MEMORANDUM - CITY OF PASADENA
DEPARTMENT of TRANSPORTATION

DATE: February 27, 2014

TO: Transportation Advisory Commission

FROM: Frederick C. Dock, Director of Transportation

SUBJECT: NEW TRANSPORTATION PERFORMANCE MEASURES FOR TRANSPORTATION IMPACT ANALYSIS

RECOMMENDATION:

It is recommended that the Transportation Advisory Commission review the proposed New Transportation Performance Measures and provide comments to staff on how to best refine the measures.

BACKGROUND:

Over the last three years Department of Transportation staff has presented and discussed the concept of developing new mobility performance measures with both the Transportation Advisory Commission (TAC) (Attachment A) and the City Council (Attachment B). On August 2, 2010 staff held a City Council workshop on "New Transportation Performance Measures." The following was included in that presentation:

> "The new measures need to decrease the emphasis on the efficiency of auto travel relative to other modes and they need to address the manner in which people use and experience the transportation system. This is being accomplished by subscribing to the use of Multi-modal Level of Service (MMLOS) analysis that emphasizes quality of travel experience by walk, bike, transit, and car. *For the current General Plan update, the city is reevaluating the current transportation performance measures in the context of how well each helps Pasadena meet its objectives for transportation and mobility. With the expanded emphasis on sustainability and a continued focus on livability, the performance measures are also being evaluated for their ability to assist with determining how to balance trade-offs among travel modes and among the mobility needs of different members of the community.*" (emphasis added)

As Pasadena updates its General Plan, the City is using this opportunity to redefine critical aspects of its transportation policy. In addition to sustainability, the City's transportation system is expected to support the goals of livability, neighborhood protection and mobility. As a city whose street network developed in the first quarter of the 20th century and which has been fully urbanized for many years, Pasadena is rarely in a position to add new streets or to widen existing ones. As a result, the City is electing to reinforce transportation policies that embrace a system management concept using improved operations strategies, expanded transit, bicycle and pedestrian systems coupled with transportation demand management and traffic calming to manage vehicular speeds at the neighborhood level.

The Mobility Element is focused on three main policy objectives, as refined from the 2004 General Plan and extensive community input:

- Enhance livability
- Encourage walking, biking, transit, and other alternatives to motor vehicles
- Create a supportive climate for economic viability

The Mobility Element places an emphasis on multi-modal mobility and livability, prompting the use of applicable transportation performance measures to judge progress towards these objectives, as well as providing the necessary input to the General Plan EIR and development review transportation impact analysis (TIA). A key challenge facing the City is the current set of Performance Measures and Metrics, used in the 2004 General Plan and the Transportation Impact Review Current Practice and Guidelines, which place a considerable emphasis on the automobile. If these measures continue to be used in their current form, it would present a conflict with the revised Mobility Element objectives. Recent case law related to project-level transportation analysis emphasizes the need for General Plan consistency, use of state of the practice methods, and explicit guidance for resolving conflicting mitigation actions. In order to address this, our recommend practice is to revise and adopt transportation performance measures and TIA analysis procedures that ensure both legal defensibility and consistency with the General Plan.

A key challenge facing the City is the current set of Performance Measure and Metrics, used in the 2004 General Plan and the Transportation Impact Review Current Practice and Guidelines, which place a considerable emphasis on the automobile. If these measures continue to be used in their current form, it would present a conflict with the revised Mobility Element objectives.

Pasadena is currently using a conventional set of performance measures for evaluating system performance and in reviewing the impacts of new development. Intersection volume to capacity ratios and Level of Service are the primary measures. The city also uses a volume-based analysis of change in traffic on street segments to assess impact. The 1994 General Plan update went as far as to include a measure of the environmental capacity of residential streets, essentially an estimate of the level of traffic volume that would be acceptable on residential streets as opposed to the operational capacity. This measure was replaced in the 2004 update by the street segment analysis.

When looked at in the above context, the current measures are silent with regard to system performance of non-auto modes and tend to generate mitigation solutions that encourage widening of intersections and streets, which may compromise the performance of non-auto modes and are increasingly contrary to community values. Consequently, a more robust set of measures has been developed that decreases the emphasis on additional vehicle capacity and on reducing individual intersection delay in favor of increasing the emphasis on network management and travel time reliability. To achieve this shift in emphasis, the metrics shift in scale, away from individual location specific measures to corridor or area wide measures.

<u>SB-743 – Auto Level of Service under CEQA</u>

On September 27, 2013, Governor Brown signed Senate Bill 743. Among other things, SB 743 creates a process to change analysis of transportation impacts under the California Environmental Quality Act (CEQA). Currently, environmental review of transportation impacts focuses on the delay that vehicles experience at intersections and on roadway segments. That delay is measured using a metric known as "level of service," or LOS. Mitigation for increased delay often involves increasing capacity (i.e. the width of a roadway or size of an intersection), which may increase auto use and emissions and discourage alternative forms of transportation.

Under SB 743, the focus of transportation analysis will shift from driver delay to reduction of greenhouse gas emissions, creation of multimodal networks and promotion of a mix of land uses.

Specifically, SB 743 requires the Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines (Title 14 of the California Code of Regulations sections and following) to provide an alternative to LOS for evaluating transportation impacts. Particularly within areas served by transit, those alternative criteria must "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." Measurements of transportation impacts may include "vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated." Attachment C, "*Preliminary Evaluation of Alternative Methods of Transportation Analysis*" which was circulated last year by the Governor's Office of Planning and Research contains a comprehensive discussion of the alternatives to LOS being considered under SB 743. The current schedule has the State adopting new CEQA guidelines related to Auto LOS in January 2015.

Of the 12 new Transportation Performance Measures discussed below all but the Auto LOS metric are consistent with SB 743. The Auto LOS metric included here would allow the City to use this metric in the interim period prior to the State adopting new CEQA guidelines but do so in a fashion that is consistent with the intent of SB 743.

<u>New Transportation Performance Measures</u>

This memo describes 12 proposed transportation performance measures that collectively assess the quality of walking, biking, transit, and vehicular travel in the City of Pasadena. The proposed update of the City's performance metrics and thresholds addresses the new LOS policy in transportation studies, and defines how to analyze the quality of bicycle, pedestrian, and transit facilities and services. To better align transportation system and network analysis with community values as expressed in the general plan, the performance measures and methods presented in this memorandum are recommended for use in transportation analysis. Therefore, the performance measures and significant thresholds to be used seek to be internally consistent and legally defensible under the current state of the practice.

The memo also includes existing and future values for each performance measure to demonstrate their applicability and assist in the selection of appropriate thresholds. Each of the metrics corresponds to one of the following three key points:

1. Accessibility and environmental performance
2. Auto performance measures to reflect the state of the practice and tradeoffs between modes and other community values
3. Measures that promote pedestrian, bicycle, and transit mobility

Table 1 summarizes the metrics and the proposed thresholds for determining an impact. Detailed descriptions and existing and future values for each metric follow.

TABLE 1 – SUMMARY OF TRANSPORTATION PERFORMANCE MEASURES			
METRIC	**DESCRIPTION**	**IMPACT THRESHOLD (GENERAL PLAN)**	**IMPACT THRESHOLD (DEVELOPMENT REVIEW)**
1. Accessibility and environmental performance			
VMT Per Capita	Vehicle Miles Traveled (VMT) in the City of Pasadena per service population (population + jobs).	Any increase in Citywide VMT per Capita	Any increase in Citywide VMT per Capita
VT Per Capita	Vehicle Trips (VT) in the City of Pasadena per service population (population + jobs).	Any increase in Citywide VT per Capita	Any increase in Citywide VT per Capita
Auto Access to Jobs	Average number of jobs accessible to a Pasadena resident within a 25-minute drive.	Any decrease in Citywide Auto Access to Jobs	Any decrease in Citywide Auto Access to Jobs
Transit Access to Jobs	Average number of jobs accessible to a Pasadena resident within 25 minutes by transit.	Any decrease in Citywide Transit Access to Jobs	Any decrease in Citywide Transit Access to Jobs
2. Auto performance measures to reflect the state of the practice and tradeoffs between modes and other community values			
Auto Level of Service	Level of Service (LOS) as defined by the Transportation Research Board's *Highway Capacity Manual (HCM) 2010*. Uses intersection control delay to evaluate auto congestion.	Any decrease beyond the established Minimum LOS Threshold, depending on street type and surrounding activity level. See Table 5.	Any decrease beyond the established Minimum LOS Threshold, depending on street type and surrounding activity level. See Table 5.
Auto Travel Times	Auto Travel Times for significant arterials in the City will be determined and forecasted using the Dynamic Traffic Assignment (DTA) Model.	Any increase in auto travel times for significant origin – destination pairs within +/- 20%.	Any increase in auto travel times for significant origin – destination pairs within +/- 20%.
3. Measures that promote pedestrian, bicycle, and transit mobility			
Resident Pedestrian Accessibility Score	A dwelling-unit weighted average of the Pedestrian Accessibility Score within each TAZ. The Pedestrian Accessibility Score uses the mix of destinations, and a network-based walk shed to evaluate walkability.	Any decrease in Citywide Resident Pedestrian Accessibility Score	Any decrease in Citywide Resident Pedestrian Accessibility Score

<table>
<tr><th colspan="4">TABLE 1 – SUMMARY OF TRANSPORTATION PERFORMANCE MEASURES</th></tr>
<tr><th>METRIC</th><th>DESCRIPTION</th><th>IMPACT THRESHOLD (GENERAL PLAN)</th><th>IMPACT THRESHOLD (DEVELOPMENT REVIEW)</th></tr>
<tr><td>Employment Pedestrian Accessibility Score</td><td>An employment-weighted average of the Pedestrian Accessibility Score within each TAZ.</td><td>Any decrease in Citywide Employment Pedestrian Accessibility Score</td><td>Any decrease in Citywide Employment Pedestrian Accessibility Score</td></tr>
<tr><td>Resident Bike Facility Access</td><td>Percent of Pasadena dwelling units within a quarter mile of each of three bicycle facility types (see Table 6).</td><td rowspan="2">Any decrease in percent of dwelling units or employment within a quarter mile of Level 1 or Level 2 bike facilities.</td><td>Residential development without quarter-mile access to either a Level 1 or Level 2 facility (see Appendix G).</td></tr>
<tr><td>Employment Bike Facility Access</td><td>Percent of jobs located within a quarter mile of each of three bicycle facility types (see Table 6).</td><td>Employment area development without quarter-mile access to either a Level 1 or Level 2 facility (see Appendix H).</td></tr>
<tr><td>Resident Transit Access</td><td>Percent of dwelling units within a quarter mile of each of three transit facility types (see Table 7).</td><td rowspan="2">Any decrease in percent of dwelling units or employment within a quarter mile of Level 1 or Level 2 transit facilities.</td><td>Residential development without quarter-mile access to either a Level 1 or Level 2 facility (see Appendix I).</td></tr>
<tr><td>Employment Transit Access</td><td>Percent of jobs located within a quarter mile of each of three transit facility types (see Table 7).</td><td>Employment area development without quarter-mile access to either a Level 1 or Level 2 facility (see Appendix J).</td></tr>
<tr><td colspan="4">Source: Fehr & Peers, 2014</td></tr>
</table>

Table 2 summarizes the value of each performance metric under existing conditions.

METRIC	VALUE UNDER EXISTING CONDITIONS	UNIT OF MEASUREMENT
VMT Per Capita	**22.5** VMT per capita	Vehicle miles traveled per service population (population + jobs)
VT Per Capita	**2.8** VT per capita	Vehicle trips per service population (population + jobs)
Auto Access to Jobs	**267,500** jobs	Jobs accessible to the average resident within a 25-minute, congested, peak-period drive

METRIC	VALUE UNDER EXISTING CONDITIONS	UNIT OF MEASUREMENT
Transit Access to Jobs	**70,200** jobs	Jobs accessible to the average resident within 25 minutes by transit during the peak period
Auto Level of Service	See Appendix A	See Tables 3 and 4.
Auto Travel Times	See Appendix B.	Minutes of travel time
Resident Pedestrian Accessibility Score	**C** (3.2 land use types)	Count of land use types accessible to the average resident within a 5-minute walk.
Employment Pedestrian Accessibility Score	**B** (5.0 land use types)	Count of land use types accessible to the average worker within a 5-minute walk.
Resident Bike Facility Access	A – **0%** B or better – **30%** C or better – **83%** D – **17%**	Percent of total City dwelling units or jobs by Accessibility Grade: • A – access to a Level 1 bike facility (bike path, multipurpose path or cycle track) within a quarter mile • B – access to a Level 2 facility (buffered bike lane or bike lane) within a quarter mile • C – access to a Level 3 facility (bike route, enhanced bike route, bike boulevard, or emphasized bikeway) within a quarter mile • D – no facility access within a quarter mile
Employment Bike Facility Access	A – **0%** B or better – **29%** C or better – **76%** D – **24%**	
Resident Transit Access	A – **21%** B or better – **56%** C or better – **82%** D – **18%**	Percent of total City dwelling units or jobs by Accessibility Grade: • A – access to a Level 1 transit facility (Metro Gold Line station or transit route with headway of 5 minutes or less) within a quarter mile • B – access to a Level 2 facility (transit corridor with headways of 6 to 15 minutes) within a quarter mile • C – access to a Level 3 facility (transit corridor with headways greater than 15 minutes) within a quarter mile • D – no facility access within a quarter mile
Employment Transit Access	A – **59%** B or better – **83%** C or better – **95%** D – **5%**	

Proposed Metric Definitions

VMT PER CAPITA
Vehicle Miles Traveled (VMT) per Capita measure sums the miles traveled for trips within the City of Pasadena citywide model. The regional VMT is calculated by adding the VMT associated with trips generated and attracted within the City of Pasadena boundaries, and 50 either begin or end in the City, but have one trip end outside of the City. The City's VMT is then divided by the City's total service population, defined as the population plus the number of jobs, per Capita.

Although VMT itself will likely increase with the addition of new residents, the City can reduce VMT on a per-capita basis with land use policies that help Pasadena residents meet their daily needs within a short distance of home, reducing trip lengths, and by encouraging development in areas with access to various modes of transportation other than auto.

VT PER CAPITA
Vehicle Trips (VT) per Capita is a measure of motor vehicle trips associated with the City. The measure sums the trips with origins and destinations within the City of Pasadena, as generated by the Trip-Based citywide model. The regional VT is calculated by adding the VT associated with trips generated and attracted within the City of Pasadena boundaries, and 50 percent of the VT associated with trips that either begin or end in the City, but have one trip end outside of the City. The City's VT is then divided by the City's total service population, defined as the population plus the number of jobs, to calculate VT per Capita.

As with VMT, VT itself will likely increase with the addition of new residents, but the City can reduce VT on a per-capita basis with land use policies that help Pasadena residents meet their daily needs within a short distance of home, reducing trip lengths, and by encouraging development in areas with access to various modes of transportation other than auto.

AUTO AND TRANSIT ACCESS TO JOBS
Auto Access to Jobs measures the average number of jobs accessible to a Pasadena resident within a 25-minute drive. First a 25-minute auto travel shed is calculated from each origin (residential location) TAZ to identify the available destination (job location) TAZs. For each origin TAZ, the employment in the corresponding destination TAZs is summed. A dwelling-unit weighted average of the number of jobs accessible within 25 minutes by car from each residential TAZ then gives a citywide measure of jobs accessibility.

The calculation methodology for Transit Access to Jobs is similar, using a 25-minute transit travel shed in place of the 25-minute auto travel shed. The Transit travel time skims are obtained from General Transit Feed Specification data within the City, and from the SCAG regional model beyond the City limits.

The City can improve Auto Access to Jobs by increasing the number of jobs within the 25-minute travel sheds, increasing the residential population in areas with high levels of employment within their travel sheds, or expanding the travel sheds through improved vehicle travel times.

Similarly, the City can improve Transit Access to Jobs by increasing the number of employment opportunities within the 25-minute transit travel sheds, increasing the residential population in areas with high levels of employment accessibility, or expanding the travel sheds through expanded transit service and improved travel time performance.

AUTO LEVEL OF SERVICE (LOS)

Auto LOS is a qualitative description of traffic flow from a vehicle driver's perspective based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels of service are defined, ranging from LOS A (best operating conditions) to LOS F (worst operating conditions). LOS E corresponds to operations "at capacity." When volumes exceed capacity, stop-and-go conditions result and operations are designated to LOS F.

Signalized Intersections

Traffic conditions at signalized intersections are evaluated using methodologies proposed by the Transportation Research Board (TRB), as documented in the 2010 Highway Capacity Manual (2010 HCM). The HCM 2010 method calculates control delay at an intersection based on inputs such as traffic volumes, lane geometry, signal phasing and timing, pedestrian crossing times, and peak hour factors and is currently state of the practice for analyzing LOS. Control delay is defined as the delay directly associated with the traffic control device (i.e., a stop sign or a traffic signal) and specifically includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. These delay estimates are considered meaningful indicators of driver discomfort and frustration, fuel consumption, and lost travel time.

TABLE 3 – SIGNALIZED INTERSECTION LOS CRITERIA

LEVEL OF SERVICE	DESCRIPTION	DELAY IN SECONDS
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	< 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: 2010 *Highway Capacity Manual.*

Unsignalized Intersections

For unsignalized (all-way stop controlled and side-street stop controlled) intersections, the TRB 20010 HCM method for unsignalized intersections is used. With this method, operations are defined by the average control delay per vehicle (measured in seconds). The control delay incorporates delay associated with deceleration, acceleration, stopping, and moving up in queue. At side-street stop-controlled intersections, the delay is calculated for each stop-controlled movement, the left-turn movement from the major street, as well as the intersection average. The intersection average delay and highest movement/approach delay are reported for side-street stop controlled intersections.

TABLE 4 – UNSIGNALIZED INTERSECTION LOS CRITERIA

LEVEL OF SERVICE	DESCRIPTION	DELAY IN SECONDS
A	Little or no delays	≤ 10.0
B	Short traffic delays	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic, delays where intersection capacity exceeded	> 50.0

Source: 2010 *Highway Capacity Manual.*

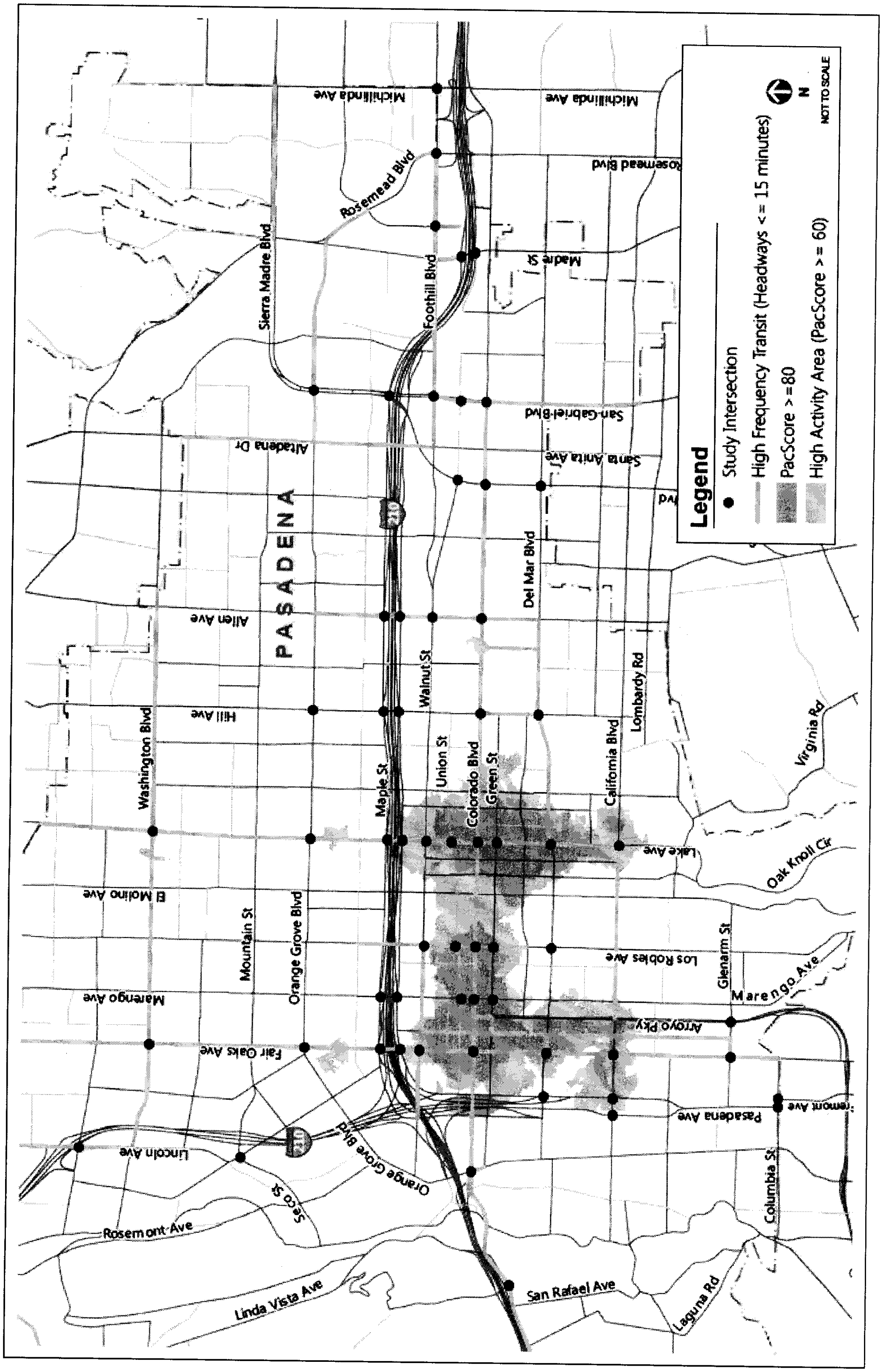
Rather than establish a single Auto LOS, applicable citywide, this new set of performance measures proposes LOS thresholds that vary according to pedestrian and economic activity context and the presence of high-frequency transit service. As shown on Table 5, the default minimum Level of Service to maintain in the City is LOS E. Study intersections along a high-frequency transit route, defined as a combined headway of 15 minutes or less, must maintain LOS D to facilitate efficient movement of transit vehicles. Regardless of the transit overlay, any study intersection in a High Activity Area (HAA) will allow LOS F. This performance measure defines High Activity Areas (HAAs) as areas scoring a PacScore of 60 or above, indicating that all or most destination types are within a quarter-mile walk from all parcels. In addition, High Activity Areas (HAAs) may also be identified based on safety merits, and special consideration may be given to locations where high-activity land uses are located. The use of LOS F as the criteria in HAAs will result in outcomes that are consistent with the direction of SB 743.

TABLE 5 – AUTO LEVEL OF SERVICE (LOS) THRESHOLDS BY CONTEXT

STREET OVERLAY	MINIMUM LEVEL OF SERVICE TO MAINTAIN FOR...	
	HIGH ACTIVITY AREAS (HAAs)	OTHER AREAS
High-Frequency Transit [a]	F	D
All other locations [b]	F	E

Note: [a] These are facilities with combined headways of 15 minutes or less in the peak periods.
[b] All other intersections in the City

Figure 1 illustrates the High Activity Areas (HAAs) and high-frequency transit segments used for determining the LOS threshold applicable to each intersection.



FEHR & PEERS

HIGH ACTIVITY AREAS (HAAS), HIGH FREQUENCY TRANSIT, AND STUDY INTERSECTIONS

FIGURE 1

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AUTO TRAVEL TIME

Auto Travel Time for significant arterials in the City was determined and forecasted using the Dynamic Traffic Assignment (DTA) model. The City has collected travel time runs for 16 significant arterials, and this travel time information was used to evaluate auto operation in the General Plan context. Travel Times along a set of 16 origin-destination pairs were determined, and forecast travel times were prepared using the City's DTA model.

The metric seeks to evaluate whether future condition auto travel times for significant arterials can be maintained within +/- 20% of exiting travel times. Travel time reliability, and the ability for the auto network to absorb new vehicle demand was evaluated with the DTA model, which incorporates link outflow and inflow capacities to reflect intersection capacity.

RESIDENT AND EMPLOYMENT PEDESTRIAN ACCESSIBILITY SCORE

The Resident Pedestrian Environment Score provides a measure of the average walkability in the TAZ surrounding Pasadena residents, based on a Pedestrian Accessibility metric. The Pedestrian Accessibility metric is a simple count of the number of land use types accessible to a Pasadena resident in a given TAZ within a 5-minute walk. The ten categories of land uses are:

- Retail
- Personal Services
- Restaurant
- Entertainment
- Office (including private sector and government offices)
- Medical (including medical office and hospital uses)
- Culture (including religious and other cultural uses)
- Park
- School (including elementary and high schools)
- College

For example, if a given TAZ has access to Retail, Office, and Entertainment, but none of the other land use types within a 5-minute walk, the metric value for that particular TAZ will be 3.

A dwelling-unit weighted average of all TAZ-level Pedestrian Accessibility metric values within the City gives a measure of the walking environment experienced near the average resident's home. The resulting count of land use types is then assigned a letter grade from A to D based on the following structure:

- **A** – greater than or equal to 0 land use types and less than 2 land use types
- **B** – greater than or equal to 2 land use types and less than 5 land use types
- **C** – greater than or equal to 5 land use types and less than 8 land use types
- **D** – greater than or equal to 8 land use types

The calculation methodology for the Employment Pedestrian Accessibility Score is similar, using an employment-weighted average of the TAZ-level metric values in place of the dwelling-unit weighting to give a measure of the walking environment experienced near the average employment location in the City.

The City can improve the Resident and Employment Pedestrian Accessibility Scores by:

- Encouraging residential development in areas with high existing Pedestrian Accessibility Scores;

- Encouraging commercial development in areas with high existing Pedestrian Accessibility Scores; and
- Attracting mixed development and new land use types to increase the Pedestrian Accessibility metric values of other areas.

RESIDENT AND EMPLOYMENT BIKE FACILITY ACCESS
Resident Bike Facility Access measures the percent of the City's dwelling units within a quarter mile of each of three bicycle facility types. The facility types are aggregated into three hierarchy levels, obtained from the City's 2012 (Draft) Bicycle Transportation Plan categories as shown in Table 6

TABLE 6 – BIKE FACILITIES HIERARCHY

LEVEL	DESCRIPTION	FACILITIES INCLUDED
1 (A)	Advanced Facilities	Bike Paths (P1) Multipurpose Paths (PP) Cycle Tracks (not planned)
2 (B)	Dedicated Facilities	Buffered Bike Lanes (not planned) Bike Lanes (2, P2)
3 (C)	Basic Facilities	Bike Routes (3, P3) Enhanced Bike Routes (E3, PE3) Bike Boulevards (BB) Emphasized Bikeways (PEB)

Source: City of Pasadena Bicycle Transportation Plan, 2012.

For each facility level, a quarter-mile network distance buffer is calculated and the total dwelling units within the buffer are added. The facility levels are exclusive and follow the precedence of the bike facility hierarchy; a given dwelling unit is counted under the highest facility type to which it has access within a quarter mile.

The Resident Bike Facility Access measure improves when the percent of the City's dwelling units with access to a given facility level increases without decreasing the percent with access to a higher facility. For example, upgrading a Bike Route to a Bike Lane will increase the Level 2 percentage and decrease the Level 3 percentage, resulting in an overall improvement. However, if residential development moves from an area served by a bike path to one served only by a bike route, it would increase Level 3 percentage, thereby decreasing Level 1 percentage, resulting in an overall worsening of access. Adding a new facility that covers areas of the City not currently served by bicycle facilities will, by default, improve the measure.

The calculation methodology for Employment Bike Facility Access is similar, adding the jobs within the quarter-mile network distance buffer rather than adding dwelling units. The City can improve measures of Bike Facility Access by improving and expanding existing bike facilities and by encouraging residential and commercial development in areas with high-quality bike facilities

RESIDENT AND EMPLOYMENT TRANSIT ACCESS
Resident Transit Access measures the percent of the City's dwelling units within a quarter mile of each of three transit facility types, as defined in the *Draft Streets Types Plan* and in Table 7.

TABLE 7 – TRANSIT FACILITIES HIERARCHY	
LEVEL	**FACILITIES INCLUDED**
1 (A)	Includes all Gold Line stops as well as corridors with transit service, whether it be a single route or multiple routes combined, with headways of five minutes or less during the peak periods.
2 (B)	Includes corridors with transit headways of between six and fifteen minutes in peak periods.
3 (C)	Includes corridors with transit headways of sixteen minutes or more at peak periods.
Source: *Draft Streets Types Plan,* Pasadena Department of Transportation, March 2013.	

For each facility level, a quarter-mile network distance buffer is calculated and the total dwelling units within the buffer are added. As with the Bike Facility Access measures, the facility levels are exclusive and follow the precedence of the hierarchy; a given dwelling unit is counted under the highest facility to which it has access within a quarter mile.

The Resident Transit Access measure improves when the percent of the City's population with access to a given facility level increases without decreasing the percent with access to a higher facility. For example, adding transit service that reduces headways from 20 minutes to 10 minutes will increase the Level 2 percentage and decrease the Level 3 percentage, an overall improvement. However, residents moving from an area served by 5-minute headways to one served only by 20-minute headways will increase the Level 3 percentage, but decrease the Level 1 percentage, an overall worsening of access. Adding a new transit service that covers areas of the city not served by existing services will also improve the measure.

The calculation methodology for Employment Transit Access is similar, adding the jobs within the quarter mile network distance buffer rather than adding dwelling units. The City can improve the measures of Transit Access by reducing headways on existing transit routes, by expanding transit routes to cover new areas, and by encouraging residential and commercial development to occur in areas with an already high-quality transit service.

NEXT STEPS

Following review by the Transportation Advisory Commission at your February 27 meeting the proposed Transportation Performance Measures will be refined and presented to the Planning Commission in March. Staff will also hold a community meeting in March before returning to the Transportation Advisory Commission at your March 27 meeting. The Transportation Performance Measures will then be presented to the Municipal Services Committee and the City Council for adoption in April.

ATTACHMENTS
A Introduction to Transportation Performance Measures, TAC Presentation
B City Council Workshop on Transportation Performance Measures
C OPR – Preliminary Evaluation of Alternative Methods of Transportation Analysis

APPENDIX A – Existing Auto Level of Service (LOS) Results

INTERSECTION ID	STREETS	MINIMUM LOS	EXISTING	
			AM LOS	PM LOS
1	N San Rafael & Colorado	D	C	C
2	Colorado & Orange Grove	D	C	C
3	Pasadena & Del Mar	E	C	C
4	Pasadena & California	F	B	C
5	St. John & California	E	C	C
6	Pasadena & Columbia	E	E	D
6.5	Fremont & Columbia	E	D	D
7	Lincoln & Howard	D	B	B
8	Lincoln & Mountain	E	B	A
9	Fair Oaks & Washington	D	C	C
10	Fair Oaks & Orange Grove	D	C	C
11	Fair Oaks & Walnut	F	C	C
12	Fair Oaks & Colorado	F	B	B
13	Fair Oaks & Del Mar	F	C	C
14	Fair Oaks & California	F	C	C
15	Fair Oaks & Glenarm	D	B	B
16	Arroyo Parkway & Glenarm	E	C	E
17	Marengo & Union	F	B	B
18	Marengo & Colorado	F	B	B
19	Marengo & Green	F	B	B
20	Los Robles & Walnut	D	B	B
21	Los Robles & Union	F	B	B
22	Los Robles & Colorado	F	B	B
23	Los Robles & Green	F	B	B
24	Los Robles & Del Mar	E	C	C
25	Lake & Washington	D	D	C
26	Lake & Orange Grove	D	D	C
27	Lake & Walnut	F	C	C
28	Lake & Union	F	A	A
29	Lake & Colorado	F	C	C
30	Lake & Green	F	B	B
31	Lake & Del Mar	F	C	C
32	Lake & California	F	D	D
33	Hill & Orange Grove	E	D	C
34	Hill & Del Mar	D	C	C
35	Hill & Colorado	D	C	C
36	Allen & Walnut	D	B	B
37	Allen & Colorado	D	B	B

INTERSECTION ID	STREETS	MINIMUM LOS	EXISTING	
			AM LOS	PM LOS
38	Sierra Madre Blvd & Orange Grove	D	C	C
39 [1]	Sierra Madre Blvd & Maple	E	C	C
40	Sierra Madre Blvd & Walnut	E	B	B
41	Sierra Madre Blvd & Colorado	D	C	C
42	Sierra Madre Blvd & Del Mar	E	C	C
43	San Gabriel & Foothill	D	B	C
44	San Gabriel & Walnut	D	A	A
45	San Gabriel & Colorado	D	C	C
46	Halstead & Foothill	D	B	C
47	Rosemead & Foothill	D	D	D
48	Michillinda & Foothill	E	D	D
49	Sierra Madre Villa & WB I-120 Ramps	D	B	B
49.5	Sierra Madre Villa & EB I-120 Ramps	E	C	C
50	Allen & Maple	D	C	C
51	Allen & Corson	D	C	B
52	Hill & Maple	E	D	C
53	Hill & Corson	E	F	C
54	Lake & Maple	F	D	D
55	Lake & Corson	F	C	C
56	Marengo & Maple	E	C	C
57	Marengo & Corson	E	C	C
58	Fair Oaks & Maple	D	C	C
59	Fair Oaks & Corson	D	C	C

Note: [1] Due to methodological limitations of HCM 2010 for complex intersections, Intersection 39 is analyzed according to HCM 2000.

APPENDIX B – DTA Model Auto Travel Time Results

STREET	DIR	FROM	TO	EXISTING TRAVEL TIME (MINUTES)	
				AM	PM
ORANGE GROVE	NB	COLUMBIA	COLORADO	4:06	3:59
	SB	COLORADO	COLUMBIA	4:24	4:16
LINCOLN	NB	ORANGE GROVE	HOWARD	3:16	3:22
	SB	HOWARD	ORANGE GROVE	3:27	3:26
FAIR OAKS	NB	GLENARM	WASHINGTON	8:16	8:31
	SB	WASHINGTON	GLENARM	9:01	9:07
ARROYO PKWY	NB	GLENARM	COLORADO	3:53	3:29
	SB	COLORADO	GLENARM	4:07	4:31
LAKE AVE	NB	DEL MAR	WASHINGTON	6:01	7:28
	SB	WASHINGTON	DEL MAR	6:22	6:25
HILL AVE	NB	DEL MAR	WASHINGTON	5:04	5:11
	SB	WASHINGTON	DEL MAR	5:06	5:13
SAN GABRIEL	NB	SAN PASQUAL	FOOTHILL	2:11	2:11
	SB	FOOTHILL	SAN PASQUAL	2:02	2:11
WASHINGTON	EB	FAIR OAKS	LAKE AVE	2:34	2:41
	WB	LAKE AVE	FAIR OAKS	2:37	2:31
ORANGE GROVE	EB	FAIR OAKS	SAN GABRIEL	7:59	8:13
	WB	SAN GABRIEL	FAIR OAKS	7:59	7:57
WALNUT	EB	FAIR OAKS	KINNELOA	10:35	11:08
	WB	KINNELOA	FAIR OAKS	10:39	10:42
FOOTHILL	EB	WALNUT	ROSEMEAD	5:27	5:51
	WB	ROSEMEAD	WALNUT	5:53	5:46
UNION	WB	HILL AVE	ST JOHN	6:47	6:55
COLORADO	EB	ARROYO PKWY	SAN GABRIEL	9:29	10:34
	WB	SAN GABRIEL	ARROYO PKWY	9:40	10:04
GREEN	EB	ST JOHN	HILL AVE	5:43	7:45
DEL MAR	EB	ORANGE GROVE	SAN GABRIEL	10:41	11:26
	WB	SAN GABRIEL	ORANGE GROVE	11:24	10:23
CALIFORNIA	EB	ORANGE GROVE	LAKE AVE	4:41	4:36
	WB	LAKE AVE	ORANGE GROVE	4:31	4:11

Introduction to Transportation Performance Measures

Presentation to Transportation Advisory Committee

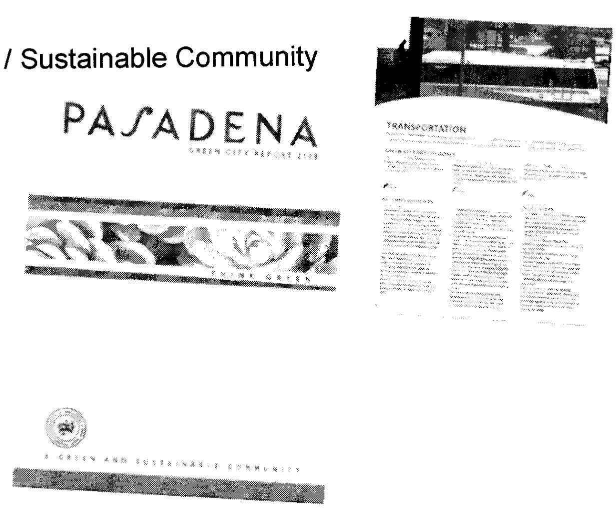
Ellen Greenberg, AICP

March 5, 2010

ARUP

A Backdrop of Evolving Values

- Green City / Sustainable Community



ARUP

A Backdrop of Evolving Values

- Green City / Sustainable Community
- Complete Streets

"Complete streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street."

ARUP

A Backdrop of Evolving Values

- Green City / Sustainable Community
- Complete Streets
- The Opposite of Traffic

Land Resource

ARUP

What can Performance Measures do?

- Indicate how the system is functioning or how it is expected to function in the future
- Evaluate how well the system meets community objectives
- Help with decision-making and implementation

ARUP

How Can Transportation Performance Measures Be Used?

- Informing the community
- Assessing progress, and monitoring progress
- Analyzing conditions and impacts
- As a basis for funding and mitigation requirements
- Guiding operating decisions and strategies
- Synching up with other goals

ARUP

Meaningful Performance Measures

Clearly connect to:

- Data and analysis that are available and understandable
- Community objectives and expectations
- Options that are realistically available to the City

ARUP

Community Objectives and Expectations

The 2004 Mobility Element objectives are a starting point for the 2010 Mobility Element Update

- Promote a Livable Community
- Encourage Non-auto Travel
- Protect Neighborhoods
- Manage Multi-modal Corridors

ARUP

What has changed?
What other objectives might be considered?

2004 Mobility Element Objectives

- Promote a Livable Community ✓
- Encourage Non-auto Travel ✓
- Protect Neighborhoods ✓
- Manage Multi-modal Corridors
- Manage Corridors to reflect 2010 street classifications
- Support Green City and Sustainability Aims

ARUP

Evaluating the Set of Realistically Available Options

Decreasing Emphasis On:

- Additional capacity
- Reducing individual intersection delay

Increasing Emphasis On:

- Network management
- Travel time reliability
- Improved transit services
- Complete Streets
- Multifunctional rights of way: green streets, social spaces
- Managing multimodal system

ARUP

Performance Measures Currently in Use

- Intersection Level of Service (LOS)
- Street Segment Impacts
- Average Vehicle Ridership (AVR) – TRO Goal of 1.5 for regulated sites
- Annual ARTS Ridership
- Green City Action Plan – Urban Environmental Accord Indicators
- Arterials average travel time & speeds

ARUP

What's right with the present system?

- Familiar
- Responds to many people's "hot button" issues
- Established basis for funding and mitigation
- Reflects typical practice vis a vis measurement
- Synchs up with other agencies

ARUP

Why consider changes to the present system?

- Can't effectively evaluate some options
- Not-so-good reflection of people's real experiences
- Need stronger basis for funding and mitigation
- May be producing unintended consequences
- Not well-aligned with adopted policies

ARUP

A new set of performance measures could

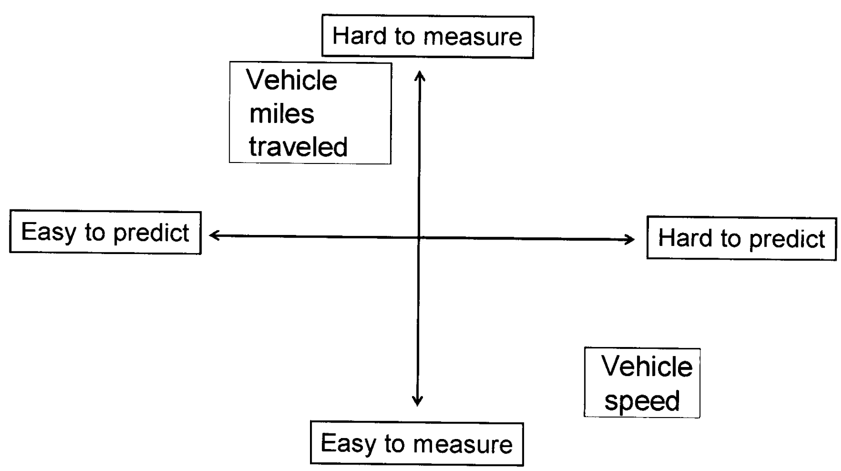
- Retain some current measures
- Emphasize quality of travel experience by all modes
- Elevate safety, livability and sustainability
- Reflect interactions between land use, community character and transportation system

ARUP

Investigating new ideas

- Create full list of possible measures
- Align current and possible future performance measures with Mobility Element and other objectives
- Analyze how new performance measures would work

Performance Measurement Challengess



Investigating new ideas

- Determine whether candidate PMs can be used for the full range of applications
- For each, specify methods to quantify impacts and justify CEQA thresholds and impact fees.
- Specify a Performance Monitoring plan for each

ARUP

Analysis of potential new performance measures

- Example: Multimodal Level of Service
- A new measure of intersection quality of service for
  - pedestrians
  - bicycles
  - transit
  - cars/trucks
- Multiple techniques for measurement and presentation are available
- Transportation Department staff will evaluate these

ARUP

What's in the mix? Possible Ideas for new Performance Measures

- Specific candidate measures
  - Multimodal level of service
  - Speed suitability for streets by type
  - Parking supply and pricing suitability
  - Traffic volumes
- Additional concerns
  - Commercial vitality, service/delivery access
  - Community education and information services
  - Local and global sustainability impacts

ARUP

What can a revised set Performance Measures accomplish (Part 1) ?

- Evaluate General Plan scenarios and policy options
- Measure conditions that the Mobility Element can influence
- Devise a mix of strategies to include in the Mobility Element update
- Link up with Green City Action Plan
- Inform regional strategies

ARUP

What can a revised set Performance Measures accomplish (Part 2) ?

- Address how people use and experience transportation
- Convey technical information clearly to decision makers and the public on the issues they value most
- Rely on cost-effective measurements
- Firmly assure that new developments are compatible with diverse City goals

ARUP

Compiling a new set of Performance Measures

- Assess the full set to address key concerns and objectives
- Evaluate feasibility of consistently using the full set
- Consider how the set works together for the full range of applications
- Refine for initial use in analyzing General Plan alternatives

ARUP

CITY OF PASADENA · INCORPORATED JUNE 1886

Agenda Report

August 2, 2010

TO: CITY COUNCIL

FROM: DEPARTMENT OF TRANSPORTATION

SUBJECT: **CITY COUNCIL WORKSHOP ON TRANSPORTATION PERFORMANCE MEASURES**

RECOMMENDATION:

This report is for information only.

BACKGROUND:

As Pasadena and other California cities move into the second decade of the 21st Century, they do so in response to a series of state mandates that have been adopted in the past several years to address climate change. The greenhouse gas reductions mandated by AB 32 and the regional targets for greenhouse gas inherent in SB 375 have introduced new dimensions into the realm of transportation management. Similarly California's adoption of a statewide Complete Streets policy has underpinned the movement toward more walkable, bike friendly cities. In addition to the state requirements, Pasadena, along with many other cities, adopted the Urban Environmental Accords and the U.S. Council of Mayors Climate Protection Agreement in the furtherance of a sustainable future.

The net effect of these sustainability programs on the transportation system is to change the perspective from which the performance of the system has been viewed. To achieve the sustainability goals, the transportation professional must look beyond the efficiency of the network as the primary metric of performance. New metrics that reflect the sustainability goals are needed and must be balanced across modes. Shorter and fewer vehicles trips become an important measure in relation to greenhouse gas production. The condition of the network for pedestrians and bicyclists becomes a factor in the performance of a multi-modal system. The availability and connectivity of transit service increases in importance. All of these metrics introduce a level of complexity into the development and measurement of urban transportation strategies that goes far beyond the current Level of Service metric that we are familiar with and use to address system performance.

As Pasadena updates its General Plan, the city is using this opportunity to redefine critical aspects of its transportation policy. In addition to the added aspect of sustainability, the city's transportation system is also expected to support the goals of livability, neighborhood protection and mobility. As a city whose street network developed in the first quarter of the

20th Century and which has been fully urbanized for many years, Pasadena is not in a position to add new streets or to widen existing ones. As a result, the city is electing to redefine its transportation policies to embrace a system management concept that emphasizes improved operations strategies, expanded transit, bicycle and pedestrian systems coupled with transportation demand management and supported by traffic calming at the neighborhood level.

Pasadena is currently using a conventional set of performance measures for evaluating system performance and in reviewing the impacts of new development. Intersection volume to capacity ratios and Level of Service are the primary measures. The city also uses a volume-based analysis of change in traffic on street segments to assess impact.

For the current General Plan update, the city is reevaluating the current transportation performance measures in the context of how well each helps Pasadena meet its objectives for transportation and mobility. With the expanded emphasis on sustainability and a continued focus on livability, the performance measures are also being evaluated for their ability to assist with determining how to balance trade-offs among travel modes and among the mobility needs of different members of the community.

When looked at in the above context, the current measures are silent with regard to system performance of non-auto modes and tend to generate mitigation solutions that encourage widening of intersections and streets, which may compromise the performance of non-auto modes and are increasingly contrary to community values. Consequently, the city has begun a process for developing a more robust set of measures that decrease the emphasis on additional vehicle capacity and on reducing individual intersection delay in favor of increasing the emphasis on network management and travel time reliability.

Vehicle miles of travel (VMT) per capita is one of the measures under consideration. Similarly, representative travel times over typical routes are also under consideration. Speed suitability by street type is also being evaluated. These measures, while measurable at an empirical level, are difficult to forecast in the absence of sophisticated models. They operate at district (VMT) and corridor (travel time, speed) scales, which maybe useful for measuring the General Plan performance, but might mask individual project-level impacts.

Additionally, the new measures need to decrease the emphasis on the efficiency of auto travel relative to other modes and they need to address the manner in which people use and experience the transportation system. This is being accomplished by subscribing to the use of Multi-modal Level of Service (MMLOS) analysis that emphasizes quality of travel experience by walk, bike, transit, and car. MMLOS techniques are available from a variety of sources that include federal research publications (NCHRP 3-70), Florida DOT, and the cities of Austin, TX and Boulder and Fort Collins, Colorado. In advance of the methodology that will ultimately be published in the 2010 Highway Capacity Manual, the city is evaluating the available methods for applicability and use in Pasadena.

The city is also considering the use of measures that reflect the interactions between land use, community character and transportation systems. These types of measures, which are more esoteric and less well-defined empirically, include parking availability and pricing suitability, the quality and accessibility of traveler information, the impact on sustainability and livability. These metrics may initially measure program availability rather than system performance.

Over the next several months, the new set of performance measures will be evaluated for their relevance to General Plan goals as well as their ability to quantify both project-specific and cumulative impacts and to serve as a basis for justifying thresholds of significance for environmental impact analysis and for supporting nexus-based impact fees (which the city already has in use).

COUNCIL POLICY CONSIDERATION:

This workshop supports the General Plan guiding principle, "Pasadena will be a city where people can circulate without a car." New transportation performance measures will assist the Department of Transportation in implementing the four major objectives of the Mobility Element:

- Promote a livable community
- Encourage non-auto travel
- Protect neighborhoods by discouraging traffic from intruding into neighborhoods
- Manage multimodal corridors to promote and improve citywide transportation services.

Respectfully submitted,

for Frederick C. Dock
Director
Department of Transportation

Prepared by:

Mark Yamarone
Transportation Administrator

Approved by:

MICHAEL J. BECK
City Manager

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Preliminary Evaluation of Alternative Methods of Transportation Analysis

December 30, 2013

As required by statute, the Governor's Office of Planning and Research is developing a new way to measure environmental impacts related to transportation. This as an opportunity both to reduce costs associated with environmental review, and, importantly, to achieve better fiscal, health and environmental outcomes. We need your help in this effort.

I. Introduction

On September 27, 2013, Governor Brown signed Senate Bill 743 (Steinberg, 2013). Among other things, SB 743 creates a process to change analysis of transportation impacts under the California Environmental Quality Act (Public Resources Code section 21000 and following) (CEQA). Currently, environmental review of transportation impacts focuses on the delay that vehicles experience at intersections and on roadway segments. That delay is measured using a metric known as "level of service," or LOS. Mitigation for increased delay often involves increasing capacity (i.e. the width of a roadway or size of an intersection), which may increase auto use and emissions and discourage alternative forms of transportation. Under SB 743, the focus of transportation analysis will shift from driver delay to reduction of greenhouse gas emissions, creation of multimodal networks and promotion of a mix of land uses.

Specifically, SB 743 requires the Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines (Title 14 of the California Code of Regulations sections and following) to provide an alternative to LOS for evaluating transportation impacts. Particularly within areas served by transit, those alternative criteria must "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." (New Public Resources Code Section 21099(b)(1).) Measurements of transportation impacts may include "vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated." (*Ibid.*) OPR also has discretion to develop alternative criteria for areas that are not served by transit, if appropriate. (*Id.* at subd. (c).)

Though a draft of the Guidelines revisions is not required until July 1, 2014, OPR is seeking early public input into its direction. This document provides background information on CEQA, the use of LOS in transportation analysis, and a summary of SB 743's requirements. Most importantly, it also contains OPR's preliminary evaluation of LOS and different alternatives to LOS. It ends with a description of open

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questions and next steps. In developing a better alternative to LOS, OPR will rely heavily on input from all stakeholders. We hope that you will share your thoughts and expertise in this effort.

Input may be submitted electronically to CEQA.Guidelines@ceres.ca.gov. Please include "LOS Alternatives" in the subject line. While electronic submission is preferred, suggestions may also be mailed or hand delivered to:

> Christopher Calfee, Senior Counsel
> Governor's Office of Planning and Research
> 1400 Tenth Street
> Sacramento, CA 95814

Please submit all suggestions before **February 14, 2014** at **5:00 p.m**.

II. CEQA Background

Since SB 743 requires a change in the analysis of transportation impacts under CEQA, this section provides a brief overview of CEQA's requirements.

CEQA generally requires public agencies to inform decision makers and the public about the potential environmental impacts of proposed projects, and to reduce those environmental impacts to the extent feasible. The rules governing that environmental analysis are contained in the Public Resources Code, in the administrative regulations known as the CEQA Guidelines, and in cases interpreting both the statute and the CEQA Guidelines.

Many projects are exempt from CEQA. Typically, however, some form of environmental analysis must be prepared. If a project subject to CEQA will not cause any adverse environmental impacts, a public agency may adopt a brief document known as a Negative Declaration. If the project may cause adverse environmental impacts, the public agency must prepare a more detailed study called an Environmental Impact Report (EIR). An EIR contains in-depth studies of potential impacts, measures to reduce or avoid those impacts, and an analysis of alternatives to the project.

The key question in an environmental analysis is whether the project will cause adverse physical changes in the environment. CEQA defines the "environment" to mean "the *physical* conditions that exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, or objects of historic or aesthetic significance." (Pub. Resources Code, § 21060.5 (emphasis added).) As this definition suggests, the focus of environmental review must be on physical changes in the environment. Generally, social and economic impacts are not considered as part of a CEQA analysis. (CEQA Guidelines, § 15131.)

Once an agency determines that an impact might cause a significant adverse change in the environment, it must consider feasible mitigation measures to lessen the impact. (Pub. Resources Code, § 21002.) Specifically, a lead agency may use its discretionary authority to change a project proposal to avoid or minimize significant effects. (CEQA Guidelines, § 15040(c).) The authority to mitigate must respect constitutional limitations, however. Mitigation measures must be related to a legitimate governmental interest, and must be "roughly proportional" to the magnitude of the project's impact. (CEQA Guidelines, § 15126.4(a)(4).)

III. Background on Measures of Automobile Delay

Many jurisdictions currently use "level of service" standards, volume to capacity ratios, and similar measures of automobile delay, to assess potential traffic impacts during a project's environmental review. Level of service, commonly known as LOS, is a measure of vehicle delay at intersections and on roadway segments, and is expressed with a letter grade ranging from A to F. LOS A represents free flowing traffic, while LOS F represents congested conditions. LOS standards are often found in local general plans and congestion management plans.

Traffic has long been a consideration in CEQA. (See, e.g., *Fullerton Joint Union High School Dist. v. State Bd. of Education* (1982) 32 Cal. 3d 779, 794 (school district's reorganization could potentially affect the environment by altering traffic patterns).) In 1990, the Legislature linked implementation of congestion management plans, including LOS requirements, with CEQA. (Gov. Code, § 65089(b)(4).) LOS has been an explicit part of CEQA analysis since at least the late 1990's, when the sample environmental checklist in the CEQA Guidelines asked whether a project would exceed LOS standards. (See former CEQA Guidelines, App. G. § XV; see also, *Sacramento Old City Assn. v. City Council* (1991) 229 Cal. App. 3d 1011, 1033 (addressing claims of an EIR's inadequacy related to level of service analysis).)

IV. Problems with using LOS in CEQA

Though, as explained above, LOS has been used in CEQA for many years, it has recently been criticized for working against modern state goals, such as emissions reduction, development of multimodal transportation networks, infill development, and even optimization of the roadway network for motor vehicles. The following are key problems with using LOS in CEQA:

LOS is difficult and expensive to calculate. LOS is calculated in several steps:

- First, the number of vehicle trips associated with a project must be estimated.
- Second, after estimating the number of vehicle trips generated by the project, an analysis requires assumptions about the path that those vehicles may take across the roadway network.
- Third, traffic levels must be estimated at points along the roadway network, as compared to traffic that might occur without the project.
- Fourth, microsimulation models are used to determine traffic outcomes of volume projections.

Thus, an analysis under LOS typically requires estimates of trip generation, estimates of trip distribution, conducting existing traffic counts at points along the network, and an analysis and comparison of traffic function at each point for future project and "no project" scenarios.

LOS is biased against "last in" development. Typical traffic analyses under CEQA compare future traffic volumes against LOS thresholds. A project that pushes LOS across the threshold triggers a significant impact. In already developed areas, existing traffic has already lowered LOS closer to the threshold. Because the LOS rating used to determine significance of the project's impact is determined by total traffic (existing traffic plus traffic added by the project), infill projects disproportionally trigger LOS thresholds compared to projects in less developed areas.

LOS scale of analysis is too small. LOS is calculated for individual intersections and roadway segments. As traffic generated by a project fans out from the project, it substantially affects a few nearby intersections and roadway segments, then affects more distant intersections and roadway segments by a smaller amount. LOS impacts are typically triggered only at the nearby intersections and roadway segments where the change is greatest. Projects in newly developed areas typically generate substantially more vehicle travel than infill projects,[1] but that traffic is more dispersed by the time it reaches congested areas with intersections and roadway segments operating near the thresholds. As a result, while outlying development may contribute a greater amount of total vehicle travel and cause widespread but small increases in congestion across the roadway network, it may not trigger LOS thresholds. Further, piecemeal efforts to optimize LOS at individual intersections and roadway segments may not optimize the roadway network as a whole. Focusing on increasing vehicle flow intersection-by-intersection or segment-by-segment frequently results in congested downstream bottlenecks, in some cases even worsening overall network congestion.[2]

LOS mitigation is itself problematic. Mitigation for LOS impacts typically involves reducing project size or adding motor vehicle capacity. Without affecting project demand, reducing the size of a project simply transfers development, and its associated traffic, elsewhere. When infill projects are reduced in size, development may be pushed to less transportation-efficient locations, which results in greater total travel. Meanwhile, adding motor vehicle capacity may induce additional vehicle travel, which negatively impacts the environment and human health.[3] It also negatively impacts other modes of transportation, lengthening pedestrian crossing distances, adding delay and risk to pedestrian travel, displacing bicycle and dedicated transit facilities, and adding delay and risk to those modes of travel.

LOS mischaracterizes transit, bicycle, and pedestrian improvements as detrimental to transportation. Tradeoffs frequently must be made between automobile convenience and the

---

[1] For information on the relationship between infill and compact development, and vehicle travel and GHG emissions, see Growing Cooler, Evidence on Urban Development and Climate Change, September 2007.

[2] This phenomenon is called Braess' Paradox. For a description, see Braess, Dietrich. 1968, translated 2005. "On a Paradox of Traffic Planning." *Transportation Science, 39 (4), pp. 446-450. ISSN 0041-1655.* For prevalence, see Steinberg, Richard and Zangwill, Willard I. (1983) The prevalence of Braess' paradox. *Transportation science*, 17 (3). pp. 301-318. ISSN 0041-1655

[3] Duranton, Gilles, and Matthew A. Turner. 2011. "The Fundamental Law of Road Congestion: Evidence from US Cities." *American Economic Review*, 101(6): 2616-52.

provision of safe and efficient facilities for users of transit and active modes. Since LOS measures the delay of motor vehicles, any improvement for other modes that might inconvenience motorists is characterized as an impediment to transportation.

Use of LOS thresholds implies false precision. Calculating LOS involves a sequence of estimates, with each step using the output of the previous step. Imprecision in an early step can be amplified throughout the sequence. While it is difficult to estimate the distribution of future trips across the network with a high level of precision, the calculation of congestion levels is highly sensitive to that estimate. Further, LOS is typically reported in environmental analyses without acknowledging potential uncertainty or error.

As a measurement of delay, LOS measures motorist convenience, but not a physical impact to the environment. Other portions of an environmental analysis will account for vehicular emissions, noise and safety impacts.

V. SB 743

SB 743 marks a shift away from auto delay as a measure of environmental impact. It does so in several ways.

First, it allows cities and counties to designate "infill opportunity zones" within which level of service requirements from congestion management plans would no longer apply. (See, SB 743, § 4 (amending Gov. Code, § 65088.4).)

Second, it requires OPR to develop criteria for determining the significance of transportation impacts of projects within transit priority areas, and further provides OPR with discretion to develop such criteria outside of transit priority areas. The Secretary for the Natural Resources Agency must then adopt the new criteria in an update to the CEQA Guidelines. (See, SB 743, § 5 (adding Pub. Resources Code § 21099).)

Third, and perhaps most importantly, once the CEQA Guidelines containing the new criteria are certified, "automobile delay, as described solely by level of service or similar measures of vehicular capacity or traffic congestion shall not be considered a significant impact on the environment pursuant to this division, except in locations specifically identified in the guidelines, if any." (*Id.* at subd. (b)(2).)

SB 743 includes legislative intent to help guide the development of the new criteria for transportation impacts. For example, Section 1 of the bill states: "New methodologies under the California Environmental Quality Act are needed for evaluating transportation impacts that are better able to promote the state's goals of reducing greenhouse gas emissions and traffic-related air pollution, promoting the development of a multimodal transportation system, and providing clean, efficient access to destinations." Further, subdivision (b) of the new Section 21099 requires that the new criteria "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." It also suggests several possible alternative measures of potential transportation impacts, including, but not limited to: "vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated."

Notably, SB 743 does not limit the types of projects to which the new transportation criteria would apply. Rather, it simply authorizes the development of criteria for the "transportation impacts of projects[.]" (New § 21099(b)(1); see also subd. (c)(1) (referring only to "transportation impacts").) The Legislature intended the new criteria to apply broadly. An early version of this provision, in SB 731, would have limited the new criteria to "transportation impacts for residential, mixed-use residential, or employment center projects [on] infill sites within transit priority areas." (See, SB 731 (Steinberg), amended in Assembly August 6, 2013.) Therefore, OPR will investigate criteria that would apply to all project types, including land use development, transportation projects, and other relevant project types.

An earlier version of SB 731 would have limited the application of these changes by determining that automobile delay is not an environmental impact only in transit priority areas. (See, SB 731(Steinberg), amended in Assembly September 9, 2013, at § 12 ("Upon certification of the guidelines by the Secretary of the Natural Resources Agency pursuant to this section, automobile delay, as described solely by level of service or similar measures of capacity or congestion within a transit priority area, shall not support a finding of significance") (emphasis added).) As adopted in SB 743, however, automobile delay may only be treated as an environmental impact "in locations specifically identified in the guidelines, if any." (New § 21099(b)(2).) Further, subdivision (c) explicitly authorizes OPR to develop criteria outside of transit priority areas. Given the statement of legislative intent that new transportation metrics are needed to better promote the state's goals, OPR intends to investigate metrics and criteria that will apply statewide.

VI. OPR Goals and Objectives in Developing Alternative Criteria

In developing alternative transportation criteria and metrics, OPR must choose metrics that "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." (New Section 21099(b)(1).) In addition to this statutory directive, OPR will also weigh other factors in evaluating different criteria. Those additional factors include:

> **Environmental Effect**. The California Supreme Court has directed that CEQA "be interpreted in such manner as to afford the fullest possible protection to the environment within the reasonable scope of the statutory language." (*Friends of Mammoth v. Board of Supervisors* (1972) 8 Cal. 3d 247, 259.) OPR, therefore, seeks to develop criteria that maximize environmental benefits, and minimize environmental harm.
>
> **Fiscal and Economic Effect**. Our state and local governments have limited fiscal resources. The state's planning priorities are intended to, among other things, strengthen the economy. (Gov. Code, § 65041.1.) In evaluating alternative criteria, OPR seeks criteria that will lead to efficient use of limited fiscal resources, for example by

reducing long run infrastructure maintenance costs, and to the extent relevant in the CEQA context, promotion of a stronger economy.

Equity. OPR will look for alternative criteria that treat people fairly. The state's planning priorities are intended to promote equity. (Gov. Code, § 65041.1.) OPR seeks to develop criteria that facilitate low-cost access to destinations. Further, OPR recognizes that in its update to the General Plan Guidelines, OPR must provide planning advice regarding "the equitable distribution of new public facilities and services that increase and enhance community quality of life throughout the community, given the fiscal and legal constraints that restrict the siting of these facilities." (Gov. Code, § 65040.12.) In addition, OPR must also provide advice on "promoting more livable communities by expanding opportunities for transit-oriented development so that residents minimize traffic and pollution impacts from traveling for purposes of work, shopping, schools, and recreation." (*Ibid.*) Though this advice must be developed within the General Plan Guidelines, OPR recognizes that similar issues may be relevant in the context of evaluating transportation impacts under CEQA.

Health. OPR recognizes that "[h]ealthy and sustainable communities are the cornerstones of the state's long-term goals." (Environmental Goals and Policy Report, Discussion Draft (September 2013), at p. 26.) OPR will, therefore, look for alternative criteria that promote the health benefits associated with active transportation and that minimize adverse health outcomes associated with vehicle emissions, collisions and noise.

Simplicity. The purpose of environmental analysis is to inform the public and decision-makers of the potential adverse effects of a project. (Pub. Resources Code, § 21003(b).) Environmental documents must "be written in plain language and may use appropriate graphics so that decision makers and the public can rapidly understand the documents." (CEQA Guidelines, § 15140.) OPR, therefore, seeks to develop criteria that are as simple and easy to understand as possible. The criteria should enable the public and other interested agencies to participate meaningfully in the environmental review process.

Consistency with Other State Policies. SB 743 included legislative intent that the alternative criteria support the state's efforts related to greenhouse gas reduction and the development of complete streets. OPR will also be guided by the state's planning priorities, and in particular, the promotion of infill development, as described in Government Code section 65041.1.

Access to destinations. Even as it serves and impacts many other interests, the fundamental purpose of the transportation network is to provide access to destinations for people and goods. A transportation network does this by providing mobility and supporting proximity. In growing communities, some degree of roadway congestion is inevitable[4]; we cannot "build our way out of congestion" by adding roadway capacity because doing so induces additional vehicle travel. Therefore, accommodating better proximity of land uses and improving the overall efficiency of network performance is essential for providing and preserving access to destinations. Transit and active mode transportation options can play a key role in providing access to destinations and supporting proximity.

The objectives described above need not be the only considerations in selecting alternative criteria. In fact, OPR invites your input into these objectives. *Are these the right objectives? Are there other objectives that should be considered?*

VII. Preliminary Evaluation of the Alternative Criteria

This section provides OPR's preliminary evaluation of the alternative metrics set forth in SB 743, as well as other metrics suggested during our initial outreach. This preliminary evaluation asks whether the alternative satisfies the objectives set forth in SB 743, as well as OPR's own objectives described above. It also attempts to identify which mitigation measures and project alternatives might flow from use of each candidate metric. Finally, this evaluation seeks to identify the level of difficulty of using each metric, including availability of models and data required.

Vehicle Miles Traveled

Variant 1: per capita for residential, per employee for employment centers, per trip for commercial
Variant 2: per person-trip for all projects

Vehicle Miles Traveled (VMT)[5] is one of two metrics specified by SB 743 for consideration. VMT counts the number of miles traveled by motor vehicles that are generated by or attracted to the project. VMT captures motorized trip generation rates, thereby accounting for the effects of project features and surrounds. It also captures trip length, and so can also account for regional location, which is the most important single determinant of vehicle travel. Although VMT counts only motor vehicle trips, not trips taken by other modes, it registers the benefits of transit and active transportation trips insofar as they reduce motor vehicle travel. In this way, VMT captures the environmental benefits of transit and active mode trips.

Of the metrics we consider here, VMT is relatively simple to calculate. Assessing VMT is substantially easier than assessing LOS because it does not require counting existing trips, estimating project trip distribution, or traffic microsimulation for determining congestion. Assessing VMT requires only estimates of trip generation rates and trip length, and can be readily modeled using existing tools such as the U.S. Environmental Protection Agency's EPA's MXD model.

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[4] Duranton, Gilles, and Matthew A. Turner. 2011. "The Fundamental Law of Road Congestion: Evidence from US Cities." *American Economic Review*, 101(6): 2616-52.

[5] For additional information about VMT and its relationship to environmental impacts, see U.S. Environmental Protection Agency, "Our Built and Natural Environments: A Technical Review of the Interactions Between Land Use, Transportation, and Environmental Quality (2nd Edition)," June 2013.

Mitigation to reduce VMT can include designing projects with a mix of uses, building transportation demand management (TDM) features into the project, locating the project in neighborhoods that have transit or active mode transportation opportunities, or contributing to the creation of such opportunities. Since VMT is sensitive to regional location, it can also be mitigated by choosing a more central location for the project.

Used as a transportation metric under CEQA, VMT could encourage reduction of motor vehicle travel, increase transit and active mode transportation, and increase infill development.

Automobile Trips Generated

Per capita for residential, per employee for employment centers

Automobile trips generated (ATG) is one of two metrics specified by SB 743 for consideration. ATG counts the number of motor vehicle trips that are generated by or attracted to the project. ATG thereby accounts for the effects of project features and project surroundings (i.e., the availability of transit). It does not, however, account for the length of the trip, and therefore it does not account for regional location, the most important determinant of vehicle travel[6]. Although ATG counts only motor vehicle trips, not trips taken by other modes, it registers the benefits of transit and active transportation trips insofar as they reduce motor vehicle trips taken. In this way, ATG captures some of the environmental benefits of transit and active mode trips.[7]

Of all the metrics considered, ATG is the easiest to calculate. It does not require counts of existing traffic, estimation of project trip distribution, or traffic microsimulation for determining congestion. In fact, calculating ATG is simply the first step in calculating most of the other metrics, including LOS.

Mitigation for ATG can include locating a project in an area that facilitates transit or active mode transportation, such as an infill or transit oriented location, and including transportation demand management features in the project.

Used as a transportation metric under CEQA, ATG could encourage reduction of motor vehicle travel, increased active mode transportation, and increased infill development. Because it omits regional location, however, it may be less effective at achieving those ends than VMT.

Multi-Modal Level of Service

Multi-Modal Level of Service (MMLOS) is a metric of user comfort for travelers on various modes. Along with the traditional motor vehicle LOS metric, MMLOS includes additional ratings for transit, walking

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[6] Reid Ewing & Robert Cervero (2010) Travel and the Built Environment, Journal of the American Planning Association, 76:3, 265-294, DOI: 10.1080/01944361003766766.

[7] For more information on the ATG metric, see Automobile Trips Generated: CEQA Impact Measure & Mitigation Program, City of San Francisco, October 2008.

and biking modes. It rates intersections and roadway segments, delivering an A through F grade for each mode at each location. However, like LOS, MMLOS does not account for the total extent of motor vehicle travel, just its effect near the project. It also does not examine the transportation system on the scale of an entire trip length for other modes. The most commonly used MMLOS methodology is that put forth by the 2010 Highway Capacity Manual.

Assessing MMLOS requires detailed data on existing conditions for each mode of travel at intersections and roadway segments analyzed, plus trip generation and distribution by mode from the project. MMLOS is more difficult to calculate than LOS. Further, the methodology for non-motorized modes continues to develop. MMLOS is the subject of expert debate. For example, increased pedestrian traffic may be a desirable environmental outcome rather than an impact to be mitigated. Meanwhile, reducing the number of motor vehicle lanes on a street with bicycle lanes can benefit cyclists, but can degrade MMLOS under the Highway Capacity Manual's methodology.

Impacts determined by MMLOS can be mitigated by adding motor vehicle capacity, improving transit service, and/or adding amenities for transit and active mode travelers. Since transportation facilities near infill projects often already support a variety of modes, projects in these locations may require more mitigation than projects further from these amenities, potentially discouraging infill development.

MMLOS could act either to increase or reduce motor vehicle travel, depending on the relative weight of ratings between modes. It could encourage development of transit and active mode facilities, potentially increasing use of those modes. However, because it would assign the burden of those mitigations to development, it has the potential to raise infill costs and thereby reduce infill development.

Fuel Use

Per capita for residential, per employee for employment centers, per trip for commercial

Fuel use counts the amount of fuel used by vehicle trips generated by or attracted to the project. In doing so, it captures motorized trip generation rates, thereby accounting for the effects of project features and surrounds. It also captures trip length, and so can also account for regional location, which is the most important single determinant of vehicle travel. Finally, it also captures fuel efficiency, which is affected by vehicle mix and traffic conditions. Although fuel use counts only motor vehicle trips, not trips taken by other modes, it registers the benefits of trips taken by other modes insofar as they reduce motor vehicle travel. In this way, Fuel Use captures the environmental benefits of transit and active mode trips.

Assessing Fuel Use with precision would require the application of microsimulation tools over the area affected by project motorized vehicle traffic. Alternately, a fuel efficiency multiplier could be applied to VMT, but that would eliminate sensitivity to roadway operations, rendering this metric equivalent to the VMT metric.

Mitigation for Fuel Use can include building in transportation demand management (TDM) features as part of the project, locating the project in neighborhoods that supply transit or active mode transportation opportunities. Also, because Fuel Use traces the full extent of motor vehicle trips and therefore is sensitive to regional location, it can also be mitigated by choosing a more central location for the project. Mitigation measures for Fuel Use might also include improving motor vehicle traffic operations and speeds. However, to the extent that these mitigation measures would induce demand, they would lose effectiveness. In the coming years, fuel efficiency improvements will necessitate shifting thresholds, and zero emissions vehicles could eventually render the metric irrelevant. Also, permeation of electric-drive vehicles with regenerative braking reduces the effect of traffic operations improvements on fuel use.

Used as a transportation metric under CEQA, Fuel Use would act to reduce motor vehicle travel, except where transportation operations improvements or capacity expansions induce more travel in the long run. It would tend to increase transit and active mode transportation, although it could penalize their operation if they have a negative effect on motor vehicle traffic operations. Finally, it would tend to increase infill development, with the same caveats.

Motor Vehicle Hours Traveled

Per capita for residential, per employee for employment centers, per trip for commercial

Motor Vehicle Hours Traveled (VHT) counts the time taken by motor vehicle trips generated by or attracted to the project. In doing so, it captures motorized trip generation rates, thereby accounting for the effects of project features and project surroundings. It also captures trip length, and so can account for regional location, which is the most important single determinant of vehicle travel. Finally, it also captures travel time, which is affected by traffic conditions. Although VHT counts only motor vehicle trips, not trips taken by other modes, it registers the benefits of trips taken by other modes insofar as they reduce motor vehicle travel. In this way, VHT captures the environmental benefits of transit and active mode trips.

Assessing VHT with precision would require the application of more sophisticated modeling tools than those needed to assess VMT. In some areas, those tools may not be available or data might not be available to support them.

Mitigation for VHT can include building in transportation demand management (TDM) features as part of the project, locating the project in neighborhoods that supply transit, or active mode transportation opportunities. Because VHT traces the full extent of motor vehicle trips and therefore is sensitive to regional location, it can also be mitigated by choosing a more central location for the project. In the near term, VHT could be mitigated by increasing travel speeds, e.g. by increasing vehicle capacity. In the long run, however, increased travel speeds generate additional vehicle travel, eventually re-congesting the roadway and congesting traffic. Increased vehicle speeds may also adversely affect bicycle and pedestrian travel.

As a metric, VHT could act to reduce motor vehicle travel, except if it were used to justify roadway expansion to create short-run benefit without considering long-run induced demand. VHT would in many cases tend to increase transit and active mode transportation, although it would penalize their operation if they have a negative effect on traffic operations. Finally, in some cases VHT would remove a barrier to infill development, although mitigation measures that increase roadway capacity could have the opposite effect.

Presumption of Less Than Significant Transportation Impact Based on Location

Development in centrally-located areas and areas served by transit generally impacts the regional transportation network substantially less than outlying development. Given the lower motor vehicle trip generation rates and shorter trip distances that have been shown for projects in such areas compared with projects elsewhere, project location could serve as predetermined "transportation-beneficial development" areas. Such areas might be presumed to cause less than significant regional transportation impacts. These areas could be mapped so as to be easily identified. Projects outside of such areas may require additional analysis, and mitigation if necessary, using one of the metrics described above.

VIII. Open questions and next steps

The discussion above described OPR's initial impressions of several suggested transportation metrics. Many open questions remain at this point. Some of those open questions, as well as next steps, are set forth below.

1. SB 743 requires that whatever metric is developed, it must promote reductions in greenhouse gas emissions. Increases in roadway capacity for automobiles may lead to increases in noise, greenhouse gas emissions and other air pollutants. SB 743 similarly provides that air quality, noise, safety and other non-delay effects related to transportation will remain a part of a CEQA analysis.

    a. Are there environmental impacts related to transportation other than air quality (including greenhouse gas emissions), noise and safety? If so, what is the best measurement of such impacts that is not tied to capacity?

    b. Are there transportation-related air quality, noise and safety effects that would not already be addressed in other sections of an environmental analysis (i.e., the air quality section or noise section of an initial study or environmental impact report)? If so, what is the best measurement of such impacts that is not tied to capacity?

    c. Would consistency with roadway design guidelines normally indicate a less than significant safety impact?

2. What are the best available models and tools to measure transportation impacts using the metrics evaluated above? SB 743 allows OPR to establish criteria "for models used to analyze transportation impacts to ensure the models are accurate, reliable, and consistent with the intent of" SB 743. Should OPR establish criteria for models? If so, which criteria?

3. SB 743 provides that parking impacts of certain types of projects in certain locations shall not be considered significant impacts on the environment. Where that limitation does not apply, what role, if any, should parking play in the analysis of transportation impacts?

OPR will continue conducting research and meeting with stakeholders while this preliminary evaluation is being publicly reviewed. Following the close of the comment period, OPR will evaluate the input it receives, and develop a discussion draft of the alternatives to LOS and relevant changes to the CEQA Guidelines. The public will be invited to provide input on that discussion draft. If necessary, OPR may further revise the discussion draft based on that input. OPR intends to transmit a final draft of the changes to the CEQA Guidelines to the Natural Resources Agency by July 1, 2014.