

**BRIEFING MEMO**

**AC TRANSIT DISTRICT**  
**Board of Directors**  
Executive Summary

**GM Memo No. 06-004**  
  
Meeting Date: January 4, 2006

**Committees:**

- |                            |                                     |                              |                          |
|----------------------------|-------------------------------------|------------------------------|--------------------------|
| Planning Committee         | <input checked="" type="checkbox"/> | Finance Committee            | <input type="checkbox"/> |
| External Affairs Committee | <input type="checkbox"/>            | Operations Committee         | <input type="checkbox"/> |
| <b>Board of Directors</b>  | <input type="checkbox"/>            | <b>Financing Corporation</b> | <input type="checkbox"/> |

**SUBJECT:**

Receive further review of the Transit Capacity and Quality of Service Manual: Part 3, Chapter 3: *Fixed Route Transit Service Measures*

**RECOMMENDED ACTION:**

- Information Only     Briefing Item     Recommended Motion

**Fiscal Impact:**

None; background only.

**Background/Discussion:**

For the past several months, staff has presented various concepts of quality and capacity from the *Transit Capacity and Quality of Service Manual (TCQSM), Part 3*. In October, the Planning Committee was presented with the A-F Level-of-Service (LOS) ranking system referred to in the TCQSM. This concept was originally developed and published in the *Highway Capacity Manual*. Chapter 3 includes more detail on the characteristics that influence a rank within each service element. This memorandum discusses the Manual's more detailed approach to LOS issues for transit availability

**BOARD ACTION:**      **Approved as Recommended**    [ ]      **Other**      [ ]  
                                 **Approved with Modification(s)**    [ ]

[To be filled in by District Secretary after Board/Committee Meeting]

The above order was passed on \_\_\_\_\_, 2006.  
  
Rose Martinez, District Secretary  
By \_\_\_\_\_

(pages 3-29 – 3-52). (Some of the information concerning Comfort and Convenience is a review of an earlier memorandum).

### **Measuring Quality of Service/Availability**

The Manual evaluates and measures transit availability by identifying distinct service elements:

- Transit Stops/Frequency
- Segments/Corridors
- System/Service Design/Access

#### **Transit Stops**

As part of availability, this is primarily a measurement of how much service is provided at each stop – simply, it is frequency of service. The more service, the higher the LOS ranking:

<b>LOS</b>	<b>Average Headway (min)</b>	<b>veh/hr</b>	<b>Comments</b>
A	< 10	>6	Passengers do not need schedules
B	10-14	5-6	Frequent service, passengers consult schedules
C	15-20	3-4	Maximum desirable time to wait if bus/train missed
D	21-30	2	Service unattractive to choice riders
E	31-60	1	Service available during the hour
F	>60	<1	Service unattractive to all riders

LOS A is excellent service that is attractive to all passengers and allows passengers the convenience of not using schedules because service is provided so frequently. Conversely, LOS D is not attractive to choice riders because it is infrequent and requires in-depth knowledge of the service schedule.

Other factors that affect LOS at transit stops include pedestrian access, bicycle access, park and ride access and ADA access. These are also all measured by the LOS index.

**AC Transit Practice:** While the District does not use the LOS measurements, Policy 550 identifies minimum frequencies for classes of routes. The preferred level of service set forth in Policy 550 for different classes of routes is:

- ◆ Trunk and Major Corridors – 10 minute peak or better (LOS B)
- ◆ Rapid Services – 12 minutes (LOS B)
- ◆ Urban Crosstown – 15 minute peak or better (LOS C)
- ◆ Suburban Crosstown – 30 minute peak or better (LOS D)
- ◆ Owl Services – 30 to 60 minutes (LOS E)

No standards are established for low density routes. Due to budget restrictions, the District does not currently provide these service levels on all trunk and corridors, but generally does provide them on suburban crosstown routes.

### **Route Segments/Corridors**

As a measure of availability, this focuses on the hours of service, or “span of service” for individual routes or corridors. The longer the span of service, the higher the LOS ranking:

<b>LOS</b>	<b>Hours of Service</b>	<b>Comments</b>
A	19-24	Night or "Owl" service provided
B	17-18	Late Evening service provided
C	14-16	Early evening service provided
D	12-13	Daytime service provided
E	4-11	Peak hour service only or limited midday service
F	0-3	Very limited or no service

LOS A means that for that route segment or corridor, service is provided almost continuously throughout the day and night (or through the late night hours as Owl service). Conversely, LOS E means that only peak hour service, or limited mid-day service, is provided on that route or corridor.

**AC Transit Practice:** Policy 550 “commits” the District to operating all services from 5 am to 10 pm – about 18 hours of service, or LOS B. Due to budget restrictions, the District does not provide these levels of service on all corridors, but does provide them on all trunk routes and major corridors. Owl service is provided on five corridors per Policy 550 – under the TCQSM these corridors have LOS A.

### **System Availability**

As defined in the Manual, this generally uses *service coverage* as the measurement for the availability of transit services systemwide. As with the Manual, AC Transit has attempted to balance the overall geographical desire for systemwide coverage with the more practical measurements of putting service where it will be used. The manual notes, “as a compromise, service coverage LOS looks at how much of the area that would typically produce the majority of a system’s ridership – that is, the densest areas – are served. Specifically, those areas that may be capable of supporting hourly transit service are addressed.”

To determine System Availability LOS, several metrics are used. These include:

- Route miles per square mile
- Service coverage area - the area within 1/4 mile of a bus stop, or within 1/2 mile of a busway or rail station

- Transit supportive areas – those areas with densities that support and encourage transit ridership
- Park and ride access

The most complex of these calculations involves determining the transit supportive area. Elements of the calculation include identifying densities, locating transit routes, and using GIS systems to identify the most promising transit supportive land use areas and considering street system impacts (grid versus discontinuous). All these measurements and calculations identify the appropriate level of service to provide in areas where people will actually ride the service.

**AC Transit Practice:** The Service Deployment Policies, which formed the basis for Policy 550, specifically recommended placing service in the areas where land use was most promising for good patronage. Policy 550 reinforced this with *Guiding Principle Number 8: Transit service must be prioritized to those areas with the greatest potential for transit use, with good patronage rewarded by better service and shorter passenger waits.* As a proxy for the more elaborate methods suggested in TCQSM, Policy 550 uses density (persons per square mile) to identify appropriate service levels.

## Measuring Comfort and Convenience

The Manual evaluates and measures passenger comfort and convenience by identifying distinct service characteristics:

- Transit Stops
- Segments and Corridors
- System

### Transit Stops

As part of comfort/convenience, Transit Stops measure the comfort level on board a vehicle during a transit trip. Again, the TCQSM uses the standardized A-F LOS, with A being an extremely uncrowded vehicle, and F being a crush load:

LOS	Load Factor	Comments
A	0.00-0.50	No passenger need sit next to another
B	0.51-0.75	Passenger can choose where to sit
C	0.76-1.00	All passengers can sit
D	1.01-1.25	Comfortable standee load for design
E	1.26-1.50	Maximum schedule load
F	>1.50	Crush load

**AC Transit Practice:** Policy 550 identifies a load factor of 1.25 as the maximum acceptable load. This is LOS D. For Transbay and Express services, the maximum load is 1.0 (LOS C).

Other factors included as part of Transit Stops are amenities and security. There are no defined LOS measurements related to these characteristics.

### **Segments and Corridors**

As part of comfort/convenience, the TCQSM references several measures of reliability, including on-time performance, headway adherence, missed trips and the distance traveled between mechanical breakdowns ("miles between roadcalls"). As the Manual states, on-time performance is the most widely used of these measures.

**On-Time Performance** measures service delivery, not service design. On-Time measurements involve numerous observations and surveys, followed by a calculation that compresses those observations into the experience of a typical passenger. Most operators in the nation use the standard that if a bus is 5 minutes late, it is still considered to be "on-time". However, in Canada, the standard is defined as being no more than 3 minutes late. On-time performance can be applied to any transit service, but it is most useful in service that operates greater than every 10 minutes. From the riders' viewpoint, a bus that is late or early is considered "not on time." From a review of operators by the authors of the Manual, more than 50% of buses that would be considered "not on time" were actually running early.

At least 20 observations are needed on any one line to establish a confidence level in the resultant data. The measurement assumes the perspective of a passenger who makes one round-trip by transit, five days a week. From that perspective, one late trip within a two week period is defined as LOS A, while one late trip daily is LOS F:

<b>LOS</b>	<b>On-Time Percentage</b>	<b>Comments</b>
A	95-100%	1 late transit vehicle every 2 weeks
B	90-94.9 %	1 late transit vehicle every week
C	85-89.9%	3 late transit vehicles every 2 weeks
D	80-84.9%	2 late transit vehicle every week
E	75-79.9%	1 late transit vehicle every day
F	<75%	1 late transit vehicle at least daily

**AC Transit Practice:** AC Transit conforms to national standards in that a bus is considered "on-time" if it is up to 5 minutes late. However, the District considers a trip that is early by greater than 60 seconds as "not on-time." On-time performance measurement on a route level is conducted as needed to determine route-specific

characteristics. From a systemwide perspective, measurements are taken at 13 predetermined locations in accordance with a National Transit Database (NTD) approved sampling plan. However, as more data is collected and analyzed through both the UTA and ORBCAD automatic passenger counter systems (APC's), it will be increasingly possible to conduct line profiles on a regular basis. The District does not have a standard for on-time performance; however staff does calculate a measurement. For 4<sup>th</sup> quarter FY 04-05, on-time performance was 70.5 percent, which was the highest quarter all year.

**Headway Adherence** is another performance indicator measuring service delivery as opposed to service design. The TCQSM recommends that the *interval* between scheduled transit trips be measured as well as their on-time performance. This is important for high frequency lines, where service runs often and bunching can create problems. The calculation is the standard deviation of headway deviations divided by the average scheduled headway. The practical outcome of the formula is the probability that the headway will be off by half a headway (as an example, a four minute headway is off by more than two minutes). The LOS is as follows:

LOS	Deviation Less than x% Headway	Comments
A	1%	Runs like clockwork
B	10%	Slightly off headway
C	20%	Often off headway
D	33%	Irregular headways, with some bunching
E	50%	Frequent bunching
F	>50%	Most vehicles bunched

**AC Transit Practice:** The District does not measure headway adherence, nor does it have a standard to measure against. However, as more Rapid Lines with headway-based schedules are introduced, the District has implemented various strategies designed to maintain an even headway on those lines. Thus far, these strategies have included:

- Use of transit signal technology (the system is designed to give priority to one schedule every ten minutes; if a second bus approaches an intersection in advance of that time span, that schedule will not be given priority)
- The use of end-of-the-line cameras, for remote monitoring of headways by radio in Central Dispatch
- On-site Transportation Supervisors

### **System**

While Segments and Corridors measures service delivery, System measures service design. The TCQSM specifically identifies travel time as the Comfort and Convenience factor to be studied from a System perspective. It is a well-known fact that transit

ridership increases as speed increases. This LOS measurement captures the desirability of transit with LOS A being faster than auto travel, while LOS F is significantly slower:

LOS	Travel Time Difference (min)	Comments
A	0	Faster by transit than auto
B	1-15	About as fast by transit as by auto
C	16-30	Tolerable for choice riders
D	31-45	Round trip at least one hour longer by transit
E	46-60	Tedious for all riders
F	>60	Unacceptable to most riders

**AC Transit Practice:** The District does not have a standard measurement or objective for travel time, but Policy 550 states that *AC Transit will aggressively pursue transit priority and transit preferential measures at the most important locations to improve street operation of the transit system, to decrease passenger travel times, to improve reliability and to reduce overall system operating costs (Guiding Principle 5).* The District does monitor average miles per revenue vehicle hour – and this measurement has declined over the last several years from 13.0 mph in 1990 to 11 mph in 2000.

### Next Review

This completes the initial review of the Transit Capacity and Quality of Service Manual as identified in GM Memo 05-022. Should the Board desire, upcoming reviews could include *Bus Capacity Fundamentals*, *Bus Priority Measures*, and *Bus Lanes and Grade Separated Facilities*. However, pursuant to direction from the Planning Committee concerning GM Memo 05-173a, now is the appropriate time for staff to begin work on a comprehensive report to the Board to include the following:

- Discussion of those concepts from the Transit Capacity and Quality of Service Manual that should be incorporated into District Policies or Operating Procedures
- Recommendations for any specific Board Policy revisions
- Recommendations for development or revision of Operating Procedures
- Recommendations for development or revision of Level of Service Standards
- Recommendations for development of procedures and standards to measure quality of service from the riders' point of view

### Prior Relevant Board Actions/Policies:

GM Memo 05-218: Part 3: Measuring Quality of Service

GM Memo 05-199: Part 3: Service Availability

GM Memo 05-173a: Part 3, Chapter 2: Quality of Service Factors

GM Memo No. 06-004

Subject: Transit Capacity and Quality of Service Manual: Part 3, Chapter 3: *Fixed Route Transit Service Measures*

Date: January 4, 2006

Page 8 of 8

GM Memo 05-137: Part 3: Chapter 4: Demand Responsive Transit Service

GM Memo 05-109: Part 3, Transit Decision-making

GM Memo 05-083: Part 3, Transit Performance Measures

GM Memo 05-062: Part 1 TCRP Manual

GM Memo 05-022: Review Timeline for Review of TCRP Manual

GM Memo 04-361: Overview of TCRP Manual

GM Memo 05-027: Designing with Transit

Board Policy 520 – Promoting Public Transit in Land Use Planning

Board Policy 550 – Service Standards and Design Policy

**Attachments:** None

**Approved by:** Rick Fernandez, General Manager  
Nancy Skowbo, Deputy General Manager, Service Development

**Prepared by:** Anthony Bruzzone, Manager of Service and Operations Planning

**Date Prepared:** December 29, 2005