300 mph2/sec	0.23%
	Total 1-Sec Obs	1686877								>=300 mph2/sec	0.02%

Baltimore Instrumented Vehicle Weekend Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
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Totals	19.825	8.382	5.389	5.764	6.042	6.950	8.348	8.377	6.383	4.828	3.949	4.945	5.706	3.614	1.115	0.344	0.038	0.000				100.000

Summary Statistics	Avg Speed	26.38 mph	Modal Region Frequencies	Total Idle	19.83%	Outside LA-4 Frequencies	Above LA-4 Accel	2.03%	Specific Power Distribution	0 mph2/sec	59.70%
	Avg Trip Length	5.33 miles	Total Cruise	39.76%		Below LA-4 Decel	3.06%		>0 - <100 mph2/sec	35.86%	
	Avg Trip Time	12.13 min	Total Accel	20.97%		Above LA-4 Speed	10.82%		100 - <200 mph2/sec	4.17%	
	Avg Non-Zero Power	46.79 mph2/s	Total Decel	19.45%		Total Beyond LA-4	15.91%		200 - <300 mph2/sec	0.25%	
	Total 1-Sec Obs	807854							>=300 mph2/sec	0.01%	

Los Angeles 92 Chase Car Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
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Totals	14.679	10.033	6.193	7.035	7.128	7.997	9.267	8.876	7.203	4.602	3.040	3.497	4.899	3.761	1.455	0.284	0.051					100.000

Summary Statistics	Avg Speed	26.34 mph	Modal Region Frequencies	Total Idle	14.68%	Outside LA-4 Frequencies	Above LA-4 Accel	2.60%	Specific Power Distribution	0 mph2/sec	55.84%
	Avg Trip Length	7.88 miles	Total Cruise	32.80%		Below LA-4 Decel	4.57%		>0 - <100 mph2/sec	36.77%	
	Avg Trip Time	17.95 min	Total Accel	28.76%		Above LA-4 Speed	10.45%		100 - <200 mph2/sec	6.79%	
	Avg Non-Zero Power	57.11 mph2/s	Total Decel	23.76%		Total Beyond LA-4	17.62%		200 - <300 mph2/sec	0.47%	
	Total 1-Sec Obs	110909							>=300 mph2/sec	0.14%	

Spokane Chase Car Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
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Totals	15.217	8.471	6.020	6.424	6.024	7.224	10.523	11.549	6.898	3.007	3.630	6.317	5.184	2.199	1.185	0.091	0.032	0.006				100.000

Summary Statistics	Avg Speed	26.91 mph	Modal Region Frequencies	Total Idle	15.22%	Outside LA-4 Frequencies	Above LA-4 Accel	1.84%	Specific Power Distribution	0 mph2/sec	58.84%
	Avg Trip Length	5.98 miles	Total Cruise	40.13%		Below LA-4 Decel	2.76%		>0 - <100 mph2/sec	36.45%	
	Avg Trip Time	13.34 min	Total Accel	23.78%		Above LA-4 Speed	8.70%		100 - <200 mph2/sec	4.34%	
	Avg Non-Zero Power	49.6 mph2/s	Total Decel	20.87%		Total Beyond LA-4	13.30%		200 - <300 mph2/sec	0.29%	
	Total 1-Sec Obs	200037							>=300 mph2/sec	0.08%	

Spokane Instrumented Vehicle Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
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Totals	18.087	8.751	6.018	6.511	6.741	8.799	13.406	13.532	6.402	2.471	1.747	2.827	3.276	0.921	0.503	0.008						100.000

Summary Statistics	Avg Speed	23.28 mph	Specific Power Distribution	0 mph2/sec	60.21%
	Avg Trip Length	3.52 miles	>0 - <100 mph2/sec	>0 - <100 mph2/sec	36.00%
	Avg Trip Time	9.08 min	100 - <200 mph2/sec	100 - <200 mph2/sec	3.56%
	Avg Non-Zero Power	42.67 mph2/s	200 - <300 mph2/sec	200 - <300 mph2/sec	0.21%
	Total 1-Sec Obs	2081180	>=300 mph2/sec	>=300 mph2/sec	0.03%
Modal Region Frequencies	Total Idle	18.09%	Outside LA-4 Frequencies	Above LA-4 Accel	2.00%
	Total Cruise	41.45%		Below LA-4 Decel	2.60%
	Total Accel	20.63%		Above LA-4 Speed	4.71%
	Total Decel	19.83%		Total Beyond LA-4	9.31%

Spokane Instrumented Vehicle Weekday Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
-18																						
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Totals	18.498	8.801	6.087	6.628	6.915	8.982	13.507	13.337	6.013	2.343	1.654	2.716	3.176	0.818	0.537	0.008						100.000

Summary Statistics	Avg Speed	22.92 mph	Modal Region Frequencies	Total Idle	18.50%	Outside LA-4 Frequencies	Above LA-4 Accel	2.00%	Specific Power Distribution	0 mph2/sec	60.42%
	Avg Trip Length	3.46 miles	Total Cruise	40.82%		Below LA-4 Decel	>0 - <100 mph2/sec	2.59%		>0 - <100 mph2/sec	35.82%
	Avg Trip Time	9.07 min	Total Accel	20.74%		Above LA-4 Speed	100 - <200 mph2/sec	4.54%		100 - <200 mph2/sec	3.54%
	Avg Non-Zero Power	42.66 mph2/s	Total Decel	19.95%		Total Beyond LA-4	200 - <300 mph2/sec	9.13%		200 - <300 mph2/sec	0.20%
	Total 1-Sec Obs	1596201					>=300 mph2/sec			>=300 mph2/sec	0.02%

Spokane Instrumented Vehicle Weekend Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
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-1																						
0	16.324	2.173	1.338	1.220	1.297	2.918	7.689	10.170	5.752	2.060	1.532	2.697	3.221	1.102	0.352	0.005						
1	0.229	1.095	0.808	0.993	1.021	1.649	2.052	1.612	0.789	0.333	0.223	0.216	0.149	0.059	0.013	0.001						
2	0.075	0.683	0.653	0.893	0.895	0.787	0.522	0.234	0.081	0.041	0.025	0.020	0.011	0.005	0.002							
3	0.043	0.387	0.495	0.582	0.503	0.261	0.105	0.037	0.016	0.007	0.002	0.001	0.000	0.000								
4	0.023	0.245	0.083	0.045	0.030	0.018	0.010	0.003	0.001	0.000												
5	0.008	0.132	0.031	0.014	0.009	0.006	0.004	0.000														
6	0.006	0.063	0.007	0.002	0.000	0.001	0.000															
7	0.002	0.027	0.001	0.000																		
8	0.001	0.013	0.000	0.000																		
9	0.000	0.007	0.000																			
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Totals	16.737	5.859	5.855	6.126	6.167	8.195	13.074	14.177	7.683	2.892	2.052	3.194	3.603	1.257	0.390	0.008						100.000

Summary Statistics	Avg Speed	24.44 mph	Total Idle	16.74%	Outside LA-4 Frequencies	Above LA-4 Accel	2.00%	Specific Power Distribution	0 mph2/sec	59.49%
	Avg Trip Length	3.7 miles	Total Cruise	43.54%		Below LA-4 Decel	2.63%		>0 - <100 mph2/sec	36.58%
	Avg Trip Time	9.09 min	Total Accel	20.27%		Above LA-4 Speed	5.26%		100 - <200 mph2/sec	3.64%
	Avg Non-Zero Power	42.66 mph2/s	Total Decel	19.46%		Total Beyond LA-4	9.88%		200 - <300 mph2/sec	0.25%
	Total 1-Sec Obs	484979							>=300 mph2/sec	0.04%

Difference Between Chase Car and Instrumented Driving SAFD (%) in Baltimore

ACCEL BIN (mph/s)	SPEED BIN (mph)																				NET TOTALS	ABS TOTALS	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19			20
-20																						0.000	
-19																							
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NET TOTALS	-5.465	-0.239	0.444	0.104	-0.290	-0.719	-1.091	-0.965	-0.302	1.026	2.016	1.866	2.642	0.932	0.126	-0.085	-0.015	-0.005	0.000	0.000	0.000	0.000	26.024
ABS TOTALS	6.385	1.067	1.232	1.094	0.604	0.857	1.385	1.711	1.910	1.508	2.016	1.866	2.642	1.100	0.532	0.095	0.015	0.005	0.000	0.000	0.000	0.000	26.024

Summary Statistics Differences

Difference in Average Speed 3.71 mph
 Difference in Average Power 9.65 mph²/s

Specific Power Distribution Differences

0 mph²/sec -3.69%
 >0 - <100 mph²/sec 0.85%
 100 - <200 mph²/sec 2.23%
 200 - <300 mph²/sec 0.47%
 >=300 mph²/sec 0.14%
 Total Absolute Difference 7.38%
 High-Power Difference 0.61%

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Difference Between Instrumented Driving SAFD (%) Spokane vs. Baltimore

ACCEL BIN (mph/s)	SPEED BIN (mph)																				NET TOTALS	ABS TOTALS	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19			20
-20																						0.000	
-19																							
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NET TOTALS	-3.235	0.075	0.363	0.331	1.212	4.458	4.862	0.163	-1.815	-1.679	-1.248	-0.908	-2.080	-0.569	-0.216	-0.020	-0.005	0.000	0.000	0.000	0.000	0.000	26.702
ABS TOTALS	3.235	0.269	0.613	0.483	0.399	1.276	4.714	5.490	1.683	1.815	1.679	1.248	0.908	2.080	0.569	0.216	0.020	0.005	0.000	0.000	0.000	0.000	26.702

Summary Statistics Differences

Difference in Average Speed -1.24 mph
Difference in Average Power -5.60 mph²/s

Specific Power Distribution Differences

0 mph²/sec 0.09%
>0 - <100 mph²/sec 0.79%
100 - <200 mph²/sec -0.79%
200 - <300 mph²/sec -0.09%
>=300 mph²/sec 0.00%
Total Absolute Difference 1.76%
High-Power Difference 0.09%

A-41

All Chase Car Freeway & Ramp Driving at LOS A-C SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
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-16																						
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18																						
19																						
20																						
Totals	1.272	1.033	0.509	0.690	0.771	1.310	1.644	2.027	2.245	3.565	8.359	18.557	28.860	19.610	8.283	1.056	0.192	0.017				100.000

Summary Statistics

Avg Speed 55.61 mph
 Avg Segment Dist 4.45 miles
 Avg Segment Time 4.8 min
 Avg Power 32.1 mph2/s
 Total 1-Sec Obs 70856

Modal Region Frequencies

Total Idle 1.27%
 Total Cruise 58.38%
 Total Accel 20.76%
 Total Decel 19.60%

Outside LA-4 Frequencies

Above LA-4 Accel 1.41%
 Below LA-4 Decel 2.18%
 Above LA-4 Speed 58.02%
 Total Beyond LA-4 61.61%

Specific Power Distribution

0 mph2/sec 52.52%
 >0 - <100 mph2/sec 37.42%
 100 - <200 mph2/sec 8.42%
 200 - <300 mph2/sec 1.29%
 >=300 mph2/sec 0.35%

Baltimore Chase Car Freeway & Ramp Driving at LOS A-C SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
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20																						
Totals	0.828	0.523	0.358	0.430	0.506	1.183	1.641	2.071	2.250	4.159	8.779	19.238	31.328	19.821	6.107	0.737	0.040					100.000

Summary Statistics

Avg Speed 56.08 mph
 Avg Segment Dist 4.68 miles
 Avg Segment Time 5.01 min
 Avg Power 35.9 mph2/s
 Total 1-Sec Obs 35154

Modal Region Frequencies

Total Idle 0.83%
 Total Cruise 52.67%
 Total Accel 23.78%
 Total Decel 22.72%

Outside LA-4 Frequencies

Above LA-4 Accel 1.61%
 Below LA-4 Decel 2.19%
 Above LA-4 Speed 58.03%
 Total Beyond LA-4 61.84%

Specific Power Distribution

0 mph2/sec 51.35%
 >0 - <100 mph2/sec 36.22%
 100 - <200 mph2/sec 10.36%
 200 - <300 mph2/sec 1.66%
 >=300 mph2/sec 0.41%

Los Angeles Chase Car Freeway & Ramp Driving at LOS A-C SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																		TOTALS			
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85		90	95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11						0.007																0.007
-10				0.007	0.007	0.007	0.007															0.029
-9					0.007	0.007	0.007	0.007														0.022
-8				0.007	0.022	0.007	0.007	0.007														0.051
-7				0.007	0.037	0.007	0.015	0.022	0.007	0.015												0.139
-6				0.015	0.037	0.037	0.066	0.022	0.037	0.022	0.015											0.286
-5				0.066	0.044	0.066	0.103	0.110	0.066	0.073	0.029	0.022	0.007	0.015								0.601
-4				0.051	0.029	0.044	0.059	0.088	0.073	0.123	0.051	0.044	0.015	0.007	0.022	0.015						0.530
-3				0.132	0.066	0.103	0.110	0.117	0.132	0.095	0.198	0.183	0.117	0.117	0.029	0.044	0.007					1.451
-2				0.198	0.117	0.154	0.095	0.154	0.161	0.154	0.095	0.242	0.396	0.242	0.249	0.147	0.029	0.015				2.462
-1				0.396	0.139	0.161	0.139	0.308	0.212	0.278	0.403	0.462	1.128	2.191	3.136	3.019	1.319	0.249	0.044			13.583
0				2.044	0.901	0.959	0.176	0.227	0.557	0.513	0.703	0.571	1.150	2.989	7.173	15.789	16.426	7.598	1.685	0.315		58.876
1				0.081	0.484	0.088	0.198	0.205	0.315	0.432	0.513	0.586	0.762	1.612	2.682	3.773	2.835	1.150	0.322	0.044		16.082
2				0.117	0.051	0.205	0.271	0.315	0.388	0.366	0.388	0.381	0.322	0.205	0.110	0.066	0.015	0.007				3.209
3				0.015	0.117	0.169	0.161	0.190	0.227	0.139	0.132	0.147	0.103	0.073								1.509
4				0.015	0.095	0.044	0.088	0.095	0.066	0.037	0.037	0.037	0.015	0.007								0.542
5				0.022	0.059	0.037	0.022	0.022	0.022	0.029	0.015											0.300
6				0.059	0.037	0.022	0.022								0.007							0.169
7				0.022	0.007																	0.037
8				0.007																		0.015
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Totals	2.154	2.718	0.982	1.480	1.597	2.352	2.308	2.535	2.579	3.407	6.696	12.638	23.145	22.580	10.133	2.279	0.418					100.000

Summary Statistics

Avg Speed 53.4 mph
 Avg Segment Dist 2.47 miles
 Avg Segment Time 2.77 min
 Avg Power 32.41 mph2/s
 Total 1-Sec Obs 13649

Modal Region Frequencies

Total Idle 2.15%
 Total Cruise 56.83%
 Total Accel 21.75%
 Total Decel 19.26%

Outside LA-4 Frequencies

Above LA-4 Accel 1.90%
 Below LA-4 Decel 3.20%
 Above LA-4 Speed 58.55%
 Total Beyond LA-4 63.65%

Specific Power Distribution

0 mph2/sec 53.55%
 >0 - <100 mph2/sec 36.24%
 100 - <200 mph2/sec 8.49%
 200 - <300 mph2/sec 1.31%
 >=300 mph2/sec 0.43%

Spokane Chase Car Freeway & Ramp Driving at LOS A-C SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
-17																						
-16																						
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20																						
Totals	1.433	0.803	0.458	0.617	0.680	0.866	1.238	1.641	2.031	2.716	8.720	21.135	28.463	17.435	10.606	0.807	0.295	0.054				100.000

Summary Statistics

Avg Speed 56.22 mph
 Avg Segment Dist 7.33 miles
 Avg Segment Time 7.82 min
 Avg Power 25.85 mph2/s
 Total 1-Sec Obs 22053

Modal Region Frequencies

Total Idle 1.43%
 Total Cruise 68.43%
 Total Accel 15.32%
 Total Decel 14.82%

Outside LA-4 Frequencies

Above LA-4 Accel 0.78%
 Below LA-4 Decel 1.53%
 Above LA-4 Speed 57.66%
 Total Beyond LA-4 59.98%

Specific Power Distribution

0 mph2/sec 53.76%
 >0 - <100 mph2/sec 40.07%
 100 - <200 mph2/sec 5.28%
 200 - <300 mph2/sec 0.68%
 >=300 mph2/sec 0.20%

All Chase Car Freeway & Ramp Driving at LOS D SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																	TOTALS				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80		85	90	95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10					0.010																	0.010
-9																						0.010
-8				0.010	0.010																	0.049
-7				0.020	0.020	0.010	0.020	0.010	0.030	0.010	0.010	0.010	0.010	0.010	0.010							0.167
-6				0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.384
-5				0.010	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.512
-4				0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	1.399
-3				0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	3.073
-2				0.433	0.158	0.069	0.059	0.069	0.138	0.207	0.187	0.217	0.384	0.374	0.424	0.404	0.236	0.118	0.010	0.010	0.010	17.396
-1				2.384	0.719	0.325	0.089	0.089	0.305	0.739	0.670	1.487	1.763	4.935	11.791	14.697	11.003	3.369	0.167	0.167	0.167	54.531
0				0.049	0.384	0.236	0.108	0.069	0.207	0.315	0.581	0.719	1.281	2.236	4.413	4.393	3.191	0.778	0.039	0.039	0.039	19.001
1				0.079	0.059	0.079	0.049	0.108	0.069	0.158	0.207	0.305	0.364	0.384	0.345	0.246	0.059	0.059	0.059	0.059	0.059	2.512
2				0.089	0.020	0.059	0.049	0.079	0.059	0.049	0.079	0.059	0.039	0.039	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.581
3				0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.128
4				0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.069
5				0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.059
6				0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.039
7				0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.010
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20																						
Totals	2.443	2.000	1.152	0.670	0.591	1.231	1.980	2.403	3.842	5.102	9.909	20.764	24.340	17.996	5.230	0.345						100.000

Summary Statistics	Avg Speed 52.54 mph	Avg Segment Dist 1.56 miles	Avg Segment Time 1.78 min	Avg Power 31.06 mph2/s	Total 1-Sec Obs 10152
Modal Region Frequencies	Total Idle 2.44%	Total Cruise 52.15%	Total Accel 22.34%	Total Decel 23.07%	
Outside LA-4 Frequencies	Above LA-4 Accel 1.16%	Below LA-4 Decel 3.19%	Above LA-4 Speed 47.91%	Total Beyond LA-4 52.27%	
Specific Power Distribution	0 mph2/sec 54.25%	>0 - <100 mph2/sec 35.52%	100 - <200 mph2/sec 8.80%	200 - <300 mph2/sec 1.12%	>=300 mph2/sec 0.32%

Baltimore Chase Car Freeway & Ramp Driving at LOS D SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																	TOTALS				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80		85	90	95	100
-20																						
-19																						
-18																						
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-11																						
-10																						
-9																						
-8																						
-7																						
-6			0.023																			0.023
-5			0.023																			0.139
-4																						0.501
-3			0.023	0.023																		1.066
-2			0.046	0.046	0.093																	3.730
-1			0.371	0.232	0.070	0.116	0.209	0.348	0.857	1.344	1.877	3.568	4.495	4.796	1.576	0.255					20.227	
0			1.367	0.139	0.417	0.046	0.070	0.162	0.510	0.672	2.317	2.155	4.588	8.758	11.098	12.512	4.147	0.348			49.305	
1			0.070	0.093	0.185	0.070	0.139	0.116	0.255	0.950	1.274	2.363	4.379	5.028	4.935	1.297	0.093				21.270	
2			0.023	0.023	0.070	0.023	0.046	0.139	0.162	0.440	0.510	0.649	0.649	0.533	0.139						3.452	
3			0.023																			0.417
4																						0.046
5																						0.023
6																						0.023
7																						
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20																						
Totals	1.460	0.718	0.950	0.371	0.255	0.626	1.228	1.807	4.680	5.839	10.102	18.188	22.220	23.378	7.461	0.718						100.000

Summary Statistics

Avg Speed 55.22 mph
 Avg Segment Dist 1.84 miles
 Avg Segment Time 2 min
 Avg Power 36.88 mph2/s
 Total 1-Sec Obs 4316

Modal Region Frequencies

Total Idle 1.46%
 Total Cruise 47.94%
 Total Accel 25.12%
 Total Decel 25.49%

Outside LA-4 Frequencies

Above LA-4 Accel 1.39%
 Below LA-4 Decel 2.67%
 Above LA-4 Speed 53.78%
 Total Beyond LA-4 57.83%

Specific Power Distribution

0 mph2/sec 52.03%
 >0 - <100 mph2/sec 34.62%
 100 - <200 mph2/sec 11.08%
 200 - <300 mph2/sec 1.78%
 >=300 mph2/sec 0.51%

Los Angeles Chase Car Freeway & Ramp Driving at LOS D SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
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-10					0.018																	0.018
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Totals																						

Summary Statistics	Avg Speed 50.28 mph	Avg Segment Dist 1.37 miles	Avg Segment Time 1.63 min	Avg Power 27.35 mph2/s	Total 1-Sec Obs 5481
Modal Region Frequencies	Total Idle 3.38%	Total Cruise 53.71%	Total Accel 20.95%	Total Decel 21.97%	
Outside LA-4 Frequencies	Above LA-4 Accel 1.06%	Below LA-4 Decel 3.80%	Above LA-4 Speed 43.79%	Total Beyond LA-4 48.64%	
Specific Power Distribution	0 mph2/sec 56.26%	>0 - <100 mph2/sec 35.38%	100 - <200 mph2/sec 7.52%	200 - <300 mph2/sec 0.68%	>=300 mph2/sec 0.18%

All Chase Car Freeway & Ramp Driving at LOS E SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10					0.014																	0.014
-9																						
-8																						
-7				0.014				0.028														
-6			0.014	0.014	0.055	0.014				0.055	0.014		0.028									0.069
-5			0.042	0.042	0.069	0.069	0.069	0.055	0.028	0.055	0.042	0.042	0.028	0.028								0.194
-4			0.042	0.083	0.125	0.139	0.139	0.069	0.097	0.153	0.097	0.055	0.042	0.042								0.527
-3			0.139	0.180	0.250	0.347	0.416	0.333	0.305	0.250	0.222	0.111	0.111	0.028	0.042	0.028						1.082
-2			0.277	0.305	0.361	0.416	0.485	0.361	0.458	0.347	0.374	0.291	0.430	0.236	0.028	0.014						2.759
-1			0.666	0.374	0.749	1.234	1.359	1.719	0.984	1.068	1.525	1.123	2.011	1.844	0.596	0.069						4.922
0			0.832	1.303	0.957	1.303	2.440	2.884	4.049	2.163	3.245	3.924	3.439	7.196	8.014	2.510	0.347					15.322
1			0.069	0.721	0.666	0.749	1.539	1.844	2.440	1.789	2.399	2.510	2.246	2.995	2.537	0.610	0.083					44.606
2			0.458	0.203	0.458	0.596	0.652	0.763	0.582	0.444	0.513	0.291	0.416	0.222	0.014							23.197
3			0.139	0.180	0.153	0.166	0.222	0.111	0.055	0.069	0.055	0.014	0.069	0.014								5.616
4			0.028	0.028	0.055	0.069	0.055	0.028	0.028	0.014												1.248
5			0.014	0.014	0.014	0.014																0.333
6																						0.069
7			0.014	0.014																		0.028
8			0.014																			0.014
9																						
10																						
11																						
12																						
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14																						
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20																						
Totals	0.915	3.827	3.064	4.285	7.099	8.153	10.469	6.531	8.098	9.290	7.654	13.297	12.965	3.813	0.541							100.000

Summary Statistics	Avg Speed	39.16 mph	Specific Power Distribution	0 mph2/sec	49.70%
	Avg Segment Dist	1.15 miles	>0 - <100 mph2/sec	>0 - <100 mph2/sec	40.70%
	Avg Segment Time	1.77 min	100 - <200 mph2/sec	100 - <200 mph2/sec	8.64%
	Avg Power	31.42 mph2/s	200 - <300 mph2/sec	200 - <300 mph2/sec	0.72%
	Total 1-Sec Obs	7212	>=300 mph2/sec	>=300 mph2/sec	0.25%
Modal Region Frequencies	Total Idle	0.92%	Outside LA-4 Frequencies	Above LA-4 Accel	1.35%
	Total Cruise	43.77%		Below LA-4 Decel	3.77%
	Total Accel	30.42%		Above LA-4 Speed	17.32%
	Total Decel	24.89%		Total Beyond LA-4	22.44%
Outside LA-4 Frequencies					

Los Angeles Chase Car Freeway & Ramp Driving at LOS E SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
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-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10					0.017																	0.017
-9																						
-8																						
-7					0.017																	0.017
-6					0.017	0.069																0.087
-5					0.035	0.035	0.052	0.087	0.069	0.017	0.017											0.226
-4					0.052	0.104	0.139	0.156	0.052	0.087	0.052	0.035	0.035									0.556
-3					0.139	0.226	0.278	0.382	0.434	0.330	0.365	0.313	0.278	0.122	0.087	0.035	0.035					1.111
-2					0.313	0.313	0.347	0.347	0.451	0.486	0.799	0.504	0.347	0.417	0.226	0.295	0.087	0.017				3.021
-1					0.799	0.434	0.868	1.406	1.215	1.650	1.059	0.972	1.597	1.181	1.823	1.563	0.621	0.035				4.619
0					1.042	1.597	1.129	1.597	2.553	2.813	4.237	2.205	2.900	3.924	3.334	7.032	8.022	2.813	0.295			15.124
1					0.069	0.851	0.781	0.886	1.719	1.658	2.223	1.841	2.327	2.744	2.118	2.535	2.327	0.625	0.035			45.494
2					0.521	0.208	0.488	0.712	0.573	0.660	0.608	0.504	0.573	0.208	0.226	0.139	0.017					22.938
3					0.104	0.191	0.139	0.087	0.208	0.087	0.052	0.035	0.035	0.017	0.017							5.435
4					0.035	0.017	0.052	0.052	0.035	0.017	0.035	0.017										0.972
5					0.017	0.017	0.017	0.017														0.278
6																						0.069
7																						0.035
8																						0.017
9																						
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18																						
19																						
20																						
Totals	1,129	4,480	3,480	4,897	7,675	7,901	10,123	6,807	7,710	9,724	7,328	12,068	12,259	4,028	0,382							100,000

Summary Statistics

Avg Speed 38.17 mph
 Avg Segment Dist 1.13 miles
 Avg Segment Time 1.78 min
 Avg Power 29.61 mph2/s
 Total 1-Sec Obs 5759

Modal Region Frequencies

Total Idle 1.13%
 Total Cruise 44.45%
 Total Accel 29.66%
 Total Decel 24.76%

Outside LA-4 Frequencies

Above LA-4 Accel 0.92%
 Below LA-4 Decel 3.87%
 Above LA-4 Speed 16.67%
 Total Beyond LA-4 21.46%

Specific Power Distribution

0 mph2/sec 50.43%
 >0 - <100 mph2/sec 41.00%
 100 - <200 mph2/sec 7.90%
 200 - <300 mph2/sec 0.50%
 >=300 mph2/sec 0.17%

All Chase Car Freeway & Ramp Driving at LOS F SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																		TOTALS			
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85		90	95	100
-20																						
-19																						
-18																						
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Totals	3.426	12.316	10.930	13.241	14.347	13.175	9.840	7.165	4.872	3.558	3.063	1.899	1.610	0.710	0.050							100.000

Summary Statistics

Avg Speed 22.69 mph
 Avg Segment Dist 1.91 miles
 Avg Segment Time 5.05 min
 Avg Power 24.22 mph2/s
 Total 1-Sec Obs 12114

Modal Region Frequencies

Total Idle 3.43%
 Total Cruise 35.47%
 Total Accel 35.08%
 Total Decel 26.03%

Outside LA-4 Frequencies

Above LA-4 Accel 1.31%
 Below LA-4 Decel 2.22%
 Above LA-4 Speed 2.37%
 Total Beyond LA-4 5.90%

Specific Power Distribution

0 mph2/sec 46.59%
 >0 - <100 mph2/sec 47.79%
 100 - <200 mph2/sec 5.17%
 200 - <300 mph2/sec 0.39%
 >=300 mph2/sec 0.07%

Los Angeles Chase Car Freeway & Ramp Driving at LOS F SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
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-15																						
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-13																						
-12																						
-11																						
-10																						
-9																						
-8				0.011																		
-7			0.021	0.011	0.011	0.021	0.011	0.011	0.011													
-6		0.021	0.021	0.043	0.032	0.011	0.011	0.011	0.011	0.011												0.043
-5			0.107	0.096	0.107	0.075	0.075	0.043	0.032	0.011	0.011											0.064
-4		0.043	0.192	0.192	0.139	0.096	0.149	0.053	0.053	0.032	0.011	0.011										0.555
-3		0.267	0.395	0.288	0.470	0.267	0.213	0.096	0.032	0.064												0.371
-2		0.726	0.673	0.683	0.811	0.811	0.619	0.310	0.203	0.171	0.085	0.064	0.032									2.092
-1		2.028	1.857	2.541	2.562	2.327	1.751	1.377	0.651	0.352	0.192	0.096	0.075	0.075								5.188
0	1.644	4.996	3.096	4.601	4.772	5.732	3.854	2.914	2.146	1.569	1.014	0.673	0.235	0.235	0.235							16.204
1	0.117	3.010	2.146	3.138	3.651	3.256	3.010	2.295	1.612	1.281	0.907	0.448	0.213	0.085	0.085							38.813
2	0.011	1.003	1.046	1.238	1.366	1.238	0.986	0.416	0.256	0.181	0.107	0.053										25.171
3		0.395	0.427	0.470	0.299	0.246	0.107	0.064	0.021	0.011				0.011								7.603
4		0.213	0.192	0.096	0.096	0.032	0.011															2.050
5		0.085	0.011	0.043		0.021																0.651
6		0.011	0.021		0.011																	0.160
7		0.021	0.011																			0.043
8																						
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19																						
20																						
Totals	1.772	12.820	10.205	13.461	14.325	14.133	10.717	7.590	5.006	3.672	3.096	1.783	1.014	0.406								100.000

Summary Statistics

Avg Speed 22.87 mph
 Avg Segment Dist 1.86 miles
 Avg Segment Time 4.88 min
 Avg Power 23.53 mph2/s
 Total 1-Sec Obs 9368

Modal Region Frequencies

Total Idle 1.77%
 Total Cruise 37.17%
 Total Accel 35.79%
 Total Decel 25.27%

Outside LA-4 Frequencies

Above LA-4 Accel 1.09%
 Below LA-4 Decel 2.20%
 Above LA-4 Speed 1.42%
 Total Beyond LA-4 4.71%

Specific Power Distribution

0 mph2/sec 44.93%
 >0 - <100 mph2/sec 50.34%
 100 - <200 mph2/sec 4.51%
 200 - <300 mph2/sec 0.19%
 >=300 mph2/sec 0.04%

All Chase Car Freeway & Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
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Totals	1.825	2.694	2.016	2.462	2.846	3.226	3.302	3.009	3.121	4.131	7.826	16.391	23.970	16.029	6.424	0.780	0.136	0.012				100.000

Summary Statistics

Avg Speed 50.14 mph
 Avg Segment Dist 6.99 miles
 Avg Segment Time 8.36 min
 Avg Power 31.08 mph2/s
 Total 1-Sec Obs 100334

Modal Region Frequencies

Total Idle 1.63%
 Total Cruise 53.93%
 Total Accel 23.34%
 Total Decel 21.10%

Outside LA-4 Frequencies

Above LA-4 Accel 1.37%
 Below LA-4 Decel 2.40%
 Above LA-4 Speed 47.35%
 Total Beyond LA-4 51.12%

Specific Power Distribution

0 mph2/sec 51.66%
 >0 - <100 mph2/sec 38.80%
 100 - <200 mph2/sec 8.11%
 200 - <300 mph2/sec 1.13%
 >=300 mph2/sec 0.31%

Baltimore Chase Car Freeway & Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
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20																						
Totals																						

Summary Statistics

Avg Speed 53.5 mph
 Avg Segment Dist 6.72 miles
 Avg Segment Time 7.53 min
 Avg Power 35.62 mph2/s
 Total 1-Sec Obs 43391

Modal Region Frequencies

Total Idle 1.39%
 Total Cruise 50.35%
 Total Accel 24.77%
 Total Decel 23.49%

Outside LA-4 Frequencies

Above LA-4 Accel 1.67%
 Below LA-4 Decel 2.30%
 Above LA-4 Speed 53.39%
 Total Beyond LA-4 57.35%

Specific Power Distribution

0 mph2/sec 51.28%
 >0 - <100 mph2/sec 36.31%
 100 - <200 mph2/sec 10.36%
 200 - <300 mph2/sec 1.64%
 >=300 mph2/sec 0.41%

Los Angeles Chase Car Freeway & Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
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20																						
Totals																						

Summary Statistics

Avg Speed 41.99 mph
 Avg Segment Dist 6.77 miles
 Avg Segment Time 9.68 min
 Avg Power 28.85 mph2/s
 Total 1-Sec Obs 34257

Modal Region Frequencies

Total Idle 2.07%
 Total Cruise 48.88%
 Total Accel 26.79%
 Total Decel 22.26%

Outside LA-4 Frequencies

Above LA-4 Accel 1.38%
 Below LA-4 Decel 3.14%
 Above LA-4 Speed 33.53%
 Total Beyond LA-4 38.04%

Specific Power Distribution

0 mph2/sec 50.88%
 >0 - <100 mph2/sec 40.92%
 100 - <200 mph2/sec 7.19%
 200 - <300 mph2/sec 0.77%
 >=300 mph2/sec 0.24%

All Chase Car Non-Freeway & Non-Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
-18																						
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20																						
Totals	18.619	10.232	7.055	7.451	7.125	8.195	10.565	10.940	7.391	4.318	3.393	3.005	1.484	0.203	0.021	0.003						100.000

Summary Statistics

Avg Speed 21.92 mph
 Avg Segment Dist 3.19 miles
 Avg Segment Time 8.74 min
 Avg Power 21.67 mph2/s
 Total 1-Sec Obs 423530

Modal Region Frequencies

Total Idle 18.62%
 Total Cruise 31.24%
 Total Accel 26.78%
 Total Decel 23.37%

Outside LA-4 Frequencies

Above LA-4 Accel 2.35%
 Below LA-4 Decel 3.67%
 Above LA-4 Speed 1.71%
 Total Beyond LA-4 7.73%

Specific Power Distribution

0 mph2/sec 58.59%
 >0 - <100 mph2/sec 35.74%
 100 - <200 mph2/sec 5.20%
 200 - <300 mph2/sec 0.38%
 >=300 mph2/sec 0.09%

Baltimore Chase Car Non-Freeway & Non-Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																	TOTALS				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80		85	90	95	100
-20																						
-19																						
-18																						
-17																						
-16																						
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Totals	19.563	10.289	7.335	7.573	7.327	8.134	9.294	9.081	6.801	5.583	4.658	2.827	1.317	0.180	0.034	0.005						100.000

Summary Statistics

Avg Speed 21.76 mph
 Avg Segment Dist 2.9 miles
 Avg Segment Time 8 min
 Avg Power 22.89 mph2/s
 Total 1-Sec Obs 169527

Modal Region Frequencies

Total Idle 19.56%
 Total Cruise 28.26%
 Total Accel 27.50%
 Total Decel 24.68%

Outside LA-4 Frequencies

Above LA-4 Accel 2.39%
 Below LA-4 Decel 3.75%
 Above LA-4 Speed 1.54%
 Total Beyond LA-4 7.68%

Specific Power Distribution

0 mph2/sec 57.80%
 >0 - <100 mph2/sec 35.94%
 100 - <200 mph2/sec 5.60%
 200 - <300 mph2/sec 0.54%
 >=300 mph2/sec 0.12%

Los Angeles Chase Car Non-Freeway & Non-Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																	TOTALS				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80		85	90	95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						0.001
-14																						0.001
-13																						
-12																						
-11																						0.003
-10																						0.003
-9																						0.009
-8																						0.023
-7																						0.082
-6																						0.248
-5																						0.689
-4																						1.723
-3																						2.080
-2																						3.862
-1																						5.324
0																						10.382
1																						45.180
2																						15.503
3																						7.106
4																						4.699
5																						1.828
6																						0.879
7																						0.282
8																						0.161
9																						0.025
10																						0.005
11																						0.003
12																						
13																						
14																						
15																						
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17																						
18																						
19																						
20																						
Totals	20.313	11.904	7.178	7.834	7.638	8.703	10.743	10.766	8.531	4.527	1.536	0.190	0.136	0.001								100.000

Summary Statistics

Avg Speed 19.34 mph
 Avg Segment Dist 2.57 miles
 Avg Segment Time 7.98 min
 Avg Power 23.54 mph²/s
 Total 1-Sec Obs 76652

Modal Region Frequencies

Total Idle 20.31%
 Total Cruise 25.62%
 Total Accel 29.64%
 Total Decel 24.43%

Outside LA-4 Frequencies

Above LA-4 Accel 3.14%
 Below LA-4 Decel 5.22%
 Above LA-4 Speed 0.14%
 Total Beyond LA-4 8.49%

Specific Power Distribution

0 mph²/sec 58.14%
 >0 - <100 mph²/sec 34.86%
 100 - <200 mph²/sec 6.58%
 200 - <300 mph²/sec 0.33%
 >=300 mph²/sec 0.09%

Spokane Chase Car Non-Freeway & Non-Ramp Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																	TOTALS				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80		85	90	95	100
-20																						
-19																						
-18																						
-17																						
-16																						
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19																						
20																						
Totals	16.985	9.455	6.734	7.169	6.710	8.035	11.703	12.793	7.461	3.019	2.987	4.391	2.227	0.312	0.017	0.003						100.000

Summary Statistics

Avg Speed 23.19 mph
 Avg Segment Dist 3.89 miles
 Avg Segment Time 10.05 min
 Avg Power 19.71 mph2/s
 Total 1-Sec Obs 177351

Modal Region Frequencies

Total Idle 16.99%
 Total Cruise 36.51%
 Total Accel 24.86%
 Total Decel 21.65%

Outside LA-4 Frequencies

Above LA-4 Accel 1.97%
 Below LA-4 Decel 2.92%
 Above LA-4 Speed 2.56%
 Total Beyond LA-4 7.45%

Specific Power Distribution

0 mph2/sec 59.54%
 >0 - <100 mph2/sec 35.93%
 100 - <200 mph2/sec 4.22%
 200 - <300 mph2/sec 0.24%
 >=300 mph2/sec 0.06%

Non-Freeway/Ramp Driving Los Angeles vs. Baltimore Difference SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)															NET TOTALS	ABS TOTALS		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14			15	16
-15					-0.001	0.000												-0.002	0.002
-14			0.001	-0.001	-0.001													-0.002	0.004
-13		-0.001		-0.001		-0.001												-0.003	0.003
-12			0.000	-0.001	0.001													-0.001	0.003
-11			-0.001	-0.001	0.000	0.001												-0.003	0.005
-10			0.001	-0.002	0.005	0.000	0.001	-0.001										0.003	0.011
-9			-0.002	0.005	-0.001	0.000	-0.001	0.003	0.002	-0.001								0.005	0.015
-8			0.009	0.013	0.014	0.001	0.003	0.003	0.003	0.000								0.039	0.047
-7			-0.001	0.028	0.047	0.036	0.023	0.015	0.014	0.005	-0.002	-0.001						0.163	0.173
-6			0.009	0.079	0.108	0.074	0.066	0.035	0.009	0.000	0.000	-0.001						0.387	0.391
-5			0.028	0.158	0.172	0.193	0.179	0.108	0.054	0.001	0.005	-0.004	0.001					0.895	0.903
-4			0.011	0.088	0.100	0.049	0.079	0.104	0.036	-0.001	-0.025	-0.011	-0.002	-0.001				0.316	0.398
-3			0.001	0.058	0.040	0.019	0.088	0.098	0.146	0.163	0.018	-0.033	-0.029	-0.005	-0.006			0.553	0.707
-2			-0.002	0.029	-0.094	-0.054	-0.098	-0.025	-0.031	0.085	-0.004	-0.126	-0.135	-0.083	-0.033			-0.579	0.807
-1			0.028	0.095	-0.158	-0.164	-0.162	-0.206	0.009	0.036	0.160	-0.354	-0.589	-0.477	-0.174	-0.031	-0.008	-2.052	2.652
0			1.141	0.037	-0.235	-0.213	-0.355	-0.382	0.293	0.857	1.508	0.129	-1.609	-1.540	-0.808	-0.111	-0.013	-1.505	9.035
1			-0.012	0.429	-0.215	-0.145	-0.101	0.106	0.330	0.566	0.169	-0.457	-0.610	-0.436	-0.143	-0.026	-0.008	-0.554	3.754
2			-0.062	-0.005	-0.271	-0.041	0.041	0.404	0.405	0.088	-0.100	-0.155	-0.118	-0.079	-0.011	-0.003	-0.001	-0.278	1.970
3			-0.121	0.207	0.085	0.372	0.318	0.231	0.037	-0.015	-0.024	-0.031	-0.015	-0.009	-0.004	-0.001		1.028	1.471
4			-0.080	0.211	0.114	0.069	0.015	-0.016	-0.012	-0.008	-0.008	-0.001	-0.001	-0.002	-0.002			0.276	0.542
5			-0.050	0.330	0.167	0.058	0.013	0.007	0.003	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001			0.522	0.634
6			-0.012	0.141	0.051	0.012	0.004	0.002	0.001	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001			0.194	0.228
7			-0.008	0.030	0.014	-0.001	-0.002	0.003	0.001	0.001								0.037	0.061
8			-0.010	0.009	0.003				0.003									0.005	0.025
9			-0.004	0.001	0.000				-0.001									-0.005	0.007
10			-0.002	-0.001	0.001													-0.002	0.004
11			-0.001															-0.001	0.001
12			-0.001															-0.001	0.001
13																			
14																			
15																			
NET																			0.001
TOTALS	0.746	1.615	-0.157	0.265	0.311	0.569	1.449	1.685	1.730	-1.059	-3.126	-2.636	-1.181	-0.180	-0.034	-0.006		0.000	
ABS	1.536	1.635	1.793	1.507	1.761	1.831	1.541	1.745	2.014	1.327	3.126	2.638	1.181	0.180	0.034	0.006			23.855

Summary Statistics Differences

Difference in Average Speed -2.42 mph
 Difference in Average Power 0.65 mph²/s

Specific Power Distribution Differences

0 mph²/sec 0.35%
 >0 - <100 mph²/sec -1.09%
 100 - <200 mph²/sec 0.99%
 200 - <300 mph²/sec -0.22%
 >=300 mph²/sec -0.03%
 Total Absolute Difference 2.66%
 High-Power Difference 0.25%

Appendix B

Travel Mix Adjustments for Area-Wide Cycle

Weighting Factors to Derive Non-Freeway Instrumented Driving

	<u>Baltimore</u>	<u>Spokane</u>	<u>Los Angeles</u>	<u>Atlanta</u>
Chase Car Short Trip "Bump Up" factor	6.21	3.49	3.85	5.50
Initial Travel Fractions (% time)				
Non-Freeway/Ramp	20.38%	11.34%	30.89%	19.15%
Freeway/Ramp	79.62%	88.66%	69.11%	80.85%
Adjusted Travel Fractions (% time)				
Freeway/Ramp LOS A-C	15.56%	10.20%	11.68%	-
Freeway/Ramp LOS D	1.91%	0.16%	4.69%	-
Freeway/Ramp LOS E	0.52%	0.13%	4.93%	-
Freeway/Ramp LOS F	1.22%	0.00%	8.02%	-
Freeway/Ramp Total	19.21%	10.50%	29.32%	-
Non-Freeway/Ramp Total	80.79%	89.50%	70.68%	-

Short Trip (< 5min) Percentages

<u>Driving Database</u>	<u>Short Trip % Time</u>
Baltimore Instrumented	6.86
Baltimore Chase Car	1.17
Spokane Instrumented	10.42
Spokane Chase Car	3.23
Atlanta Instrumented	6.13
Los Angeles Chase Car	1.88

Unadjusted Freeway/Ramp Travel Fractions (% time)

	<u>Baltimore</u>	<u>Spokane</u>	<u>Los Angeles</u>	<u>Combined</u>
<u>Freeway/Ramp Total</u>	20.38	11.34	30.89	19.15
Freeway/Ramp LOS A	27.14	41.74	4.60	22.74
Freeway/Ramp LOS B	31.83	30.80	10.47	24.30
Freeway/Ramp LOS C	22.06	24.67	24.78	23.58
Freeway/Ramp LOS A-C	81.02	97.21	39.84	70.62
Freeway/Ramp LOS D	9.95	1.57	16.00	10.12
Freeway/Ramp LOS E	2.71	1.23	16.81	7.19
Freeway/Ramp LOS F	6.33	-	27.35	12.07

<u>Non-Freeway/Ramp Total</u>	79.62	88.66	69.11	80.85
Non-Freeway/Ramp LOS A	56.59	65.12	45.58	58.17
Non-Freeway/Ramp LOS B	21.55	21.13	23.74	21.77
Non-Freeway/Ramp LOS C	13.59	10.58	17.63	13.06
Non-Freeway/Ramp LOS D	5.99	2.63	8.80	5.09
Non-Freeway/Ramp LOS E	1.98	0.33	3.33	1.53
Non-Freeway/Ramp LOS F	0.29	0.21	0.92	0.37
Freeway Only Total	16.91	9.79	25.77	
Ramp Only Total	3.47	1.55	5.11	

Short Trip-Adjusted Travel Fractions

	<u>Baltimore</u>	<u>Spokane</u>	<u>Los Angeles</u>	<u>Atlanta</u>
Instrumented Vehicle short trip % time (IVshort)	6.86	10.42	6.86	6.13
Chase Car short trip % time (CCshort)	1.17	3.23	1.88	1.17
Raw % time on freeway/ramp (Fraw)	20.38	11.34	30.89	-
Raw % time on non-freeway/ramp (NFraw)	79.62	88.66	69.11	-
Chase Car short trip "bump up" factor (BF)	6.21	3.49	3.85	5.50
Adjusted % time on freeway/ramp (Fadj)	19.21	10.50	29.32	-
Adjusted % time on non-freeway/ramp (NFadj)	80.79	89.50	70.68	-
Adjusted % time on freeways only total	15.93	9.06	24.46	-
Adjusted % time on freeways only LOS AC (bag 1)	12.91	8.81	9.75	-
Adjusted % time on freeways only LOS D (bag 2)	1.58	0.14	3.91	-
Adjusted % time on freeways only LOS E (bag 3)	0.43	0.11	4.11	-
Adjusted % time on freeways only LOS F (bag 4)	1.01	-	6.69	-
Adjusted % time on ramps only total (bag 5)	3.27	1.44	4.85	-
Adjusted % time on non-freeways/ramps (bag 6)	80.79	89.50	70.68	-

Short Trip Adjustment Procedure

Variable Definitions

- FWYinit = % time driving on freeway/ramp (from chase car data)
 NonFWYinit = % time driving on non-freeway/ramp facilities (also from chase car data)
 SHORTcc = % time driving short trips from chase car data (5 minutes or less)
 SHORTiv = % time driving short trips from instrumented data

Approach

The basic idea involves adjusting the initial freeway/ramp and non-freeway/ramp travel mix, which is based on chase car data, to contain the fraction of short (5 minutes or less) trips found in instrumented vehicle driving.

By assumption, short trips occur exclusively over non-freeway/ramp facilities. The following equation can then be applied to identify the “bump-up” factor needed to bring short trips in the chase car data in line with the instrumented vehicle short trip fraction:

$$\frac{SHORTcc \times BF}{SHORTcc \times BF + (NonFWYinit - SHORTcc) + FWYinit} \times 100 = SHORTiv$$

Solving for BF, the multiplicative bump-up factor, and simplifying yields:

$$BF = \frac{SHORTiv \times (1 - SHORTcc/100)}{SHORTcc \times (1 - SHORTiv/100)}$$

The adjusted freeway/ramp and non-freeway ramp fractions are then computed from the following equations:

$$FWYadj = \frac{FWYinit}{SHORTcc \times (BF - 1) + 100} \times 100$$

$$NonFWYadj = 100 - FWYadj$$

Appendix C

Facility-Specific and Non-Freeway Area-Wide Cycle Statistical Comparisons

Edited Freeway LOS E Driving Cycle SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10																						
-9																						
-8					0.219	0.219																0.439
-7					0.219	0.219																0.439
-6					0.439	0.219	0.219															1.316
-5					0.439	0.219	0.219	0.219														0.439
-4					0.439	0.658	0.877	0.658	0.219	0.219	0.219	0.439	0.439	0.219	0.219							3.947
-3					0.219	1.096	0.219	0.219	0.219	0.219	0.658	0.219	0.439	0.439	0.219	0.219						3.728
-2					0.658	0.877	0.439	1.535	1.754	2.183	2.183	0.439	1.096	1.096	1.096							14.035
-1					1.754	1.974	2.632	4.603	6.140	5.263	4.187	3.728	3.289	3.289	0.877							45.175
0	0.877	1.096	1.316	1.096	1.974	3.070	3.509	2.632	2.412	1.096	0.877	1.316	1.096									21.711
1	0.219	0.219	0.877	1.316	2.193	2.193	0.658	0.219	0.439	0.219	0.219											6.579
2					0.219	0.439	0.877															1.535
3																						0.219
4																						0.439
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						
16																						
17																						
18																						
19																						
20																						
Totals	1.096	4.825	6.798	8.772	12.061	12.719	12.500	10.307	7.237	6.140	4.605	6.579	5.482	0.877								100.000

Cycle Summary Statistics

Avg Speed (mph)	30.50	Avg PKE (miles/hr ²)	2884.45
Max Speed (mph)	63.00	Avg Total Specific Power (mph ² /sec)	24.44
Avg Non-Idle Speed (mph)	30.84	Avg Non-Zero Specific Power (mph ² /sec)	56.00
Avg Cruise Speed (mph)	32.40	Max Specific Power (mph ² /sec)	231.20
Avg Acceleration (mph/sec)	1.07	Spec Pwr Freq (%): 0 mph ² /sec	56.360
Max Acceleration (mph/sec)	5.30	Spec Pwr Freq (%): >0-100 mph ² /sec	39.474
Avg Deceleration (mph/sec)	-1.30	Spec Pwr Freq (%): >100-200 mph ² /sec	3.728
Max Deceleration (mph/sec)	-8.10	Spec Pwr Freq (%): >200-300 mph ² /sec	0.439
		Spec Pwr Freq (%): >300 mph ² /sec	0.000
Time at Idle (%)	1.097		
Time in Cruise (%)	77.632		
Time in Accel (%)	9.868		
Time in Decel (%)	11.404		
Cycle Length (miles)	3.863		
Cycle Time (min)	7.600		
# Stops per Mile	0.518		
# of 1-sec Observations	456		

Target 3-City Chase Car LOS G Freeway Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10																						
-9																						
-8																						
-7				0.025																		0.074
-6																						
-5																						
-4																						
-3																						
-2																						
-1																						
0																						
1																						
2																						
3																						
4																						
5																						
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13																						
14																						
15																						
16																						
17																						
18																						
19																						
20																						
Totals	3.334	26.158	20.544	16.156	13.337	9.439	4.560	3.751	2.255	0.270	0.196											100.000

Target Driving Population Summary Statistics

Avg Speed (mph)	14.39	Avg PKE (miles/h ²)	3.334	Avg PKE (miles/h ²)	3187.39
Max Speed (mph)	49.10	Avg Total Specific Power (mph ² /sec)	83.746	Avg Total Specific Power (mph ² /sec)	12.74
Avg Non-Idle Speed (mph)	14.89	Avg Non-Zero Specific Power (mph ² /sec)	6.497	Avg Non-Zero Specific Power (mph ² /sec)	25.54
Avg Cruise Speed (mph)	14.82	Max Specific Power (mph ² /sec)	6.423	Max Specific Power (mph ² /sec)	389.84
Avg Acceleration (mph/sec)	0.83	Spec Pwr Freq (%): 0 mph ² /sec	0.741	Spec Pwr Freq (%): 0 mph ² /sec	50.110
Max Acceleration (mph/sec)	5.70	Spec Pwr Freq (%): >0-100 mph ² /sec	3.090	Spec Pwr Freq (%): >0-100 mph ² /sec	48.909
Avg Deceleration (mph/sec)	-0.89	Spec Pwr Freq (%): >100-200 mph ² /sec	1.533	Spec Pwr Freq (%): >100-200 mph ² /sec	0.883
Max Deceleration (mph/sec)	-6.90	Spec Pwr Freq (%): >200-300 mph ² /sec	4079	Spec Pwr Freq (%): >200-300 mph ² /sec	0.074
		Spec Pwr Freq (%): >300 mph ² /sec		Spec Pwr Freq (%): >300 mph ² /sec	0.025
		Time at Idle (%)		Time at Idle (%)	
		Time in Accel (%)		Time in Accel (%)	
		Time in Decel (%)		Time in Decel (%)	
		Avg Trip or Segment Length (miles)		Avg Trip or Segment Length (miles)	
		Avg Trip or Segment Time (min)		Avg Trip or Segment Time (min)	
		# Stops per Mile		# Stops per Mile	
		# of 1-Sec Observations		# of 1-Sec Observations	

Edited Arterial LOS A-B Driving Cycle SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10																						
-9																						
-8																						
-7																						
-6																						
-5																						
-4																						
-3																						
-2																						
-1																						
0																						
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16																						
17																						
18																						
19																						
20																						
Totals	14.925	7.870	5.699	6.784	7.056	8.548	11.669	13.840	9.362	4.749	4.071	3.864	1.764									100.000

Cycle Summary Statistics

Avg Speed (mph)	24.75	14.925	Avg PKE (miles/hr ²)	3342.93
Max Speed (mph)	58.90	59.837	Avg Total Specific Power (mph ² /sec)	22.99
Avg Non-Idle Speed (mph)	29.10	11.533	Avg Non-Zero Specific Power (mph ² /sec)	55.00
Avg Cruise Speed (mph)	32.95	13.704	Max Specific Power (mph ² /sec)	200.07
Avg Acceleration (mph/sec)	1.25	5.068	Spec Pwr Freq (%): 0 mph ² /sec	56.209
Max Acceleration (mph/sec)	5.00	12.283	Spec Pwr Freq (%): >0-100 mph ² /sec	36.228
Avg Deceleration (mph/sec)	-1.54	0.789	Spec Pwr Freq (%): >100-200 mph ² /sec	5.427
Max Deceleration (mph/sec)	-6.60	737	Spec Pwr Freq (%): >200-300 mph ² /sec	0.136
			Spec Pwr Freq (%): >300 mph ² /sec	0.000
Time at Idle (%)		14.925		
Time at Cruise (%)		59.837		
Time in Accel (%)		11.533		
Time in Decel (%)		13.704		
Cycle Length (miles)		5.068		
Cycle Time (min)		12.283		
# Stops per Mile		0.789		
# of 1-sec Observations		737		

Target 3-City Chase Car LOS A-B Arterial Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
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-9																						
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-7																						
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-2																						
-1																						
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17																						
18																						
19																						
20																						
Totals	15.142	8.514	5.791	6.353	6.238	7.756	11.302	12.934	9.252	5.617	4.399	4.183	2.173	0.313	0.027	0.005						100.000

Target Driving Population Summary Statistics

Avg Speed (mph)	25.17	15.142	Avg PKE (miles/hr ²)	3319.39
Max Speed (mph)	74.90	60.725	Avg Total Specific Power (mph ² /sec)	23.21
Avg Non-Idle Speed (mph)	29.66	11.961	Avg Non-Zero Specific Power (mph ² /sec)	55.25
Avg Cruise Speed (mph)	33.32	12.272	Max Specific Power (mph ² /sec)	913.43
Avg Acceleration (mph/sec)	1.23	1.801	Spec Pwr Freq (%): 0 mph ² /sec	57.998
Max Acceleration (mph/sec)	14.86	4.292	Spec Pwr Freq (%): >0-100 mph ² /sec	35.545
Avg Deceleration (mph/sec)	-1.41	1.287	Spec Pwr Freq (%): >100-200 mph ² /sec	5.925
Max Deceleration (mph/sec)	-15.42	271701	Spec Pwr Freq (%): >200-300 mph ² /sec	0.434
			Spec Pwr Freq (%): >300 mph ² /sec	0.098

Edited Arterial LOS C-D Driving Cycle SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)											TOTALS										
	0	5	10	15	20	25	30	35	40	45	50		55	60	65	70	75	80	85	90	95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
-12																						
-11																						
-10																						
-9																						
-8				0.159																		0.159
-7				0.159																		0.159
-6				0.159	0.159	0.477	0.159															0.318
-5				0.318	0.477	0.477	0.159	0.318														1.113
-4				0.477	0.477	0.477	0.636	0.477	0.159	0.159												2.067
-3				1.113	0.477	0.477	0.795	1.113	0.795	1.113	0.636	0.477										3.498
-2				1.113	0.318	0.795	1.113	1.431	2.226	2.067	0.954	0.636	0.159									6.995
-1				1.590	0.954	1.431	1.749	2.862	4.610	5.246	3.180	1.590	0.954									12.083
0				20.350	3.389	0.954	1.431	1.749	1.908	2.703	2.067	1.749	0.954	0.318								46.264
1				0.636	0.795	1.113	1.749	1.908	2.703	2.067	1.749	0.954	0.318									14.785
2				0.159	0.954	0.636	0.954	1.431	0.954	0.954	0.636	0.159										6.836
3				0.477	0.636	0.636	0.795	0.795	0.636	0.318												3.657
4				0.159	0.636	0.318	0.159	0.159														1.272
5				0.318	0.159	0.159	0.318															0.795
6				0.159																		0.159
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						
16																						
17																						
18																						
19																						
20																						
Totals	21.304	10.334	5.564	7.154	10.016	9.857	12.560	11.447	6.677	3.657	1.431											100.000

Cycle Summary Statistics

Avg Speed (mph)	19.23	21.304	Avg PKE (miles/hr ²)	4053.69
Max Speed (mph)	49.50	52.146	Avg Total Specific Power (mph ² /sec)	21.66
Avg Non-Idle Speed (mph)	24.44	12.401	Avg Non-Zero Specific Power (mph ² /sec)	58.97
Avg Cruise Speed (mph)	27.12	14.149	Max Specific Power (mph ² /sec)	204.91
Avg Acceleration (mph/sec)	1.45	3.361	Spec Pwr Freq (%): 0 mph ² /sec	63.275
Avg Deceleration (mph/sec)	5.70	10.483	Spec Pwr Freq (%): >0-100 mph ² /sec	30.525
Max Acceleration (mph/sec)	-1.60	2.083	Spec Pwr Freq (%): >100-200 mph ² /sec	5.882
Max Deceleration (mph/sec)	-7.70	629	Spec Pwr Freq (%): >200-300 mph ² /sec	0.318
			Spec Pwr Freq (%): >300 mph ² /sec	0.000
Time at Idle (%)				
Time at Cruise (%)				
Time in Accel (%)				
Time in Decel (%)				
Cycle Length (miles)				
Cycle Time (min)				
# Stops per Mile				
# of 1-sec Observations				

Target 3-City Chase Car LOS C-D Arterial Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
-17																						
-16																						
-15																						
-14																						
-13																						
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18																						
19																						
20																						
Totals	21.136	12.031	6.242	7.543	8.481	9.750	12.013	10.773	6.383	2.899	1.777	0.730	0.203	0.009	0.018							100.000

Target Driving Population Summary Statistics

Avg Speed (mph)	18.90	Time at Idle (%)	21.136	Avg PKE (miles/hr ²)	4191.29
Max Speed (mph)	71.29	Time at Cruise (%)	53.208	Avg Total Specific Power (mph ² /sec)	22.01
Avg Non-Idle Speed (mph)	23.97	Time in Accel (%)	13.373	Avg Non-Zero Specific Power (mph ² /sec)	52.87
Avg Cruise Speed (mph)	26.49	Time in Decel (%)	12.282	Max Specific Power (mph ² /sec)	853.63
Avg Acceleration (mph/sec)	1.32	Avg Trip or Segment Length (miles)	0.800	Spec Pwr Freq (%): 0 mph ² /sec	58.379
Max Acceleration (mph/sec)	10.41	Avg Trip or Segment Time (min)	2.539	Spec Pwr Freq (%): >0-100 mph ² /sec	35.437
Avg Deceleration (mph/sec)	-1.43	# Stops per Mile	1.869	Spec Pwr Freq (%): >100-200 mph ² /sec	5.660
Max Deceleration (mph/sec)	-13.80	# of 1-sec Observations	75710	Spec Pwr Freq (%): >200-300 mph ² /sec	0.421
				Spec Pwr Freq (%): >300 mph ² /sec	0.103

Edited Arterial LOS E-F Driving Cycle SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
-19																						
-18																						
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-16																						
-15																						
-14																						
-13																						
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-9																						
-8																						
-7																						
-6		0.198		0.198	0.397		0.198				0.198											0.397
-5			0.198	0.198	0.397	0.595					0.198											0.794
-4			0.595	0.595	0.595	0.397	0.595				0.397	0.198										1.389
-3			2.183	1.190	0.397	0.595	0.397	0.397	0.198	0.198												3.373
-2			3.373	1.587	0.992	1.389	1.190	0.595	0.794	0.397												6.151
-1			5.357	1.984	1.786	1.587	2.183	2.579	1.786	0.595												10.714
0	31.746																					49.603
1	0.794	2.381	1.190	1.786	1.389	2.183	1.786	1.190	0.397													13.095
2	0.198	1.786	1.389	0.992	1.389	1.389	1.190	0.397														8.730
3	0.198	0.992	0.992	0.595	0.397	0.198	0.198															3.770
4		0.595	0.198	0.198	0.198																	1.190
5		0.595																				0.595
6			0.198																			0.198
7																						
8																						
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Totals	32.937	18.056	9.722	8.135	7.540	8.532	8.333	4.960	1.786													100.000

Cycle Summary Statistics

Avg Speed (mph)	11.56	Avg PKE (miles/hr ²)	5242.21
Max Speed (mph)	39.90	Avg Total Specific Power (mph ² /sec)	16.83
Avg Non-Idle Speed (mph)	17.23	Avg Non-Zero Specific Power (mph ² /sec)	46.35
Avg Cruise Speed (mph)	18.12	Max Specific Power (mph ² /sec)	187.65
Avg Acceleration (mph/sec)	1.48	Spec Pwr Freq (%): 0 mph ² /sec	63.691
Max Acceleration (mph/sec)	5.80	Spec Pwr Freq (%): >0-100 mph ² /sec	32.341
Avg Deceleration (mph/sec)	-1.66	Spec Pwr Freq (%): >100-200 mph ² /sec	3.968
Max Deceleration (mph/sec)	-5.80	Spec Pwr Freq (%): >200-300 mph ² /sec	0.000
		Spec Pwr Freq (%): >300 mph ² /sec	0.000
Time at Idle (%)	32.937		
Time at Cruise (%)	40.873		
Time in Accel (%)	14.087		
Time in Decel (%)	12.103		
Cycle Length (miles)	1.618		
Cycle Time (min)	8.400		
# Stops per Mile	4.326		
# of 1-Sec Observations	504		

Target 3-City Chase Car Local Roadway Driving SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																			TOTALS		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
-20																						
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Totals	26.486	12.829	11.707	11.254	9.780	9.411	7.410	4.516	2.005	1.225	1.673	1.304	0.397	0.003								100.000

Target Driving Population Summary Statistics

Avg Speed (mph)	14.60	Avg PKE (miles/hr ²)	3704.93
Max Speed (mph)	62.70	Avg Total Specific Power (mph ² /sec)	15.03
Avg Non-Idle Speed (mph)	19.87	Avg Non-Zero Specific Power (mph ² /sec)	38.66
Avg Cruise Speed (mph)	22.56	Max Specific Power (mph ² /sec)	508.31
Avg Acceleration (mph/sec)	1.29	Spec Pwr Freq (%): 0 mph ² /sec	61.125
Max Acceleration (mph/sec)	12.50	Spec Pwr Freq (%): >0-100 mph ² /sec	36.859
Avg Deceleration (mph/sec)	-1.51	Spec Pwr Freq (%): >100-200 mph ² /sec	1.904
Max Deceleration (mph/sec)	-12.13	Spec Pwr Freq (%): >200-300 mph ² /sec	0.104
		Spec Pwr Freq (%): >300 mph ² /sec	0.007
Time at Idle (%)	26.486		
Time in Cruise (%)	50.233		
Time in Accel (%)	11.184		
Time in Decel (%)	12.097		
Avg Trip or Segment Length (miles)	0.520		
Avg Trip or Segment Time (min)	2.137		
# Stops per Mile	2.926		
# of 1-Sec Observations	57446		

Edited LA92 Driving Cycle SAFD (%)

ACCEL BIN (mph/s)	SPEED BIN (mph)																				TOTALS	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95		100
-20																						
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Totals	16.435	10.376	6.198	8.496	7.173	8.148	11.072	6.755	5.362	5.223	2.646	1.462	6.407	4.248								100.000

Cycle Summary Statistics

Avg Speed (mph)	24.59	Avg PKE (miles/hr ²)	3656.17
Max Speed (mph)	67.20	Avg Total Specific Power (mph ² /sec)	24.97
Avg Non-Idle Speed (mph)	29.42	Avg Non-Zero Specific Power (mph ² /sec)	65.32
Avg Cruise Speed (mph)	33.02	Max Specific Power (mph ² /sec)	271.32
Avg Acceleration (mph/sec)	1.51	Spec Pwr Freq (%): 0 mph ² /sec	61.769
Max Acceleration (mph/sec)	6.90	Spec Pwr Freq (%): >0-100 mph ² /sec	30.710
Avg Deceleration (mph/sec)	-1.69	Spec Pwr Freq (%): >100-200 mph ² /sec	7.103
Max Deceleration (mph/sec)	-15.00	Spec Pwr Freq (%): >200-300 mph ² /sec	0.418
		Spec Pwr Freq (%): >300 mph ² /sec	0.000
Time at Idle (%)	16.435		
Time at Cruise (%)	54.735		
Time in Accel (%)	14.972		
Time in Decel (%)	13.858		
Cycle Length (miles)	9.808		
Cycle Time (min)	23.933		
# Stops per Mile	1.631		
# of 1-Sec Observations	1436		

Appendix D

Composite Los Angeles-Weighted Area-Wide Cycle Comparisons

