



MAP-21 Target-Setting Exercise

Background Resources

Document Overview

This document is designed to support the AASHTO SCOPM MAP-21 Target-Setting exercise. It includes material specific to the System Performance area. It presents targeted excerpts from documents that have already been developed through previous Task Force activities. This documents also contains selected information from research conducted through NCHRP 20-24(37) Comparative Performance Measurement series. The appendix contains a brief System Performance Measure Factsheet produced through a previous effort of the SCOPM Task Force.

This document is organized into three sections:

1. General Target-Setting Recommendations

SCOPM Task Force Findings on MAP-21 Performance Measure Target-Setting (3/13)

2. System Performance Area Recommendations

SCOPM Task Force Findings on MAP-21 Performance Measure Target-Setting (3/13)

SCOPM Task Force Findings on National-Level Performance Measures (11/12)

SCOPM Task Force Workshop on National Performance Measures Background Paper (9/12)

3. Appendix

Performance Measure Factsheet

Additional information is available at the Target-Setting Exercise website:

<http://sites.spypondpartners.com/targetsetting/systp>

1. General Target-Setting Recommendations

1.1. Target-Setting Overview

The findings on of the SCOPM Task Force with regard to MAP-21 target-setting requirements included in this document are based on the following interpretation of the related MAP-21 target-setting requirements:

- A set of standard, consistent national performance measures will be established, but states will have flexibility to establish the target values of those measures. Thus, the term “consistent” applies to the performance measures, data methodologies (collection, processing and analysis), and performance reporting processes. There is no presumption that targets will be consistent across states – rather they will be specific to local conditions and needs and at set at the discretion of DOTs and MPOs.
- States must submit biennial reports on progress toward target achievement for each national measure.
- For the Highway Safety Improvement Program, states that have not made significant progress towards meeting established targets face reductions in funding flexibility and additional reporting requirements.
- For the National Highway Performance Program (NHPP), states that do not make significant progress towards meeting their established targets for asset condition or performance must report actions that they will undertake to achieve the targets.

1.2. Target-Setting Findings and Recommendations

The findings of the SCOPM Task Force with regard to target-setting center around three general findings and eleven recommendations.

1.2.1. General Findings

- **First**, State DOTs request maximum flexibility when setting performance targets. Every state and municipality faces different constraints and opportunities affecting their transportation system. Funding levels and sources vary, as do environmental conditions, population growth trends, and legislative and gubernatorial mandates and priorities. Flexibility in target-setting allows states and municipalities to face the realities of their unique situations. Furthermore, accountability should be based on what states can accomplish with their shares of federal funding.
- **Second**, consistent with the National-Level Guiding Principle #2 (see page 3), *Specificity and Simplicity*, MAP-21 rulemaking should encourage States DOTs to adopt performance targets that are attainable and realistic. These targets should be periodically reevaluated and adjusted

to reflect risks, revenue expectations, and strategic priorities. In addition, the State DOTs agree that consistent data collection and analysis methods are essential to ensure that national-level measures and reporting use comparable data.

- **Third**, in keeping with National-Level Guiding Principle #3 (see page 3), *Possession is 9/10ths of the Law*, the establishment of performance targets can provide a focal point for action and a basis for accountability. However, it is important to recognize that for several of the national-level performance measures, State DOTs have relatively limited control over outcomes. There are many externalities that could affect a State DOT attaining certain performance targets from economic to social forces. For example, the effect of background changes in traffic related to economic conditions can overwhelm any deliberate actions on the part of a state to improve safety or reduce traffic delay. Generally speaking, State DOTs have more control over achieving targets related to asset condition and less control over performance measures associated with safety and system performance.

1.2.2. Specific Recommendations

The following are specific recommendations of the SCOPM Task Force that should be considered in drafting specific rules for implementation of the target-setting provisions of MAP-21:

Provide maximum flexibility

- Regional, local, or other targets are to be established by states or MPOs as appropriate when necessary. Baseline conditions may vary significantly state-to-state and region-to-region.
- Many factors, such as population growth and environmental conditions affect performance outcomes for metrics like congestion and pavement. Therefore, maximum flexibility is required for target-setting.

Focus on what matters – the right outcome

- Target-setting should not focus on a single target value for a performance measure but on achieving improved performance over time.
- States and MPOs often have to make priority decisions based on customer and stakeholder requirements. Each state and MPO must consider these requirements – which will vary from state to state – within its target-setting process.
- The value of performance management is found in better decision-making, not target achievement. DOTs support the idea of allowing states to establish ranges of acceptable performance outcomes. Use of ranges can provide DOTs with a more nuanced way of discussing performance outcomes across multiple competing objectives.

Align targets with system ownership and funding levels

- Targets set for federal performance measures should be aligned with federal funding levels as state DOTs and local partners may or may not have multiple funding sources in addition to federal funds.
- Diverting state funds to meet federal requirements may not be an option. State funding is typically used to match federal funds and allocated to meet state obligations and priorities set by state government such as non-federal-aid eligible maintenance activities.

Base target-setting on longer term trend data

- Targets cannot be set in isolation of solid baseline and reliable, quality, multi-year trend data.
- The expansion of the NHS in MAP-21 has provided challenges as baseline and multi-year data may not be available for the full NHS system.
- Long term viewpoints and multi-year efforts should be considered in target-setting; one data point should not be used to evaluate a program.

Coordinate target-setting through a continuing, cooperative, and comprehensive process

- The development of state, MPO and transit provider targets should be coordinated through a 3C (continuing, cooperative and comprehensive) planning process. This process should result in MPO targets that are attainable given the level of investment a DOT plans to make in a metropolitan planning area (MPA) over a particular time-horizon. Whenever possible, DOTs and MPOs should use consistent (i.e. equivalent) targets to assess the condition and performance of state highways within an MPA.
- Only hold state DOTs and MPOs accountable for what they manage and control. Those who set targets should be those who manage and fund the system and are held responsible for compliance.
- Agencies should not be penalized for not meeting targets due to circumstances beyond their control.

Tell the story: performance is more than just a number

- Analysis and reporting on achieving targets should be both qualitative and quantitative:
- Target-setting should reflect a good faith effort and provide qualitative and quantitative reasoning, as appropriate, to support the results of failing to meet specific targets. For example, states and MPO should be given the opportunity to explain how available resources and other factors such as population dynamics and environmental factors influenced the failure to meet specific targets.
- State DOTs are under increasing pressure and scrutiny from the public regarding investments of public funds and the quality of services provided. While defining measures, setting targets, and aligning strategies to achieve the targets can all positively affect the performance of the state DOTs, these actions will do little to increase the credibility of DOTs unless there is a

reliable, transparent, and understandable method of reporting the progress in achieving the performance targets.

Avoid unachievable targets or the “one size target fits all approach”

- Funding constraints should be factored into the process for determining what values to use for targets. DOTs and local partners work within resource constraints, and cannot be expected to perform to a uniform level (target value) on all measures.
- Targets should reflect realistic expectation about what can be achieved through transportation investments.

Allow for appropriate timelines for target achievement

- Allow for appropriate timelines for achieving targets as a measurable change or progress toward targets may take many years to be noticeable. These may vary by performance area and measure.
- In addition, time horizon (short vs. long-term) for targets should be allowed to vary depending on the measure and at the discretion of each state. For example, safety measures could use the 5 year projection of the 5-year moving average to set targets; annual reports would demonstrate progress using these projections.
- At each DOT’s discretion, targets should be regularly reevaluated and adjusted to reflect evolving risks (e.g. new revenue expectations, changing strategic priorities, etc.)
- At each DOT’S discretion, targets should be reviewed and revised periodically to confirm the selected target is still suitable for achieving the required results.

Guard against unintended consequences

- Consider how targets set for one measure could have unintended consequences for the performance of another measure due to resources shifting to other priorities.
- Targets could drive a “worst first” prioritization approach, risking neglect of long-term system needs. A sustainable, efficient transportation system must place a high priority on system maintenance, preservation, and maximizing asset life while minimizing overall life cycle costs.
- Worst first prioritization can lead to unintended consequences in the system. For example, International Roughness Index (IRI) targets could lead to smooth pavements with deteriorating structural conditions. The IRI target could also prompt states to address the wrong problems, and inadvertently shorten pavement life, instead of lengthening it.

Complement flexibility in target-setting with transparency and accountability

- Setting targets should be accompanied by a rationale for selecting the specific target value.
- When states and MPOs do not meet performance targets, they should describe what they have done to improve performance, how those actions impacted the performance, and why they have not met the target.

Allow flexibility for DOTs and MPOs to use a risk based target-setting approach

- Risk-based targets do not reflect optimal outcomes within a particular investment area; rather, risk-based targets represent strategic objectives within a plan to manage agency risks.
- Risk-based targets are meaningful in that they can be realistically achieved under existing revenue expectations. Unlike aspirational targets, risk-based targets can be managed.
- Risk-based targets are derived from risk assessments and revenue expectations at a point in time; Targets should be continuously reevaluated as risks and revenue expectations evolve.

1.2.3. Determining “Significant Progress”

The following guidelines are offered for approaches to rulemaking with respect to determination of “significant progress” for the HSIP and NHPP program areas.

- **Good Faith Effort:** In determining “significant progress achieved”, FHWA should consider the demonstration of a state’s or MPO’s “Good Faith Effort” towards meeting targets. This information should be documented and provided by states and MPOs to a reasonable level of detail.
- **Programmatic Approach:** The “significant progress” determination should be made based on a programmatic approach rather than based on separate evaluations for individual target areas. This approach would support states and MPOs in making balanced and sound investment decisions rather than trying to meet one target at the expense of another.
- **Defining Significant Progress and Progress Agreements:** Consistent with current practice, states and their local FHWA Division offices should continue to work together and be empowered to consensually develop and determine what constitutes significant program – at the program or performance measure level. Progress determination could be based on mutually agreed on templates and criteria. Periodic meetings during the performance period can be held to review, discuss and adjust progress determinations as needed. Progress determination teams could work together to cooperatively understand and document specific circumstances that may impact a state’s ability to achieve progress towards the established performance targets. These teams would consider unforeseen circumstances that may require adjusting and or resetting performance targets while considering progress.
- **Negative Trends:** Even though the value of a performance measure is not moving towards its target, this doesn’t necessarily mean that “Significant Progress” is not being made. For example, if pavement is deteriorating at a slower rate than before implementing MAP-21; or if congestion is increasing at a slower rate than population growth, progress is still being made. These are examples of how a negative or deteriorating trend direction could still meet the “significant progress’ definition.
- **Self-evaluation:** States and MPOs should be allowed to self-evaluate in determining whether ‘significant progress” has been made. This assessment should be based on quantitative and, if

needed, qualitative data. In addition, determination of “significant progress” should be supported by narrative information if specific performance targets are not achieved. In this case, states and MPOs should provide narrative information and data to document the circumstances and assessment determination.

- **Significant Progress prior to MAP-21:** States that have already made significant progress in recent years (prior to MAP-21) should not be penalized if they do not continue to make significant progress at the rate of other states that are starting with a poor/fair level of performance. In other words, states that have already made significant progress over past (pre MAP-21) years, based on trend data, should be given credit for these improvements. In these circumstances, the failure to meet targets, especially if aggressive targets are pursued (i.e Target Zero), should not be considered a lack of progress.
- **Significant Progress Time Frame Constraints:** States and MPOs generally have 4 to 6 year STIP/TIPs. These are viewed as commitments to constituents. Even if resources are available and policy priorities can be shifted, “significant progress” may not be realized until the 4th or 6th year of a program since it may take time to redirect funds to a different priority.
- **Allow for Target Range Considerations:** When setting targets, states and MPOs may consider setting a target range (opposed to a single number). When making “significant progress” determinations during self–assessment (or FHWA assessment), states and MPOs can consider the full range of the performances measure target area.

2. System Performance — Performance Area Recommendations

2.1. Measures

- **Annual Hours of Delay (AHD)**—Travel time above a congestion threshold (defined by State DOTs and MPOs) in units of vehicle -hours of delay on Interstate and NHS corridors.
- **Reliability Index (RI₈₀)**—The Reliability Index is defined as the ratio of the 80th percentile travel time to the agency-determined threshold travel time.

2.2. Targets

2.2.1. Delay

- AASHTO supports state flexibility in the setting of targets; as provided in MAP-21. To that end, the AHD target would be set by individual state DOTs and MPOs expressed in terms of annual vehicle-hours of delay. Targets may vary by facility, by corridor, by region, by rural or urban, by freight versus commute route or other factors such as investment levels, available transit options, remaining capacity and levels of recurrent versus non recurrent congestion levels.
- Targets could have a negative or positive direction. For example “annual delay should not increase more than 5 percent per year”. Another example of a target could be a comparison of the growth in the delay to the growth in regional economy. The economic recession has played a major role in reducing congestion in recent years, but population and job growth have had a significant role in congestion increases in many regions over the past several decades. Measuring the percent change in delay compared to percent change in gross metropolitan product could provide a more relevant comparison of the role of transportation and land use decisions during periods of rapid growth with periods of slow or no growth. An example target for this measure may state that the percent increase in delay should be no more than the percent increase of the gross metropolitan product.

2.2.2. Reliability

- AASHTO supports state flexibility in the setting of targets; as provided in MAP-21. To that end, the targets would be set by individual State DOTs and MPOs expressed in terms of the Reliability Index. Targets may vary by facility, by corridor, by region, by rural or urban, by freight versus commute route or other factors such as investment levels, available transit options, remaining capacity and levels of recurrent versus non recurrent congestion levels.

2.3. Thresholds

2.3.1. Delay

- The Agency-specified Threshold Speed would be set by DOTs based on established agency practices and defensible factors. These factors could include:
 - corridor characteristics
 - local conditions; operational factors
 - community opinion about the desirability of additional capacity in a corridor; existing capacity
 - population growth
 - rural/urban routes
 - level of existing revenues
 - potential investment required to achieve performance levels
- Agencies use speed thresholds to address these types of criteria and investment levels. For example, California uses 35 mph on freeways as a threshold to identify serious congestion problems. Washington State uses a maximum productivity-based threshold where a value of 85% of the free-flow speed (51 mph) is used to define the point where the maximum vehicle volume per hour per lane occurs; the freeway is not as productive at moving people at speeds above this level. Rural areas, or areas with less congestion, may use the speed limit or free-flow speeds as the basis to identify the size of the congestion problem.
- Any of these threshold approaches can be used for communicating the congestion problems or for analysis of potential solutions. They all can illustrate the effect of a full range of congestion reduction strategies.
- Using one condition, the agency-determined threshold speed, for both System Performance Measures (Annual Vehicle-Hours of Delay and Reliability Index) simplifies the communication of the performance measure results (particularly with non-technical audiences) and supports the expectations of the local community as expressed in the threshold. It is important to note that selecting a threshold speed only applies to corridors that experience congestion (based on the historic speed data).

2.3.2. Reliability

- The Reliability Index performance measure uses the “base speed thresholds” determined by the State DOTs and MPOs to define the comparison standard for congested corridors. The agency-determined threshold speed for congested corridors could be based on several factors that the state considers appropriate, such as (and among others): corridors’ characteristics; local conditions; community opinion about the desirability of additional capacity in a corridor; freight movement goals; rural/urban routes; capacity assumptions and/or level of potential investment required to achieve performance levels.
- Using one condition, the agency-determined threshold speed, for both System Performance Measures (Annual Vehicle-Hours of Delay and Reliability Index) simplifies the communication

of the performance measure results (particularly with non-technical audiences) and supports the expectations of the local community as expressed in the threshold. It is important to note that selecting a threshold speed only applies to corridors that experience congestion (based on the historic speed data). In uncongested corridors the 80th percentile travel time will be equal to the posted speed. For the purpose of reliability measurements for uncongested corridors posted speed would be used for the base speed threshold.

2.4. Methodology

2.4.1. Delay

Input Data:

- Corridor Segments—Definition of Interstate and NHS Corridors being analyzed and established by State DOTs and MPOs.
- Measurement Period—Peak/Off Peak or Daily.
- Vehicle Miles Traveled (VMT)—VMT needs to be available in appropriate units depending on the measurement being analyzed. Hourly values would be estimated for both passenger vehicles and trucks for each of the 24 hours during each of the seven days of the average week.
- Average number of persons per vehicle – Initially can be an assumed value for most roads, with data collection focused on roads with higher bus and carpool volumes
- Travel Speed—Average speed of the vehicles during the measurement period on the corridor segments. An hourly value would be used for each road segment and day.
- Agency-specified threshold speed—This is the agency-specified threshold speed for the analysis time period; below this speed delay is calculated (e.g., free-flow, posted speed [60mph], maximum throughput speed [50mph], severe congested speed [35mph])

Procedure State DOTs Would Use:

1. Establish corridor segments.
2. For each Interstate and NHS corridor, determine expected travel speed to be used as Agency-specified Threshold Speed.
3. For each day and Interstate and NHS corridor, calculate the Daily Vehicle-Hours of Delay:

$$\text{Daily Hours of Delay} = \frac{\text{Daily VMT}}{\text{Travel Speed}} - \frac{\text{Daily VMT}}{\text{Agency-specified Threshold Speed}}$$

4. Sum the Daily Hours of Delay for each Day.
5. Sum the Hours of Delay for each Interstate and NHS corridor

Output Data:

- AHD on each Interstate and NHS Corridor
- Statewide AHD for all Interstate and NHS Corridors

2.4.2. Reliability

There are multiple ways to determine 80th percentile travel time, below is an example of one such methodology using the following equation based upon Travel Time. However, given a fixed travel distance between the origin and destination of a trip, speed and travel time are inversely related. Meaning, higher travel speeds result in lower travel times for a given commute distance and vice versa. Hence the RI can be calculated using the speed input as well:

$$RI_{80} = \frac{80^{th} \text{ percentile Travel Time}}{\text{Travel Time at the Agency specified Threshold Speed}}$$

1. Measurement Intervals: The day is divided into 288 five-minute intervals (24X12 = 288).
2. For each of these five minute intervals array 240 workdays or 365 calendar days of travel times.
3. From these 240 workdays (or 365 calendar days) travel times are arranged in ascending order. From this list, the 80th percent worst travel time is selected. This will be the annual average 80th percentile travel time for that 5-minute interval across all days.
4. Repeat the same process for the other 287 five-minute intervals.
5. From the weekday peak periods of this set of travel times (i.e., Monday to Friday between 6 and 9 a.m. and 4 to 7 p.m.); again pick the five-minute interval that corresponds to the highest peak period 80th percentile travel time. (Note: refine/discuss AM and PM peak period vs. all day; 240 work days vs. 365 calendar days)
6. Determine the base speed threshold: This may be the same threshold as agency's delay/congestion threshold (e.g., a percentage of posted speed – see threshold discussion). This provides the average travel time that travelers should be able to travel this corridor (note: freight and passenger car could have different thresholds). Please note selecting a threshold speed only applies to corridors that experience congestion (based on the historic speed data). In uncongested corridors the 80th percentile travel time will be equal to the posted speed.
7. Divide the 80th percentile worst travel time by the comparison travel time to compute the Reliability Index.
8. The individual corridor RI values will be weighted by the number of miles traveled in each corridor (or truck-miles traveled for the freight measure) and a statewide average RI value is calculated. This step requires (vehicle miles traveled data) volume data in addition to speed data and should be available in the same manner as volume data is provided in the delay measure proposal.

2.5. MAP-21 Performance Reporting Requirements

- Performance Measures for States to Assess Performance of the Interstate and Non-Interstate NHS [§1203; 23 USC 150(c)(3)] The Secretary will establish performance measures for States to use to assess Interstate performance and non-Interstate NHS performance.
- States to Set Performance Targets [§1203; 23 USC 150(d)] States have 12 months from final rulemaking to set targets reflecting the established measures, with the option of setting different targets for rural and urbanized areas.
- States to Submit Biennial Performance Reports [§1203; 23 USC 150(e)] States have four years from the enactment of MAP–21 to submit a first biennial performance report addressing progress in achieving performance targets. *Note: MAP-21 does not specify which aspect of “performance” is required. The interpretation assumed here is that measures of operational performance were intended – related to travel time, speed, delay, reliability, etc.*

3. Appendix

Performance Measure Factsheet

System Performance

AASHTO SCOPM Communications Workshop

Why it's Important

- Efficient movement of people and goods along the nation's highways boosts economic productivity and helps keep or create jobs
- Fewer vehicle delays are an indicator of more efficient traffic movement, which reduces transportation costs
- Individuals place a high value on the predictability of trip times – meaning they want to be able to accurately predict how long a trip is likely to take
- Congestion is a fact of life in many urban areas, but unexpected congestion that creates wide variations in travel times on key corridors from day-to-day is most problematic.

Measure #1: Hours of Delay

What FHWA May Measure

Simply put: The time vehicles spend delayed on the interstate and other NHS systems.

Technically speaking: Travel time above the congestion threshold in units of vehicle-hours for vehicles on interstate and other NHS corridors

Language of the Measure

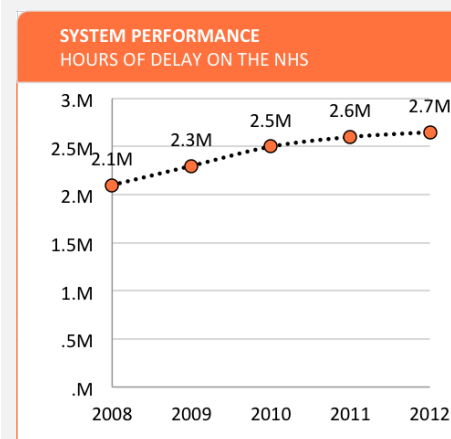
Communicating at the right level. At the highest level, all of the delay can be rolled up into one large aggregated number. For example:

- “Vehicles experienced 2.7 million hours of delay on our state's highways last year”

If this large aggregated number is hard to put in perspective, it can be expressed in other ways. Some examples include:

- By corridor – “Vehicles experienced 100,000 hours of delay on I-70 between City A and City B last year”
- By vehicle, driver, or commuter – “The average commuter experienced 2 hours of delay on our state's highways last year”
- By day – “Every day drivers experience over 100,000 hours of delay on our interstates”
- By mile – “Drivers experienced an average of 5 seconds of delay per mile on our State's highways last year”

Visualizing it



National Reporting Issues and Key Concepts

Congestion is relative. What people consider a congested roadway in a large urban area can be very different from how congestion is perceived in a less populated part of the country. To account for this, DOTs may have the flexibility to define what constitutes delay in their state and those definitions are likely to vary greatly. Some examples of how states might defined delay might be:

- Urban State X: When speeds drop below 35 mph
- Rural State Y: When speeds drop below the posted speed limit
- Other State Z: When speeds drop below 85% of the free-flow speed

Because the definition of delay is likely to vary greatly from state to state (or even within a state), comparisons may be difficult and easily misinterpreted.

Measure #2: Reliability Index

What FHWA May Measure

Simply put: The predictability of trip times

Technically speaking: The ratio of the total travel time needed to ensure on-time arrival to the agency-determined travel time

Language of the Measure

Travelers want travel time reliability. In many parts of the U.S., drivers are used to everyday congestion. Although congestion is not welcomed, most travelers are less tolerant of unexpected delays than they are of everyday congestion they can plan around and prepare for.

The reliability index represents how much total time a traveler should allow to ensure on-time arrival. For example:

Time a trip is expected to take in normal conditions: 10 minutes

Total time needed to ensure on-time arrival: 12 minutes

Reliability index: $12/10 = 1.2$

Apple-to-apples comparisons. One benefit of the reliability index is that it provides a common denominator for comparison of congestion across corridors or collections of corridors across urban areas.

Overcoming the abstract. A downside of indexes is that they are not well understood by the general public. Few people would understand how to interpret the following statement:

- “The reliability index was 1.20 in 2013”

To combat the abstract nature of the measure, a clear explanation is needed. Some examples:

- “Our reliability index is 1.2, meaning if a traveler allows 12 minutes to complete a trip that should normally take 10 minutes, they will arrive at their destination on time 8 days out of 10.
- “The reliability index is the ratio of how long a trip is likely to actually take vs. how long it would take in normal conditions.”

Some have found these types of explanations too cumbersome and have instead converted their reliability index into a strict on-time performance metric, such as:

- “Truck trips in our state arrive on-time 87% of the time”

National Reporting Issues and Key Concepts

It is possible that states will be allowed some flexibility in how they define the “time a trip is expected to take in normal conditions.” Permitting agencies to define the threshold of what is considered normal would allow for apples-to-apples comparisons and aggregation of reliability based on what is ‘normal’ in each state. There are potential pitfalls though - this method could conceivably allow for some states to set unusually low standards for ‘normal’, which would make it more difficult to use the measure for comparison across states.

System Performance Communication Issues

System performance comes with its own set of communication challenges and issues, such as:

- Some congestion may be a sign of beneficial economic activity.
- Congestion can often be in large part a result of things outside the DOTs control, such as land use policies, housing costs, economic trends, etc.
- Some of the language and measures may require education of the audience.
- Large aggregated congestion and reliability measures are not likely to mean much to individual members of the public. Individuals care much more about the delay and reliability of a specific trip at a specific time than they do about those of the entire system.

Visualizing it

. Averages don't tell the full story

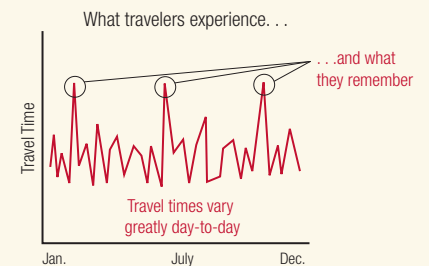
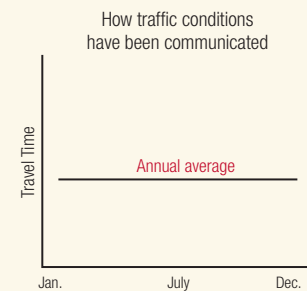


Figure from USDOT *Travel Time Reliability* brochure