

The Importance of Mobility Performance Measures and Dimensions of Mobility
(McLeod's paper for TRB's Performance Measures Committee's
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Mobility and its dimensions

Providing mobility for people and goods is transportation's most essential function. Most of all, transportation analyses should deal with mobility. To fully address mobility four dimensions must be considered and addressed:

- Quantity of travel
 - Magnitude of use of a facility or service
 - More people and goods transported the better
- Quality of travel
 - Traveler satisfaction with a facility or service
 - User experience is usually most important to the traveling public
- Accessibility
 - Ease in which travelers can engage in desired activities
 - It doesn't matter how good the quality is if it is hard to get there
- Capacity utilization
 - Quantity of operations relative to capacity
 - Indicates how efficiently resources are being used

Note the treatment of only one of the dimensions of mobility can lead to an inadequate assessment at either a project or system-wide level. Furthermore, there are multiple performance measures within each dimension that help frame the mobility picture and can lead to better decisions. Frequently at a project level the Highway Capacity Manual's level of service concept, as a measure of quality of service, predominates as the service measure. Although this author believes it is the single best highway mobility performance measure, it is relied on too heavily for project decisions. For the quality of service dimension, travel time reliability or delay may be more meaningful. For site impact analyses the amount of available capacity used frequently may be more important than the level of service obtained. The level of service concept also does not directly deal with serving the greatest amount of travelers.

States and other public entities have developed numerous performance measures to assess how well they are performing and how well they are meeting public desires. Although states and others use many performance measures, surprisingly few measures deal directly with mobility and its four dimensions.

Because of the dominance of the automobile mode and highway performance measures the following discussion concentrates on that mode. (Note: it is recognized a highway is not a mode; the five major highway modes are automobiles, bus transit, bicycles, pedestrians, and trucks. Nevertheless, because of common usage, in this article “automobile” will refer to all motorized vehicles on highways and “highway” performance measures refer to that collective mode.)

System level mobility performance measures:

For states, MPOs and others wishing to improve their use of system level highway mobility performance measures by reporting and linking the measures to transportation improvements the following are offered as effective mobility measures for consideration.

Quantity:

- Vehicle miles traveled
- Person miles traveled
- Truck miles traveled

Quality

- Average travel speed
- Vehicle delay
- Person delay
- Level of service
- Travel time reliability

Accessibility

- Proximity to major transportation hubs
- Percent urban miles with sidewalks
- Percent miles with paved shoulders / bicycle lanes

Capacity utilization

- Vehicles per lane mile

- Percent of miles heavily congested
- Percent of travel heavily congested
- Duration of congestion

Many of the above measures are currently being used and reported by the Florida DOT. Others are in the final development stages for future use. (Within Florida the accessibility performance measures in general and the travel time reliability performance measure in particular have proved to be the most elusive. However, the Florida DOT is close to having a travel time reliability model that can be applied to the state's total freeway system, regardless of whether the freeways are ITS instrumented or not.)

Project level mobility performance measures:

At a project level the author considers the following to be excellent mobility performance measures.

Quantity:

- Average annual daily traffic
- Average annual daily truck traffic
- Number of persons served

Quality

- Average travel speed
- Level of service
- Threshold delay (delay below a generally acceptable speed or level of service threshold)
- Travel time reliability

Accessibility

- Roadway access management
- Modal (transit, bicycle, pedestrian) options

Capacity utilization

- Roadway capacity
- Demand volume to capacity ratios
 - Peak hour (typical v/c ratios)
 - Peak period ("weighted average" ratios to indicate percent of time overloaded and by how much)

Role of the Highway Capacity Manual

For highway mobility performance measurement the U.S. and the world have greatly benefited from TRB's Highway Capacity Manual. Since 1950 with its first publication it has served as the authoritative source on capacity and capacity utilization. Through the years its scope has been expanded to include the "quality of service" mobility dimension as well as including the bicycle, pedestrian and transit modes. Although elements of "quantity of travel" and "accessibility" are found in the Highway Capacity Manual, it is not contemplated that it will become the leading technical resource for those two dimensions for the automobile or other highway modes.

Multimodal Mobility Performance Measures

Although the above information concentrated on the automobile mode, it's important to realize the four dimensions of mobility are directly applicable to all major modes of transportation: airplane, automobile, bicycle, pedestrian, rail, ships, transit, and truck. Yet frequently for performance measurement, most modal analyses concentrate performance measurement on only one performance measure and by doing so don't give an overall picture of mobility for that mode or for the transportation system as a whole.

The attached table provides an example of mobility performance measures that could be applied for strategic multimodal transportation prioritization and statewide reporting. It was developed by senior modal analysts within Florida DOT. As can be seen in the table, not all potential individual performance measures may be directly applicable to all modes; however, the mobility structure of four dimensions of mobility is applicable. Modal analysts tend to be concerned about a specific measure (e.g., ridership, level of service) from one of these four dimensions to address their modes. However, to properly address mobility a regionwide entity, like a state, should consider all four.

Summary

In summary, there are four dimension of mobility that should be addressed for the most important function of transportation, the mobility of people and goods.

Possible Multimodal Mobility Performance Measures for Strategic Transportation Prioritization and Statewide Reporting

Possible Mobility Performance Measures	Highway (Auto/Truck)	Aviation	Rail	Seaport
Quantity				
Vehicle trips			Equivalent truck trips	
Vehicle mi. traveled	Vehicle mi. traveled Truck mi. traveled			
Person trips		Passengers	Passengers	Passengers
Person mi. traveled	Person mi. traveled			
Tonnage	Tonnage	Tonnage	Tonnage	Tonnage
Ton mi. traveled	Ton mi. traveled			
Quality				
Travel time	Average travel speed		Average train speed	
Delay	Delay		Delay	Delay
Travel time reliability	Reliability	Reliability	Reliability	Reliability
LOS A-F concept	Meets LOS standards			
Accessibility				
Connection adequacy to hubs	Highway connectivity to hubs	Highway connectivity to hubs Intermodal connectivity	Highway connectivity to hubs	Highway connectivity to hubs
Proximity to hubs				
Existence of facility/service				
Utilization				
Demand to capacity ratios	Demand to capacity ratios Vehicles per lane mi. congested	Demand to capacity ratios	Demand to capacity ratios	Demand to capacity ratios
% system congested	% miles congested			
% travel congested	% vehicle miles congested			