

**PART 5
QUALITY OF SERVICE**

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1. INTRODUCTION

OVERVIEW

Quality of service reflects the passenger's perception of transit performance. It measures both the availability of transit service and its comfort and convenience. Quality of service depends to a great extent on the operating decisions made by a transit system, especially decisions on where transit service should be provided, how often and how long transit service should be provided, and what kind of service should be provided.

Quality of service reflects the passenger's perspective.

Part 5 of the *Transit Capacity and Quality of Service Manual* presents methods for measuring quality of service.

Organization of Part 5.

- *Chapter 1* discusses transit performance measures in general and differentiates passenger-based quality of service measures from other kinds of transit performance measures.
- *Chapter 2* examines the factors that enter into a potential rider's decision to use transit for a particular trip and introduces a framework for categorizing quality of service measures.
- *Chapter 3* presents level of service ranges for six quality of service measures addressing transit availability and quality for transit stops, route segments, and systems.
- *Chapter 4* discusses applications for the quality of service measures.
- *Chapter 5* contains references for material presented in Part 5 which may be consulted for further information regarding transit quality of service.
- *Chapter 6* presents example problems that apply quality of service measures to "real world" situations.

Definitions

In the North American transit industry, many definitions are not standardized or are specific to a particular transit system. Caution is needed with the terms *quality of service* and *level of service*, which carry a variety of meanings. *Level of service*, for example, is often used literally to mean the amount of service both in frequency and hours of coverage—the latter sometimes referred to as the "span" of service.

This manual uses the following definitions of transit performance measures, quality of service, service measures, and levels of service:

- *Transit Performance Measure*. A quantitative or qualitative factor used to evaluate a particular aspect of transit service.
- *Quality of Service*. The overall measured or perceived performance of transit service from the *passenger's* point of view.
- *Transit Service Measure*. A quantitative performance measure that best describes a particular aspect of transit service *and* represents the passenger's point of view. It is also known elsewhere as a *measure of effectiveness*.
- *Levels of Service*. Six designated ranges of values for a particular service measure, graded from "A" (best) to "F" (worst) based on a transit passenger's perception of a particular aspect of transit service.

The primary differences between performance measures and service measures are the following:

1. Service measures must represent the passenger's point of view, while performance measures can reflect any number of points of view.
2. In order to be useful to users, service measures should be relatively easy to measure and interpret. It is recognized, however, that system-wide measures will of necessity be more complex than bus stop or route segment measures.
3. Level of service (LOS) grades are developed only for service measures. However, transit operators are free to develop LOS grades for other performance measures, if those measures would be more appropriate for particular applications.

Indexes.

Indexes are a special form of performance measure that are developed by weighting two or more other performance measures. LOS grades may or may not be assigned to ranges of index values, depending on the application. Because the weighting systems used depend on local data and/or policy decisions, indexes are difficult to apply on a national basis and so are not used in this manual to develop service measures. However, indexes are discussed in Chapter 3 for the benefit of transit operators and planners who desire to develop measures with more detail than the basic quality of service measures presented in this manual.

Levels of Service

The selection of level of service thresholds for each of the service measures presented in this manual represent the collective professional judgment of the TCRP A-15 project team and panel. However, the LOS grades—in particular, LOS F—are not intended to set national standards. It is left to local transit operators and policy agencies to decide how to apply the LOS measures. To aid in this effort, this manual provides guidance on the changes in service quality perceived by passengers at each LOS threshold.

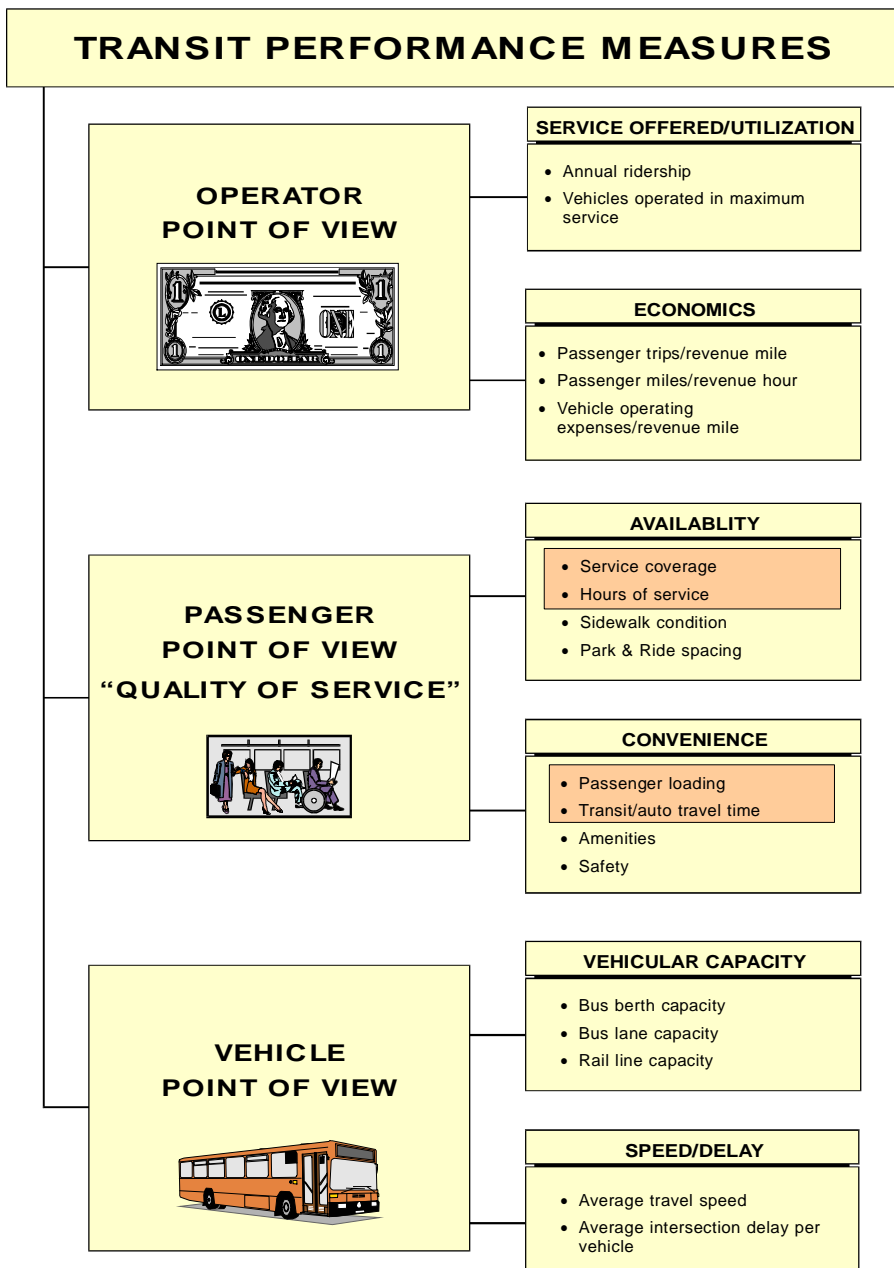
TRANSIT PERFORMANCE MEASURES

To get a sense of what quality of service is, it is useful to understand what it is not. Exhibit 5-1 illustrates one possible way that transit performance measures can be categorized and shows how quality of service fits into the spectrum of transit performance measures. TCRP Synthesis 10, “Bus Route Evaluation Standards”^(R2) is a useful compilation of a number of performance measures at both the transit route and system levels.

Operator point of view.

The *operator point of view* encompasses the measures routinely collected in the U.S. for the FTA's National Transit Database (formerly Section 15) annual reporting process. Most of these measures relate to economy or productivity. These measures are important to the operator—and indirectly to passengers—by reflecting the amount of service an operator can afford to provide on a route or the system as a whole. The productivity measures (e.g., ridership) indirectly measure passenger satisfaction with the quality of service provided. However, only two of these reported operator measures directly relate to the passenger's point of view: (1) actual vehicle revenue hours per directional mile and (2) vehicles operated in maximum service per directional mile. These measure the “amount” of service. The first is an overall system average, while the second is an average of the amount of service provided in the peak period (i.e., when maximum service is deployed).

Exhibit 5-1
Transit Performance Measure Categories and Examples



Performance Measures: Values without interpretation

Service Measures: Values grouped into LEVELS OF SERVICE, grading service quality from passengers' perspective

15 hr 28 trains/hr 21.2 km/hr ✓ shelter provided

19-24 hr	17-18 hr	14-16 hr	12-13 hr	4-11 hr	0-3 hr
A	B	C	D	E	F

Transit performance measures can represent the operator, passenger, or vehicle point of view.

Quality of service reflects the passenger point of view. Levels of service are developed for some of these important passenger performance measures.

Performance measures provide values without interpretation; service measures group values into levels of service based on the passenger's perspective. Service measures are a subset of performance measures.

Vehicle point of view.

The *vehicle point of view* includes measures of vehicular speed and delay routinely calculated for streets and highways using the procedures given in the *Highway Capacity Manual*. This point of view also includes measures of facility capacity in terms of the number of transit vehicles that can be accommodated. Because transit vehicles carry passengers, these measures also reflect the passenger's point of view: passengers on-board a transit vehicle traveling at an average speed of 20 km/h (12 mph) individually also experience this same average travel speed. However, because these vehicle-oriented measures do not take passenger loading into account, the passenger point of view is hidden because all vehicles are treated equally, regardless of the number of passengers in each vehicle. For example, while a single-occupant vehicle and a 50-passenger bus traveling on the same street may experience the same amount of delay due to on-street congestion and traffic signal delays, the person-delay experienced by the bus is 50 times as great as the single-occupant vehicle.

Passenger point of view.

The *passenger point of view*, or *quality of service*, directly measures passengers' perception of the availability, comfort, and convenience of transit service. As Exhibit 5-1 indicates, there are a number of possible performance measures that can be used. The measures that have been determined to best represent the passengers' perspective of transit availability, comfort, and convenience, yet are relatively easy to measure, have been selected as service measures, as shown by the darker tint. Level of service ranges developed for these and other service measures are presented in Chapter 3.

2. QUALITY OF SERVICE FRAMEWORK

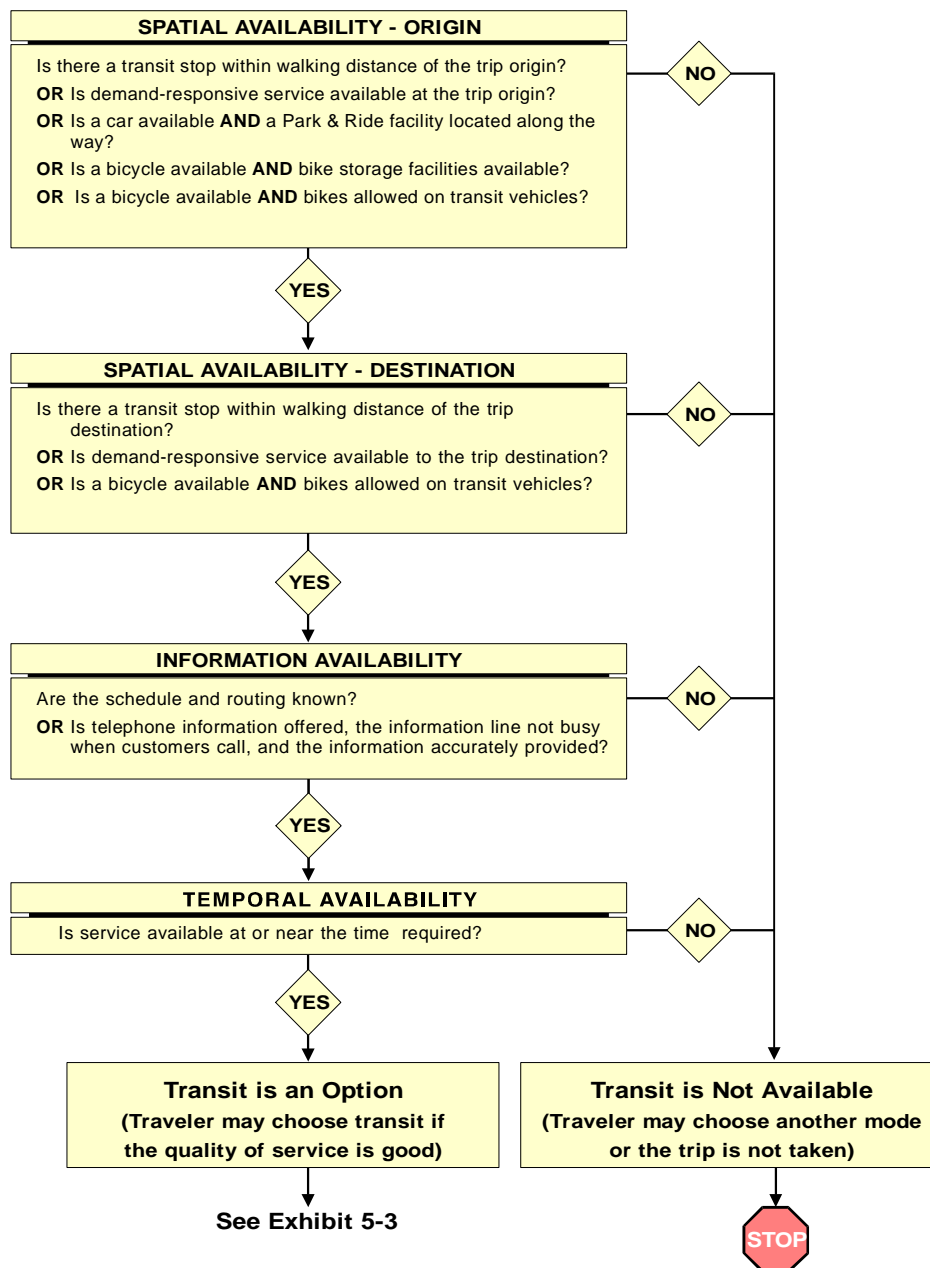
TRANSIT TRIP DECISION-MAKING PROCESS

Urban transport involves millions of individual travel decisions. Some are made infrequently—where to take a job, to locate a home outside an area with transit service, or to purchase a second car. Some decisions are made for every trip, through a two-step thought process similar to that illustrated in Exhibit 5-2 and Exhibit 5-3.

The first step in the process is to decide whether or not transit is a possibility for the trip. This step assesses the *availability* of transit service and is illustrated in Exhibit 5-2.

Exhibit 5-2
Transit Trip Decision-Making Process: Transit Availability

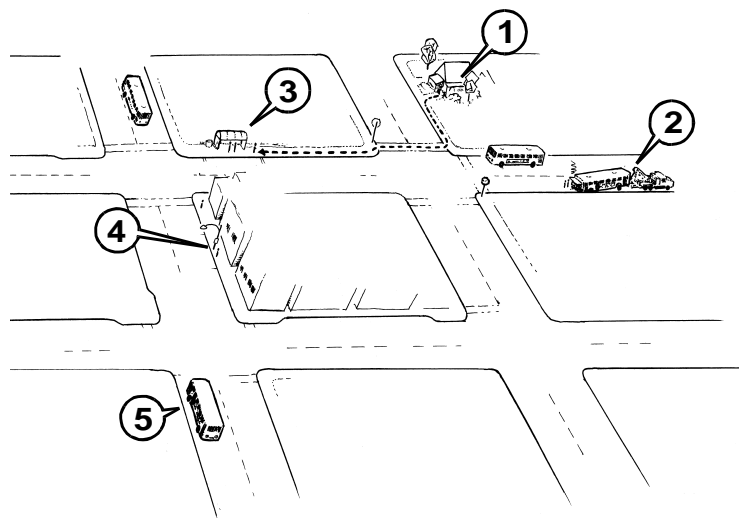
Step 1: Is transit service available to a potential passenger?



As Exhibit 5-2 indicates, there are a number of factors that enter into determining whether or not transit service is available. If any one of these factors is not met, transit is not a viable mode for the trip and the traveler will either use another mode or will not make the trip. If however, transit service is available at the trip origin and destination (or the traveler can use another mode to get to and from transit); if information is available on where, when, and how service is provided; and if transit service is provided at or near the time the trip needs to be made, then transit becomes an option. Assuming the latter is true, the decision-making process moves to step two, weighing the *comfort and convenience* of transit service against competing modes. This process is illustrated in Exhibit 5-3.

Step 2: If transit service is available, will a potential passenger find it convenient?

Exhibit 5-3
Transit Trip Decision-Making Process: Transit Convenience



1. How long is the walk? Are there sidewalks and pedestrian signals?
 2. Is the service reliable?
 3. How long is the wait? Is there a shelter at the stop?
 4. Are there security concerns—walking, waiting, or riding?
 5. How crowded is the vehicle? Are the vehicles and shelters clean?
- ❖ How much will the trip cost?
 - ❖ How many transfers are required?
 - ❖ How long will the trip take in total? How long relative to other modes?

Unlike the first decision, the kinds of questions weighed by a potential customer are not necessarily all-or-nothing. Each person has their own personal values that they apply to a given factor, and each person will “weigh” the factors shown above differently. Regular transit users familiar with the service may perceive transit service more favorably than non-users. In the end, the choice to use transit will depend on the availability of other modes and how the quality of transit service compares with those competing modes.

These factors relating to transit availability, comfort, and convenience are discussed in more detail in the next section.

QUALITY OF SERVICE FACTORS

Service Coverage

Whether or not transit service is provided near one's origin and destination is a key factor in the choice to use transit. Ideally, transit service is provided within a reasonable walking distance of one's origin and destination, or demand-responsive service is available to one's doorstep. The specifics of "reasonable walk" varies from source to source and depends on the situation: for example, people will walk farther to rail stations than to bus routes and the elderly do not walk as far as "average" adults. Potential barriers, such as wide or busy streets, hills, or an absence of pedestrian facilities, also play an important role. In general, 0.4 km (0.25 mi) or 5 minutes walk time is the limit of a bus route's typical "service area"; for a rail transit station, these figures can be doubled.^(R12)

If transit service is not provided near one's origin, other possible options include driving to a park-and-ride lot or riding a bicycle to transit. Both of these options require that the transit operator provide additional facilities (parking lots, bicycle storage facilities, and/or bicycle racks).

If transit service is not provided near one's destination, the choices are even more limited. The car one drove to a park-and-ride lot will not be available at the destination, nor will a bicycle left behind in a storage facility be available. A bicycle carried in a bicycle rack on a bus will be available at the destination, but a customer will need some degree of confidence that space will be available in the bike rack when the bus arrives. A small number of transit systems allow bicycles on-board transit vehicles (typically rail vehicles), but often not during peak commute hours or in the peak commute direction. A bicycle storage facility will also be required at one's destination and, probably (depending on the climate and the length of the ride), showers, lockers, and changing facilities.

Pedestrian Environment

Even if a transit stop is located within a reasonable walking distance of one's origin and destination, the walking environment may not be supportive of transit. Lack of sidewalks, poorly maintained sidewalks, lack of street lighting, and hills all discourage pedestrian travel. Wide or busy streets without signalized crosswalks at regular intervals, or without pedestrian refuges in the median, also discourage pedestrian travel. This latter factor in particular poses difficulties for transit operators providing service on arterial streets: the arterial street generally provides better transit vehicle speeds, but potential passengers using stops along the street must cross the street at some point during their round trip, either when they depart or when they return.

Passengers with disabilities must have sidewalk facilities, curb cuts, and bus stop loading areas between both their origin and a transit stop and between their destination and a transit stop in order to have the ability to access fixed-route transit service. In the U.S., new or improved facilities must meet Americans with Disabilities Act (ADA) standards. Without these facilities, passengers with disabilities must rely on paratransit service, which generally provides customers with fewer choices in travel times, and usually costs substantially more for transit operators to provide service.

Scheduling

How often transit service is provided and when it is provided are important factors in one's decision to use transit. The more frequent the service, the shorter the wait time when a bus or train is missed or when the exact schedule is not known, and the greater the flexibility customers have in selecting travel times. The number of hours during the day when service is provided is also highly important: it does not matter whether a transit stop is located within walking distance if service is not provided at the times one desires to travel—transit will not be an option for that trip.

If transit service is located too far away from a potential passenger, transit use is not an option.

Driving or biking to transit may be an option if transit service is beyond walking distance.

Service coverage must consider both ends of a trip.

Even if transit service is theoretically located within walking distance of one's origin and destination, the areas around the transit stops must provide a comfortable walking environment in order for transit to be available.

Transit service must be available near the time a trip needs to be made in order for transit to be an option for that trip.

Transit stop amenities make transit service more comfortable and convenient for passengers.

The kinds of amenities provided are generally related to the number of boarding passengers at a stop.

Riders need to know where and when transit service is available and how to use it.

Requiring transfers can make service more efficient for operators, but is less convenient for passengers.

Amenities

The facilities that are provided at transit stops and stations help make transit more comfortable and convenient to customers. Typical amenities, some of which were illustrated in Exhibit 4-3, include the following:^(RS)

- *Benches*, to allow passengers to sit while waiting for a transit vehicle.
- *Shelters*, to provide protection from wind, rain, and snow in northern climates and from the sun in southern climates. In cold climates, some operators provide pushbutton-operated overhead heaters at shelters located at major transit centers.
- *Informational signing*, identifying the routes using the stop, their destinations (both intermediate and ultimate), and/or scheduled arrival times.
- *Trash receptacles*, to reduce the amount of litter around the transit stop.
- *Telephones*, to allow passengers to make personal calls while waiting for a transit vehicle, as well as providing for the ability to make emergency calls.
- *Vending facilities*, ranging from newspaper racks at commuter bus stops to manned newsstands, flower stands, food carts, transit ticket and pass sales, and similar facilities at rail stations and bus transfer centers.
- *Air conditioning* on-board transit vehicles, to provide a comfortable ride on hot and humid days.

Transit operators usually link the kinds of amenities at a stop to the number of daily boarding riders at that stop. TCRP Report 19^(RS) provides guidelines for installing various kinds of transit amenities.

Transit Information

Potential riders need to know where and when transit service is available before they can begin using it. Regular riders need to be informed about service changes that will affect them. This information can be provided by a variety of means:

- *Printed maps, schedules, and brochures* that passengers can take with them, available on-board transit vehicles, at transit facilities, and at local businesses.
- *Posted information* on-board vehicles and at transit facilities. As transit systems adopt automatic vehicle location (AVL) systems, it is becoming feasible to display real-time schedule information on-board buses, at bus stops, and at bus terminals
- *On-board announcements* of major transit stops assist not only the visually impaired, but passengers unfamiliar with a route or area.
- *Telephone information* available at times that are convenient to potential passengers (including weekends and evenings).
- *Personal computers* can be used to access transit information via the Internet, and to subscribe to e-mail lists that automatically send service change and other announcements to persons on the list.

Transfers

Requiring transfers between routes adds to a passenger's total trip time by transit, although this can be minimized by implementing timed transfers. It also raises the possibility that a missed connection will occur, which would further increase the length of the transit trip. Transfers increase the complexity of a transit trip to a first-time passenger, as well. Requiring a surcharge for transfers can inhibit ridership.

Total Trip Time

Total trip time includes the travel time from one's origin to a transit stop, waiting time for a transit vehicle, travel time on-board a vehicle, travel time from transit to one's destination, and any time required for transfers between routes during the trip. The importance of each of these factors varies from person to person. Some persons will view the trip as an opportunity for exercise during the walk to transit and for catching up on reading or work while on transit. Other persons will compare the overall door-to-door travel time of a trip by transit to the time for the same trip by private automobile. Waiting time at a transit stop may seem longer than the equivalent amount of time spent walking or on-board a vehicle. In general, both the absolute travel time and the travel time in relation to competing modes will be factors in a potential passenger's choice to use transit.

Total trip time is influenced by a number of factors, including the route spacing (affecting the distance required to walk to transit), the service frequency (affecting wait time), and the frequency of stops, traffic congestion, signal timing, and the fare-collection system used (affecting travel time on-board a transit vehicle).

Cost

Potential passengers weigh the cost and value of using transit versus the out-of-pocket costs and value of using other modes. Out-of-pocket transit costs consist of the cost of the fare for each trip, or the cost of a monthly pass, while out-of-pocket automobile costs include road and bridge tolls and parking charges. Other automobile costs, such as fuel, maintenance, insurance, taxes, and the cost of buying an automobile generally do not occur for individual trips and thus generally do not enter into a person's consideration for a particular trip. Thus, if a person does not pay a toll to drive someplace and free parking is provided at the destination, transit will be at a disadvantage because there will be no immediate out-of-pocket cost for driving, while there will be for transit. Some *Transportation Demand Management* (TDM) techniques seek to overcome this obstacle by encouraging employers who provide free parking (in effect subsidizing the true cost of providing parking) to also provide subsidized transit passes or other means of encouraging transit use as an alternative to the private automobile.

Safety and Security

Riders' perceptions of the safety and security of transit, as well as actual conditions, enter into the mode choice decision. Not only is personal safety considered, relating to potential transit crime and vehicular crashes, but personal irritants are considered as well, such as encountering unruly passengers on a regular basis or having to listen to someone else's radio. Security at transit stops can be improved by placing stops in well-lit areas and by having public telephones available for emergency calls. Transit systems use a variety of methods to enhance security on-board transit vehicles, including having uniformed and plainclothes police officers ride transit, establishing community volunteer programs, providing two-way radios and silent alarms for emergency communication, and using video cameras.

Passenger Loads

Transit is less attractive when passengers must stand for long periods of time, especially when transit vehicles are highly crowded. When passengers must stand, it becomes difficult for them to use their travel time productively, which eliminates a potential advantage of transit over the private automobile. Crowded vehicles also slow down transit operation, as it takes more time for passengers to get on and off. Most transit agencies assess the degree of passenger crowding on a transit vehicle based on the occupancy of the vehicle relative to the number of seats, expressed as a *load factor*. A factor of 1.0 means that all of the seats are occupied. The importance of vehicle loading

A longer trip by transit than by automobile may be seen by passengers as being less convenient; this may be mitigated somewhat if the on-board transit time can be used productively where the in-car time would not be.

Free parking at a worksite is a disincentive to transit use.

Passengers' perceptions of safety must be considered in addition to actual conditions.

The ability to find a seat on a transit vehicle is an important passenger comfort factor for longer trips.

varies by the type of service. In general, transit provides load factors at or below 1.0 for long-distance commute trips and high-speed mixed-traffic operations. Inner-city service may approach 2.0 or even more, while other services will be in between. Because the number of seats provided varies greatly between otherwise identical rail vehicles operated by different transit systems, *passengers per unit vehicle length* is being applied more often for rail capacity calculations than load factors.

Appearance and Comfort

Having clean, graffiti-free transit stops, stations, and vehicles improves transit's image, even among non-riders. Some transit systems (for example, Bay Area Rapid Transit in the San Francisco Bay Area, Housatonic Area Regional Transit in Danbury, CT, and the Tidewater Transportation Commission in Norfolk) have established standards for transit facility appearance and cleanliness and have also established inspection programs.^(R5,R19) Passengers are also interested in ride comfort, which includes both seat comfort and the severity and amount of acceleration and deceleration (both lateral and longitudinal).

Reliability

Reliability affects the amount of time passengers must wait at a transit stop for a transit vehicle to arrive, as well as the consistency of a passenger's arrival time at a destination from day to day. Reliability encompasses both on-time performance, as well as the regularity of headways between successive transit vehicles. Uneven headways result in uneven passenger loadings, with a late transit vehicle picking up not only its regular passengers but those passengers that have arrived early for the following vehicle, with the result that the vehicle falls farther and farther behind schedule and more passengers must stand. In contrast, the vehicles following will have lighter-than-normal passenger loads and will tend to run ahead of schedule. With buses, this "bunching" phenomenon is irritating both to passengers of the bunched buses, as well as to passengers waiting for other buses, who see several buses for another route pass by while they wait for their own bus. With signaled rail operations, bunched trains often have to wait at track signals until the train ahead of them moves a safe distance forward. The resulting unscheduled waits are not popular with passengers, particularly when no on-board announcements are given explaining the delay.

Reliability is influenced by traffic conditions (for on-street, mixed-traffic operations), vehicle maintenance and staff availability (reflecting whether a vehicle can leave the garage or is likely to break down on the road), and by how well vehicle operators adhere to schedules.

CUSTOMER SATISFACTION SURVEYS

Passenger surveys can help transit systems identify areas where improvements are needed to enhance customer satisfaction with transit service. These surveys can identify not only areas of existing passenger dissatisfaction, but areas where passengers would be strongly dissatisfied if areas that are currently performing well were to decline in performance in the future. Thus, these surveys can help identify the quality of service factors of greatest importance to transit riders.

The TCRP B-11 project, "Customer-Defined Transit Service Quality"^(R10) was a study that defined the elements of a transit operation that are the most important to customers. Although the study's intent was to develop an easy-to-use system for transit operators to identify the most important customer-service issues affecting their system, the pilot tests the project performed help identify some of the factors important to transit riders, regardless of the system.

The TCRP B-11 project selected an urban rail system, a suburban bus system, and a small city bus system for its pilot tests, and distributed more than 13,000 surveys, with

Reliability includes both on-time performance and the evenness of headways between transit vehicles.

Customer surveys help transit operators identify the quality of service factors of greatest importance to their customers.

response rates ranging from 33.6% to 46.3%. The project also conducted a sampling of follow-up phone surveys. The surveys asked riders to rate 46 transit system attributes on a scale of 1-10 and to identify whether they had experienced a problem with that attribute within the last 30 days.

For ease of comparison, the 46 surveyed attributes can be grouped into the following nine categories: comfort, nuisances, scheduling, fares, cleanliness, in-person information, passive information, safety, and transfers. When analyzing the top 10 attributes that were existing problems, scheduling was the top area of concern, followed by comfort and nuisances. However, when potential problems were analyzed, fares and scheduling were the top concern, followed by comfort and safety, with nuisances the category with the least potential for high levels of concern.

The Florida Department of Transportation (FDOT) commissioned a survey of customer satisfaction factors for six larger Florida transit systems.^(R3) As with the TCRP B-11 survey, the FDOT survey sought to identify both existing problems and potential problems. A total of over 14,500 surveys were returned from the six systems, representing response rates of up to 28%. The surveys covered 22 factors, including hours of service, frequency of service, convenience of routes, on-time performance, travel time, transferring, cost, information availability, vehicle cleanliness, ride comfort, employee courtesy, perception of safety, bus stop locations, and overall satisfaction.

Existing problems of greatest significance to customers in Florida were hours of service, routes, and headways. Potential problems of greatest significance were routes and headways, service span, bus ride comfort, printed schedules, and safety and cleanliness.

TRANSIT SYSTEM SIZE CONSIDERATIONS

In measuring transit quality of service, the size of the city, metropolitan area, “commutershed,” or transit service area may need to be taken into account. A small city could regard transit service on a route every 30 minutes for 12 hours per day, six days per week to be good. In a large transit system, good service could require service at least every 10-15 minutes, 18 hours a day, seven days a week. However, these determinations of “good service” are based as much on passenger demand and the realities of transit operating costs as they are on passengers’ perceptions of service quality.

The question naturally arises, should there be different levels of service for different size areas? From purely a passenger’s perspective, which quality of service is based upon, the answer is “no”: a one-hour headway between buses is just as long for a passenger in a small town as it is for a passenger in a large city. Therefore, no distinction has been made in the levels of service presented in Chapter 3 to account for area population. (The consequences of providing a one-hour headway, though, do vary by city size and are reflected by other measures, such as passenger loads. These consequences will be more severe in a large city than in a small city.)

From an operator’s standpoint, however, there are significant differences between small towns and large cities, particularly in passenger demand volumes and available funding levels. These differences can be accounted for in the way transit agencies apply the levels of service: a small city agency may set a service frequency goal of LOS E, while a large city agency may set a service frequency target of LOS C. The measure used to determine level of service is the same in both cities; the difference is that one agency sets a higher standard than the other in order to meet its service area’s greater needs.

Level of service ranges are not adjusted to reflect differences in city sizes, but different operators may wish to set different LOS targets.

FRAMEWORK

Chapter 3 divides quality of service measures into two main categories: *availability* and *quality*. The availability measures address the spatial and temporal availability of transit service. If transit is located too far away from a potential user or if it does not run at the times a user requires the service, that user would not consider transit service to be available and thus the quality of service would be poor. Assuming, however, that transit service is available, the quality measures can be used to evaluate a user’s perception of the comfort and convenience of his or her transit experience.

Different elements of a transit system require different performance measures. The following categories are used in Chapter 3:

- *Transit Stops*. Measures addressing transit availability and convenience at a single location. Since these measures depend on passenger volumes, scheduling, routing, and stop and station design, performance measures in this category will vary from one location to another.
- *Route Segments*. Measures that address availability and convenience along a portion of a route, which can range from two stops to the entire length of a route. These measures will tend to stay the same over the length of a route segment, regardless of conditions at an individual stop.
- *Systems*. Measures of availability and convenience for more than one route operating within a specified area (e.g., a district, city, or metropolitan area) or of a specified type (e.g., fixed-route vs. demand-responsive). System measures can also address door-to-door travel.

Combining the two performance measure categories with the three transit system elements produces the matrix shown in Exhibit 5-4. Service measures presented in Chapter 3 are shown in capital letters, while other performance measures discussed in Chapter 3 are shown in lower case.

Exhibit 5-4
Quality of Service Framework

Category	Service & Performance Measures		
	Transit Stop	Route Segment	System
Availability	FREQUENCY accessibility passenger loads	HOURS OF SERVICE accessibility	SERVICE COVERAGE % person-minutes served indexes
Quality	PASSENGER LOADS amenities reliability	RELIABILITY travel speed transit/auto travel time	TRANSIT/AUTO TRAVEL TIME travel time safety

Some measures appear in more than one cell of the table, but only one service measure is assigned to each cell, representing the performance measure that best represents the passenger’s point of view of availability or convenience for a particular transit element. In many cases, though, it may be helpful to combine the service measures into a kind of transit “report card” that compares several different aspects of transit service at once. An example problem in Chapter 6 illustrates this concept.

Availability

Transit Stops

The spatial aspect of transit availability at a transit stop is a given, since the stop exists. During a typical hour-long analysis period, hours of service is also a given—either transit service exists or it does not. Therefore, *frequency* is identified as the service measure for this category.

Performance measures in CAPITAL LETTERS have corresponding levels of service in Chapter 3. Other measures shown are discussed in Chapter 3, but do not have levels of service associated with them.

Although not so easy to quantify, transit stop *accessibility* by foot, bicycle, or automobile is also an important measure of transit availability, and persons with disabilities require special consideration. *Passenger loads* determine whether there is room on a transit vehicle for additional passengers to board, which is yet another aspect of transit availability.

Route Segments

Of the three primary measures of transit availability—frequency, hours of service, and service coverage—frequency has already been used for transit stops, while service coverage is a given, since the route exists. Therefore, *hours of service* is identified as the service measure. This selection is an appropriate one, since more than one route, each operating with different frequencies and travel times, can serve the same origins and destinations. In these cases, the total span of time during which a given pair of origins and destinations can be accessed is of greatest interest.

As with transit stops, *accessibility* to transit routes by foot, bicycle, automobile, and wheelchair is important. Because pedestrian and bicycle access can vary significantly from one stop to the next along a route, access by these modes is better addressed on a stop-by-stop basis. In contrast, in the same amount of time it takes to walk or bike to a stop, motorists can choose among several stops to park and get onto transit. As long as one of these stops meets a motorist's needs, that person has access to transit. The vehicle equipment used along a route helps determine whether or not fixed-route transit service is available to persons with disabilities. All new U.S. transit buses must meet ADA requirements, but older buses in a fleet might not.

System

System availability measures look at how many people have access to transit and how often. *Service coverage* within the “transit-supportive area”—the portion of an analysis area with a population and/or job density sufficiently high to support at least hourly bus service (equivalent to service frequency LOS E)—is identified as the service measure. Service coverage determines how many people within the transit service area have any access to transit. Once the areas that have service have been identified, frequency and hours of service can be used to determine the amount of service within smaller areas.

The combination of frequency, hours of service, and service coverage together provide a reasonable “planning level” assessment of the availability of transit service, requiring a minimum of data collection and analysis. However, if a more detailed “operations level” assessment is desired, there are other, more data-intensive, performance measures to choose from, including calculating *percent person-minutes served* in an area and developing *indexes* of transit availability.

Quality

Transit Stops

Whether or not one can find a seat on a transit vehicle is an important measure of transit quality. *Passenger loads*, the selected service measure, also influences boarding and alighting times, which in turn affect total dwell time and the capacity of transit routes. The kinds of *amenities* provided at transit stops is another aspect of transit quality, but is not a service measure because it is so highly dependent on the daily boarding passenger volumes at a given stop: achieving better levels of service would require installing facilities that might not be justified economically. *Reliability* is a third measure of quality at a transit stop, but this measure also applies to a transit route and will tend to have consistent values for a series of stops along a route segment.

Route Segments

Reliability is identified as the service measure because it not only measures an aspect of service quality important to users—whether or not they get to their destination on time—but because it also affects other service measures. If transit vehicles arrive in a bunch, or not at all, the effective service frequency is reduced. Late vehicles also have higher passenger loads, as they pick up not only their regular passengers, but those passengers who have arrived early for the following vehicle.

Other measures of transit quality on a route segment are the *transit/auto travel time difference* (identified as the system service measure) and *travel speed*, both of which relate to the time it takes to make a trip by transit. Travel speed is also important to transit operators: if bus speeds, for example, can be increased sufficiently along a higher-frequency route that a time savings of one headway results, the number of buses required to operate the route can decrease, along with operating costs.

System

The *transit/auto travel time difference*—the absolute difference in travel time from one's origin to one's destination by automobile and by transit—is an important factor in a passenger's decision to use transit. On a system-wide basis, this measure can be calculated by sampling a selection of locations and trip purposes within the analysis area, or by using a transportation planning model that can calculate trip times for all combinations of origins and destinations by transit and by automobile, for a variety of trip purposes.

An alternative performance measure is *travel time*, which is useful for indicating when higher-speed service (such as limited stop or express service) should be considered between two locations. Since travel time varies depending on the size of a community and the amount of traffic congestion (for transit modes operating in mixed traffic), travel time is not suitable as a service measure without creating many different categories of city sizes. *Safety*—both in terms of transit vehicle accident rates and transit crime—affects the image of the entire transit system and is another system-wide quality measure.

3. QUALITY OF SERVICE MEASURES

INTRODUCTION

This chapter presents transit quality of service measures of transit availability and convenience for transit stops, route segments, and systems, as well as other performance measures that transit operators and planners may want to consider for specific applications. Although each combination of quality of service category and transit system elements has only one service measure, analysts may find it useful to combine measures into a transit “report card” in order to better compare a number of quality of service aspects of various alternatives. An example of this is provided in the example problems.

Each quality of service measure has been divided into six levels of service, representing ranges of values for a particular service measure. The following considerations entered into the development of the transit level of service (LOS) system:

1. *The transit LOS system should use an A-F scale.* A survey of transit operators, cities, counties, metropolitan planning organizations, state departments of transportation, and transit professionals conducted for the TCRP A-15 project found a preference for this system.^(R4) The benefits of this system are two-fold: (1) decision-makers are already familiar with the A-F scale for highways presented in the *Highway Capacity Manual*, and (2) much of the public is familiar with the A-F scale used for report cards.
2. *The LOS ranges should reflect a user’s point-of-view.* LOS A, therefore, is not necessarily representative of optimum conditions from a transit operator’s point-of-view.
3. *LOS F should represent an undesirable condition from a user’s point-of-view.* A transit operator may choose to set higher standards based on their needs or policy goals.
4. *The thresholds for LOS A-E should represent points where a noticeable change in service quality occurs.* As a secondary consideration, it is also desirable to have evenly-spaced ranges of values for each LOS grade, to the extent possible.

Thresholds for the levels of service presented in this section were derived from the TCRP A-15 project. Where appropriate, descriptions of the changes in conditions that occur at LOS thresholds are provided with each service measure.

MEASURES OF AVAILABILITY

Transit Stops

Frequency

From the user’s perspective, frequency determines the number of times an hour a user has access to the transit mode, assuming that transit service is provided within acceptable walking distance (measured by *service coverage*) and at the times the user wishes to travel (measured by *hours of service*). Service frequency also measures the convenience of transit service to choice riders and is one component of overall transit trip time (helping to determine how long one waits for a transit vehicle).

Because of the different characteristics of urban scheduled transit service, paratransit service, and intercity scheduled transit service, different measures are used to define LOS for each kind of service, as described below. Frequency LOS can vary by time of day or week: for example, a service may operate at LOS B during peak hours, LOS D midday, and LOS F at night. Similarly, paratransit service may operate at LOS D on weekdays, but at LOS F on weekends if no service is offered.

Level of service considerations.

Level of service measures presented in this chapter generally include a description of the change in conditions that occurs at each LOS threshold.

Urban scheduled transit service includes deviated fixed-route bus service. Commuter rail is treated as intercity scheduled transit service.

Headway determines service frequency LOS for urban scheduled transit service.

Urban Scheduled Transit Service

Urban scheduled transit service includes all scheduled service within a city, as well as service between cities within a larger metropolitan area. Deviated-route bus service is included in this category, because the basic service is scheduled, even if specific stops are not. Commuter rail is considered as intercity scheduled transit service, discussed below, for the purposes of determining LOS.

The service frequency LOS measure for urban scheduled transit service is *headway*; however, for convenience, Exhibit 5-5 lists LOS both by headway and by the corresponding number of vehicles per hour. It should be emphasized that although headways are given as continuous ranges for the purposes of determining LOS, passengers find it easier to understand schedules when clock headways are used (headways that are evenly divisible into 60). When clock headways are used, transit vehicles arrive at the same times each hour.

Service frequency LOS is determined by destination from a given transit stop, as several routes may serve a given stop, but not all may serve a particular destination. Some judgment must be applied to bus stops located near timed transfer centers. There is a considerable difference in service from a passenger’s perspective between a bus arriving every 10 minutes and three buses arriving in a row from a nearby transfer center every 30 minutes, even though both scenarios result in six buses per hour serving the stop. In general, buses on separate routes serving the same destination that arrive at a stop within 3 minutes of each other should be counted as one bus for the purposes of determining service frequency LOS.

Exhibit 5-5
Service Frequency LOS: Urban Scheduled Transit Service

LOS	Headway (min)	Veh/h	Comments
A	<10	>6	Passengers don't 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 hour
F	>60	<1	Service unattractive to all riders

At the service frequencies of LOS A, passengers are assured that a transit vehicle will arrive soon after they arrive at a stop. The delay experienced if one misses a vehicle is low. At LOS B, service is still relatively frequent, but passengers will consult schedules to minimize their wait time at the transit stop. Service frequencies at LOS C still provide a reasonable choice of travel times, but the wait involved if a bus or train is missed becomes long. At LOS D, service is only available about twice an hour and requires passengers to adjust their routines to fit the transit service provided. The threshold between LOS E and F is service once an hour; this corresponds to the typical analysis period and to the minimum service frequency applied when determining hours of service LOS. Service at frequencies greater than one hour entails highly creative planning or considerable wasted time on the part of passengers.

Paratransit Service

Paratransit includes all unscheduled transit service where service is obtained by notifying the service provider that a pick-up is desired. However, as noted above, deviated fixed-route service is evaluated using the urban scheduled transit service procedures, since the basic service is scheduled.

The measure of service frequency for paratransit service is *access time*, the minimum amount of time from when a passenger first requests service to the time a pick-up can be

Service frequency LOS is measured by access time.

guaranteed to occur, as shown in exhibit 5-6. Therefore, access time for *standing reservations*—where passengers are picked up every day at a given time, unless the service provider is notified otherwise—is calculated for the situation when a request for service is first made.

Exhibit 5-6
Service Frequency LOS: Paratransit Service

LOS	Access Time (h)	Comments
A	0.0-0.5	Fairly prompt response
B	0.6-1.0	Acceptable response
C	1.1-2.0	Tolerable response
D	2.1-4.0	Poor response, may require advance planning
E	4.1-24.0	Requires advance planning
F	>24.0	Service not offered every weekday or at all

Paratransit service frequency at LOS A levels provides a ride within a half-hour of the request, minimizing the wait time after one decides to make a trip. At LOS B and C, the wait time increases, but travel still requires little or no planning on the part of the passenger. At LOS D, same-day round-trip service is still possible, but generally requires some planning on the part of the passenger. The threshold between LOS E and F is one day’s advance notice for obtaining a ride. At LOS F, service is only available a few days a week or not at all.

Intercity Scheduled Transit Service

Transportation services between communities can be just as important as services within communities, especially for rural communities where medical, educational, and other services may not be readily available. Intercity transportation services, whether bus, train, or ferry, help fill these mobility needs by linking smaller communities to larger communities and to other transportation modes. A number of states recognize rural mobility needs by incorporating goals for minimum intercity service levels in their statewide transportation plans.

The number of *trips per day* between one community and another establishes the level of service for intercity service, as shown in exhibit 5-7.

Exhibit 5-7
Service Frequency LOS: Intercity Scheduled Transit Service

LOS	Trips/Day	Comments
A	>15	Numerous trips throughout the day
B	12-15	e.g., midday and frequent peak hour service
C	8-11	e.g., midday or frequent peak hour service
D	4-7	Minimum service to provide choice of travel times
E	2-3	Round trip in one day is possible
F	0-1	Round trip in one day is not possible*

*Technically, a round trip might be possible, but the transit vehicle would likely return to its origin soon after arriving at its destination, not allowing any time for errands.

At LOS A, passengers have many choices of travel times and have a relatively short wait for the next trip if one bus or train is missed. Service at LOS B and C still provides a good range of travel times, but involves longer waits when a vehicle is missed. At LOS D, only a few trips per day are made between the communities, but one is not forced to wait the entire day at one’s destination for the return trip. The threshold between LOS E and F is a minimum of two round trips per day, allowing a return to one’s origin the same day, with sufficient time in the destination city for the trip to be useful. With just one round trip a day (LOS F), a transit vehicle would likely return to its origin soon after arriving, not allowing time for one to do anything useful in the destination community, and still return home that day.

Intercity transportation services help fill the mobility needs of smaller communities.

Intercity service frequency LOS is measured by trips per day.

Exhibit 5-7 also applies to commuter rail service.

Other Measures

Accessibility

Pedestrian, bicycle, automobile, and ADA access to transit is difficult to quantify, but important to consider as part of transit availability.

Pedestrian, bicycle, automobile, and ADA accessibility to transit stops is difficult to quantify. An evaluation of pedestrian accessibility should consider whether or not sidewalks are provided; the condition of the sidewalks; terrain; traffic volumes on streets that pedestrians must cross to access a transit stop and the kind of traffic control provided on those streets; and whether out-of-direction travel is required. One possible measure could be pedestrian travel time to a stop from a point 0.4 km (0.25 mi) away, with different walking times assigned to different walking environments, and accounting for the delays involved with (1) waiting for a WALK indication at signalized intersections and (2) waiting for a sufficiently large gap in traffic to walk across a street at an unsignalized intersection. The *Manual on Uniform Traffic Control Devices*^(R7) and the *ITE Manual of Transportation Engineering Studies*^(R14) provide guidance on pedestrian travel speeds and assessing gaps in traffic.

ADA accessibility to transit.

Garrity and Eads^(R9) provide a method for assessing the ADA accessibility of bus stops and the routes leading to bus stops. (As the ADA regulations may change in the future, this method should be used for guidance in developing accessible routes for bus stops, but the current version of the regulations should be relied upon for determining legal compliance with the ADA.)

Bicycle accessibility.

Bicycle access should consider the availability and condition of bicycle facilities on the roadways leading to transit stop, traffic volumes on the roadways leading to transit stops, the provision of bicycle racks on buses and whether demand exceeds bus rack capacity, provision of bicycle storage lockers at high-volume boarding locations, and the ability to take bicycles onto rail vehicles during peak periods.

Automobile accessibility.

Automobile access should consider the capacity of park-and-ride or transit station parking lots relative to demand and the pedestrian environment within parking lots and between lots and the transit stop. For transit systems that use a zone-based fare system, consideration should be given to the parking requirements of transit stops located near a zone boundary where a drop in fare occurs, as passengers often drive to the first stop or station past the zone boundary to take advantage of the lower fare.

Passenger Loads

Passenger loads can be a transit availability concern when too few vehicles are scheduled, or at locations with strong passenger peaking characteristics.

Although passenger loads are generally more of a comfort and convenience factor than a transit availability factor, when a transit vehicle is full when it arrives at a stop, passengers waiting at the stop are unable to board and transit service is not available to those passengers at that time. Transit vehicle scheduling should provide sufficient frequency along routes to accommodate peak passenger demand volumes without having to pass up waiting passengers. Special consideration should be given to providing sufficient transit vehicles to locations with strong peaking characteristics (such as airports, sports stadiums, or concert venues), when many people will wish to board transit vehicles at the same time. Unusual weather conditions, such as snow and ice in some areas, can cause people who normally drive to use transit instead, resulting in overcrowded conditions. However, these conditions are difficult to try to plan for.

Route Segments

Hours of Service

Hours of service, also known as “service span,” is simply the number of hours during the day when transit service is provided along a route, a segment of a route, or between two locations. It plays as important a role as frequency and service coverage in determining the availability of transit service to potential users: if transit service is not provided at the time of day a potential passenger needs to take a trip, it does not matter where or how often transit service is provided the rest of the day.

Hours of service LOS, given in Exhibit 5-8, is measured similarly for fixed-route and paratransit services. For fixed-route service, LOS is based on the number of hours per day when transit service is provided at least once an hour (corresponding to a minimum LOS E for service frequency and compatible with a typical one-hour analysis period). For paratransit service, LOS is based on the number of hours per day when service is offered. As with frequency, hours of service LOS can vary by day: weekdays a route may operate at LOS B, Saturdays at LOS D, and Sundays at LOS F. Hours of service LOS is intended only for transit service provided within cities; intercity service should use only the frequency LOS measure, which is based on the number of trips provided per day.

Hours of service LOS is based only on those hours when service is offered at a minimum one-hour frequency.

Calculation Examples

To calculate hours of service, for each period of time that transit operates at a frequency of at least one hour, subtract the departure time of the last run from the departure time of the first run and add one hour. Round down any fractional hours.

Peak hour service. A bus route operates peak hours only, with trips in each direction at 6:30 a.m., 7:30 a.m., 4:30 p.m. and 5:30 p.m. Service is hourly between 6:30 and 7:30 a.m. and between 4:30 and 5:30 p.m., with four total hours of service (7:30 minus 6:30 is one hour and add one hour; 5:30 minus 4:30 is one hour and add one hour; the total is four hours). If service was provided in the peak direction only at the times given, the total hours of service for each direction would be two.

Limited daytime service. A bus route operates hourly between 5:30 a.m. and 8:30 a.m., every two hours between 8:30 a.m. and 4:30 p.m., and hourly between 4:30 p.m. and 7:30 p.m. The total hours of service is eight (8:30 minus 5:30 is three hours and add one hour; 7:30 minus 4:30 is three hours and add one hour; the total is eight hours.) Although the bus route operates during the middle of the day, it does not operate at a minimum one-hour frequency; therefore, this time is not counted.

Early evening service. A bus route operates every half-hour between 5:30 a.m. and 8:00 p.m. The total hours of service is 15 (20:00 minus 5:30 is 14.5, round down to 14, and add one hour).

Exhibit 5-8
Hours of Service LOS

LOS	Hours per Day	Comments
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/limited midday service
F	0-3	Very limited or no service

Fixed route: number of hours per day when service is provided at least once an hour.
Paratransit: number of hours per day when service is offered.

At LOS A, service is available for most or all of the day. Workers who do not work traditional 8-5 jobs receive service and all riders are assured that they will not be stranded until the next morning if a late-evening transit vehicle is missed. At LOS B, service is available late into the evening, which allows a range of trip purposes other than commute trips to be served. Transit runs only into the early evening at LOS C levels, but still provides some flexibility in one's choice of time for the return trip home. Service at LOS D levels meets the needs of commuters who do not need to stay late, and still provides service during the middle of the day for others. At LOS E, midday service is limited or non-existent and commuters have a limited choice of travel times. Finally, at LOS F, transit service is offered only a few hours a day or not at all.

Other Measures

Accessibility

The same accessibility considerations that apply to transit stops also apply to route segments. A potential measure of pedestrian, bicycle, and ADA accessibility for a route segment could include the percentage of transit stops along the segment that meet certain accessibility criteria. Automobile access should also consider the frequency of park-and-ride lots along a route, to minimize the amount of vehicle miles traveled on the area's roadway system by motorists traveling to transit.

System

Service Coverage

Service coverage is a measure of the area within walking distance of transit service. As with the other availability measures, it does not provide a complete picture of transit availability by itself, but when combined with frequency and hours of service, it helps identify the number of opportunities people have to access transit from different locations. Service coverage is solely a system measure: at the route segment or transit stop level, if transit service is provided, obviously coverage exists in that area or at that location.

Since it is a system-wide measure, service coverage LOS takes more time to calculate and requires more information than do the transit stop and route segment LOS measures. This task can be simplified through the use of a geographic information system (GIS). However, this section also provides a calculation method that does not require a GIS.

One measure of service coverage is route kilometers per square kilometer (or route miles per square mile). This measure is relatively easy to calculate, but does not address on a system-wide basis how well the areas that generate the most transit trips are being served, nor does it address how well transit service is distributed across a given area.

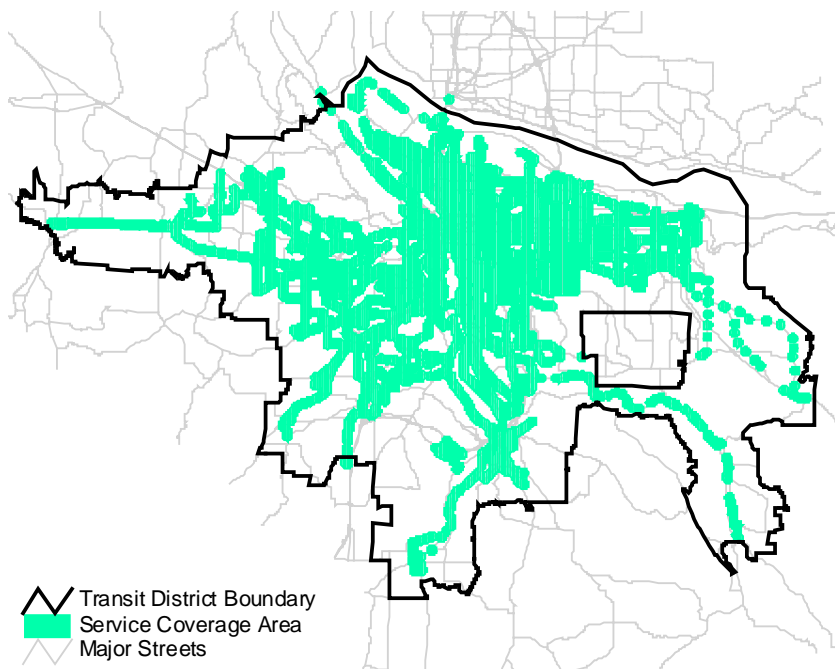
Another measure would be the percentage of the system area served. However, land uses and population and job densities may vary greatly from one system to another, depending on how land uses have developed and how the system's boundaries have been drawn. Urban transit system boundaries might include large tracts of undeveloped land that may develop in the future, while county-wide systems will likely include large tracts of rural land. Neither area would be expected to generate transit trips. How the boundaries are drawn will determine how much area is included within the service area, which in turn will affect any area-based performance measures. As a result, service areas are not the best basis for developing service coverage performance measures.

The actual area covered by transit will be smaller than a transit system's service area, depending on land use patterns in the area, and a system's financial abilities to provide service. Transit routes are not run to areas where there are no passengers to serve, even though those areas might lie within the transit agency's service area. (However, routes might be run through undeveloped areas to connect two developed areas.)

The area covered by a particular route can be defined as that area within walking distance of a transit stop. O’Sullivan and Morrall^(R12) studied walking distances to and from transit in Calgary and found that 75% of transit riders walk as far as 400 m (0.25 mi) to a bus stop or 800 m (0.5 mi) to an LRT station. The authors noted that walk distances were about 20% longer than air distances to transit stop, but did not address whether people would have walked further had other, closer transit alternatives not been available. Other studies^(R1) have found similar walk distances, but note that the elderly do not walk as far as other population groups and that ridership is higher the closer transit service is provided to one’s origin and destination.

For the purposes of determining service coverage LOS, the coverage area is defined as the air distance within 400 m (0.25 mi) of a bus stop or 800 m (0.5 mi) of a busway or rail station. Any location within 400 m (0.25 mi) of the area served by deviated fixed-route bus service is also considered to be covered. Exhibit 5-9 compares one system’s service coverage area (as of early 1998) to its district boundary.

Exhibit 5-9
Transit System Coverage Area Example



The calculation of the transit service coverage area can be performed relatively easily by GISs. However, if GIS software or accurate bus stop data are not available, this area can be approximated by outlining on a map all of the area within 400 m (0.25 mi) of a bus route. This approximation assumes reasonable bus stop spacings (at least six per mile or four per kilometer). Sections of a route where pedestrian access from the area adjacent to the route is not possible (because of a barrier such as a wall, waterway, roadway, or railroad) should not be included.

By itself, the service coverage area is not the best performance measure, since it does not lend itself easily to comparisons between systems and because it does not address how well the areas that can support transit service (by having sufficient population and/or employment density) are served.

Pushkarev and Zupan^(R13) suggest that a household density of 11 units per net hectare (4.5 units per net acre) is a typical minimum residential density for hourly transit service

to be feasible. This equates to a density of approximately 7.5 units per gross hectare (3 units per gross acre), when the land occupied by streets, parks, etc. is accounted for. Hourly service corresponds to the minimum LOS E value for service frequency as well as the minimum frequency used for determining hours of service LOS.

A Tri-Met long-range service planning study^(R11) found that an employment density of approximately 10 jobs per gross hectare (4 jobs per gross acre) produced the same level of ridership as a household density of 7.5 units per gross hectare (3 units per gross acre). These density values are used below as the minimum densities that could support hourly transit service.

To equalize comparisons between systems and to assess how well a transit system serves the areas most likely to produce transit trips, service coverage LOS uses the concept of a *transit-supportive area*. The transit-supportive area is the portion of a transit agency's service area that provides sufficient population or employment density (or an equivalent mix) to require service at least once per hour, based on the guidelines presented above. For policy reasons, or simply to provide a route connecting two high-density areas, an agency may choose to—and likely will—cover a larger area. However, service coverage LOS is based solely on the percentage of the transit-supportive area covered by transit.

Exhibit 5-10 compares one system's transit-supportive area (shaded) in relation to its early 1998 service coverage area. The transit-supportive area is considerably smaller than the coverage area, but most of the transit-supportive area is covered by transit.

Exhibit 5-10
Transit-Supportive Area Example

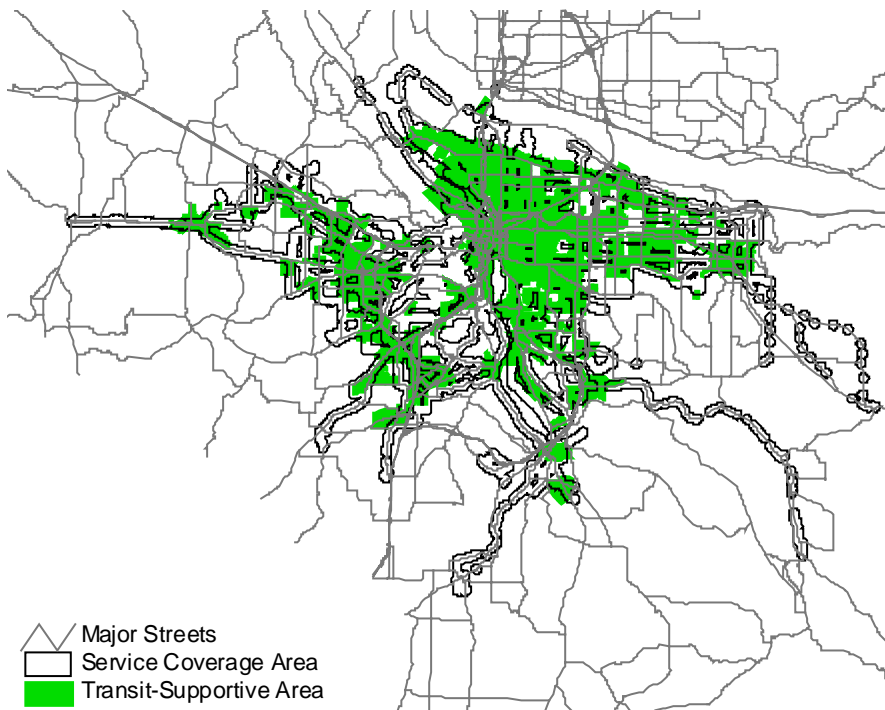


Exhibit 5-11 presents comparative statistics for each of the area types discussed above. About 55% of the district population lives in transit-supportive areas, which comprise about 20% of the total district area. Approximately 85% of the transit-supportive area (including areas with either sufficient employment or household density) receives transit service.

Service coverage LOS uses the concept of transit-supportive areas—the portion of a service area providing sufficient population or employment density to require at least hourly service.

Exhibit 5-11
Comparative Area and Population of Example Analysis Areas

Analysis Area Type	Area (km ²)	Population
District Area	1,563.1	1,066,118
Coverage Area	600.9	779,011
Transit-Supportive Area	316.0	574,791
Transit-Supportive Area Covered	270.0	522,580

Service coverage LOS is based on the percentage of the transit-supportive area covered. The measure is not intended to encourage transit operators to deviate routes substantially simply to cover more area (and thus improve service coverage LOS); should they do so, transit/auto travel time LOS will be negatively affected. Exhibit 5-12 presents the ranges of service coverage LOS.

Exhibit 5-12
Service Coverage LOS

LOS	% Transit-Supportive Area Covered
A	90.0-100.0
B	80.0-89.9
C	70.0-79.9
D	60.0-69.9
E	50.0-59.9
F	<50.0

Transit-Supportive Area: The portion of the area being analyzed that has a household density of at least 7.5 units per gross hectare (3 units per gross acre) or an employment density of at least 10 jobs per gross hectare (4 jobs per gross acre).

Covered Area: The area within 0.4 km (0.25 mi) of local bus service or 0.8 km (0.5 mi) of a busway or rail station, where pedestrian connections to transit are available from the surrounding area.

Service coverage is an all-or-nothing issue for transit riders—either service is available for a particular trip or it is not. As a result, there is no direct correlation between service coverage LOS and what a passenger would experience for a given trip. Rather, service coverage LOS reflects the number of potential trip origins and destinations available to potential passengers. At LOS A, 90% or more of the transit-supportive area has transit service; at LOS F, less than half of the area best suited for transit has service.

Calculation Example—GIS Method

Step 1: Gather data. The following GIS “themes” or “layers” will be required:

- Bus stop locations (or, alternatively, bus routes).
- Areas served by paratransit or deviated fixed-route bus service available to the general public.
- Residential unit and job data for relatively small areas. This information is often available at the transportation analysis zone (TAZ) level from the transportation planning model maintained by local metropolitan planning organizations (MPOs) or planning departments. Household data are also available from the U.S. Bureau of the Census at various levels of aggregation; job data may be available from jurisdictions that administer business licenses or collect payroll taxes.

The smaller the areas used to aggregate household and job data, the more accurate the results, and the easier it will be to identify transit-supportive areas. For the purposes of this example, TAZ-level data are assumed to be available.

Step 2: Identify the coverage area. Generate a theme containing “buffers” outlining the areas within 0.4 km (0.25 mi) of a bus stop (or bus route), 0.4 km (0.25 mi) of the area served by paratransit or deviated fixed-route bus service available to the general public, and 0.8 km (0.5 mi) of busway and rail stations. Merge all of the buffer areas together. Next, subtract from this combined area any areas that do not have transit access due to a barrier that blocks pedestrian access, such as a freeway, railroad track, waterway, or wall.

Step 3: Intersect the coverage theme with the TAZ theme. Each TAZ will be subdivided into one or more sub-TAZs that either entirely have or do not have transit coverage. For ease of analysis, the GIS software should be set to proportion data attributes (e.g., number of households) among the sub-TAZs based on the size of each sub-TAZ relative to the original TAZ. However, if a more detailed analysis is desired, expert GIS users can use other data themes that may be available (for example, land use types or zoning) to more accurately distribute households and jobs among the sub-TAZs.

Step 4: Calculate household and job densities. Create new fields within the TAZ theme for household and job densities. Calculate the values for these new fields by dividing the number of households and jobs in each sub-TAZ by the sub-TAZ’s area. The areas may first need to be converted to hectares or acres initially.

Step 5: Identify the transit-supportive area. Query the TAZ theme’s database to select all sub-TAZs where either the employment density is at least 10 jobs/gross hectare (4 jobs/gross acre) or the household density is at least 7.5 units/gross hectare (3 units/gross acre). Calculate the total combined area of the selected sub-TAZs.

Step 6: Identify the portion of the transit-supportive area covered by transit. Query the sub-TAZs selected in Step 5 to determine which ones lie within the transit coverage area. Calculate the total combined area of the selected sub-TAZs.

Step 7: Calculate the level of service. Divide the area calculated in Step 6 by the area calculated in Step 5 to determine the percentage of the transit-supportive area covered by transit. Use Exhibit 5-12 to determine the level of service based on this percentage.

Calculation Example—Manual Method

Step 1: Gather data. The items listed below will be required. Again, it is assumed for this example that household and job data are available at the TAZ level.

- A printed map (to scale) of the TAZs (or other area type for which household and job data are available) that covers the area being analyzed.
- Data on the number of households and jobs within each TAZ, in either printed or spreadsheet form.
- A map showing transit routes, busways, and rail stations, and any areas served by paratransit or deviated fixed-route bus service.

Step 2: Estimate the area of each TAZ. A transparent overlay with a printed grid assists with this task. Alternatively, if the TAZ map is available in electronic form, the CAD or other drawing software used to develop the map may be able to calculate the area of each TAZ polygon.

Step 3: Calculate household and job densities. Using a computer spreadsheet, or by hand, calculate household and job densities by dividing the number of households and jobs in each TAZ by the TAZ areas estimated in Step 2.

Step 4: Identify the transit-supportive area. Based on the results of Step 3, identify all TAZs where the household density is at least 7.5 units/gross hectare (3 units/gross acre) or the employment density is at least 10 jobs/gross hectare (4 jobs/gross acre). Mark these TAZs on the map.

Step 5: Identify the portion of the transit-supportive area covered by transit. On the printed map, outline the areas within 0.4 km (0.25 mi) of bus routes that serve or pass near the transit-supportive TAZs, the areas within 0.8 km (0.5 mi) of busway or rail stations within or near the transit-supportive TAZs, and any portion of the transit-supportive TAZs within 0.4 km (0.25 mi) of paratransit or deviated fixed-route bus service available to the general public. Estimate the percentage of each transit-supportive TAZ that is covered by transit. Do not include any areas that do not have transit access due to a barrier that blocks pedestrian access, such as a freeway, railroad track, waterway, or wall.

Step 6: Calculate areas. Add up the areas of the transit-supportive TAZs, using the information developed in Step 2. This is the total area of the transit-supportive area. Next, for each transit-supportive TAZ, multiply its area (from Step 2) by the percentage of its area covered by transit (from Step 5). Add these areas together. The result is the total transit-supportive area covered by transit.

Step 7: Calculate the level of service. Divide the areas calculated in Step 6 to determine the percentage of the transit-supportive area covered by transit. Use Exhibit 5-12 to determine the level of service based on this percentage.

Other Measures

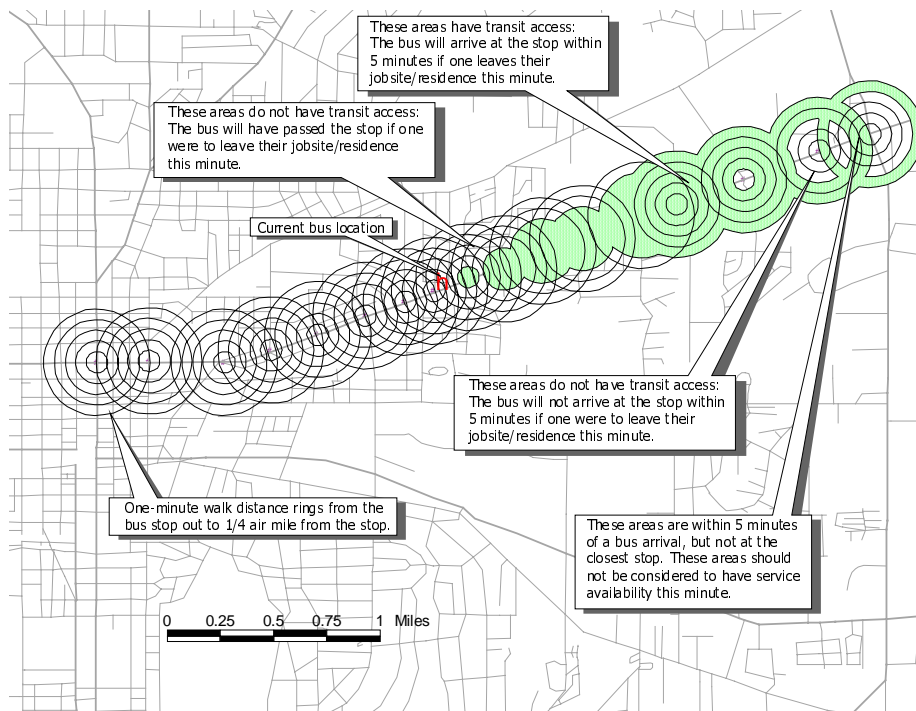
If a more detailed analysis is desired, the performance measures described below have been used in parts of the United States as means of evaluating service coverage. Some of these measures also incorporate other aspects of transit availability. GIS software is recommended to calculate any of these measures.

Percent Person-Minutes Served

A Florida Department of Transportation (FDOT) project developed a measure of transit availability based on *percent person-minutes served*, and GIS-based software to calculate the measure.^(R16) The software calculates on a minute-by-minute basis the residential population and the number of jobs that have transit availability.

Only those areas within walking distance of transit service—defined to be within 0.4 km (0.25 mi) of a transit stop, equivalent to 5 minutes walk time at 5 km/h (3 mph)—will have any transit availability. Using a GIS, rings can be drawn around a bus stop representing one-minute walk distances, and the population and number of jobs within each ring can be calculated. Each ring only has transit availability during a short window of time before a transit vehicle arrives, assumed to be a maximum desirable wait time of 5 minutes. Each transit vehicle, therefore, has a “bubble” that extends in front of it representing the rings that have access to that vehicle if one were to leave their location during that minute and walk to the nearest transit stop. Exhibit 5-13 illustrates this concept, using air distances from transit stops; the FDOT software uses walk distances from stops and accounts for roadway segments that are inaccessible to pedestrians.

Exhibit 5-13
Transit Vehicle Service Availability “Bubble”



On a minute-by-minute basis, therefore, the population and number of jobs with transit availability can be compared to the total number of people and jobs within the analysis area. When summarized over a period of time (an hour, a day, or a week, for example), the total person-minutes served can be computed. This number can then be divided by the total number of people or jobs within the analysis area times the number of minutes during the analysis period to calculate the performance measure. The measure reflects both the spatial and temporal aspects of transit availability and, on a system-wide basis, is sensitive to population and employment density.

Transit Orientation Index

A long-range planning study for Tri-Met in Portland, Oregon used the concept of a *transit orientation index* (TOI).^(R11) One element of this study analyzed the factors that influenced transit ridership in the Portland metropolitan area. The study found that employment density, housing density, and retail employment density were the most significant variables influencing ridership, accounting for 81% of the variation in transit demand within the Portland area. A regression equation was developed to estimate ridership based on these three factors and was applied to TAZs within the Portland area to estimate future ridership based on future population and employment estimates. The estimated ridership of each TAZ was then converted into a TOI score ranging from 0-9, in order to reduce the effects of potential sources of error in estimating ridership.

The TOI scores were used in developing proposed policies for the amount and kind of service provided to areas: the higher the TOI score, the higher the quality of transit service to be provided that area. Because the ridership estimates were developed using local data, the regression equation and the ranges of values used to develop TOI scores only apply to the Portland area. However, the methodology used would be applicable anywhere to develop a similar index.

Local Index of Transit Availability

Rood^(R15) developed a *local index of transit availability* (LITA) to measure the intensity of transit service in an area relative to the area's population and size. The LITA contains three components: (1) frequency, (2) capacity, and (3) route coverage. Frequency is measured using *transit vehicles per day*, averaged over the course of a week. *Seat-miles divided by combined residential population and jobs* is used for capacity, while *transit stops per square mile* is used for route coverage.

To calculate the LITA, a score value is calculated for each LITA component for each TAZ, census block, or other aggregation area used in the analysis. Only areas with transit service are included in the analysis; areas without transit service are assigned a grade of "F" automatically and not included in further calculations to avoid lowering the mean. The scores for areas served by transit are then standardized by subtracting each component's mean value from the score value and dividing the result by the standard deviation for that component. Next, the three components are averaged together to produce an overall LITA score for the TAZ, census block, etc. Finally, the scores are rescaled and assigned a letter grade based on a score's variation from the mean.

This measure assesses relative differences in transit availability, rather than providing an absolute measure of the amount of transit availability. As a result, a high or low letter grade does not necessarily mean that service is good or bad relative to some standard, only that service is better or worse than the local area average. As the name implies, the Local Index of Transit Availability scores can only be used to compare transit service within the local area where the data were developed. However, the methodology can be used anywhere.

MEASURES OF QUALITY

Transit Stops

Passenger Loads

From the passenger's perspective, passenger loads reflect the comfort level of the on-board vehicle portion of a transit trip—both in terms of being able to find a seat and in overall crowding levels within the vehicle. From a transit operator's perspective, a poor LOS may indicate the need to increase service frequency or vehicle size in order to reduce crowding and to provide a more comfortable ride for passengers. A poor passenger load LOS indicates that dwell times will be longer for a given passenger boarding and alighting demand at a transit stop and, as a result, travel times and service reliability will be negatively affected.

Passenger load LOS for bus and rail uses the same measure—*area per passenger*—but the ranges used to determine LOS differ between the two modes because of differences in the level of crowding that passengers will tolerate and because most rail modes (with the notable exception of commuter rail) provide more standing area than do buses. Passenger load LOS can be measured by time of day (e.g., LOS D peak, LOS B off-peak) or by the amount of time a certain condition occurs (e.g., some passengers must stand for up to 10 minutes).

The exhibits in Part 2, *Bus Transit Capacity* and Part 3, *Rail Transit Capacity* can be used to estimate the passenger area provided within different kinds of transit vehicles. Alternatively, the *load factors* (passengers per seat) given in Exhibit 5-14 can be used to estimate level of service.

Exhibit 5-14
Passenger Load LOS

LOS	Bus		Rail		Comments
	m ² /p	p/seat*	m ² /p	p/seat*	
A	>1.20	0.00-0.50	>1.85	0.00-0.50	No passenger need sit next to another
B	0.80-1.19	0.51-0.75	1.30-1.85	0.51-0.75	Passengers can choose where to sit
C	0.60-0.79	0.76-1.00	0.95-1.29	0.76-1.00	All passengers can sit
D	0.50-0.59	1.01-1.25	0.50-0.94	1.01-2.00	Comfortable standee load for design
E	0.40-0.49	1.26-1.50	0.30-0.49	2.01-3.00	Maximum schedule load
F	<0.40	>1.50	<0.30	>3.00	Crush loads

*Approximate values for comparison. LOS is based on area per passenger.

LOS	Bus		Rail		Comments
	ft ² /p	p/seat*	ft ² /p	p/seat*	
A	>12.9	0.00-0.50	>19.9	0.00-0.50	No passenger need sit next to another
B	8.6-12.9	0.51-0.75	14.0-19.9	0.51-0.75	Passengers can choose where to sit
C	6.5-8.5	0.76-1.00	10.2-13.9	0.76-1.00	All passengers can sit
D	5.4-6.4	1.01-1.25	5.4-10.1	1.01-2.00	Comfortable standee load for design
E	4.3-5.3	1.26-1.50	3.2-5.3	2.01-3.00	Maximum schedule load
F	<4.3	>1.50	<3.2	>3.00	Crush loads

*Approximate values for comparison. LOS is based on area per passenger.

At LOS A load levels, passengers are able to spread out and can use empty seats to store parcels, bags, etc. rather than carry them on their lap. At LOS B, some passengers will have to sit next to others, but others will not. All passengers can still sit at LOS C, although the choice of seats will be very limited. Some passengers will be required to stand at LOS D load levels, while at LOS E, a transit vehicle will be as full as passengers will normally tolerate. LOS F represents crush loading levels. A greater range of areas per passenger is provided for rail LOS than for bus LOS, as rail tends to provide fewer seats in favor of more standing room.

Other Measures

Reliability

Reliability is discussed as a service measure in the next section, route segments, because it tends not to vary between adjacent stops. However, for a passenger waiting at a particular stop, that passenger’s perception is that the transit vehicle is late arriving at his or her stop.

Amenities

The kinds of amenities provided at transit stops are usually a matter of agency policy, based on the number of boarding riders that would benefit from a particular amenity, as well other factors. Exhibit 5-15 lists common transit amenities, typical ranges of boarding passengers used by transit systems to warrant their installation, and other factors which should be considered when considering these amenities.

Exhibit 5-15
 Typical Transit Stop Amenities^(R1,R8,R18)

Amenity	Typical Daily Boarding Volumes at Stop	Other Factors to Consider
Shelter	10 (rural) 25 (suburban) 50-100 (urban)	Number of transfers at a stop Available space to place shelter ADA requirements Availability of alternative shelter Average passenger waiting time
Bench	Somewhat lower than shelter threshold	Insufficient space for shelter Walls, stairs, etc. that attract passengers onto adjacent property Stops used by elderly/disabled
Landing pad	--	Wheelchair deployments at stop Muddy waiting areas Waiting areas damaging adjacent property
Information Signs	100	Major trip generators & transfer points Number of routes using a stop Room to install display
Trash Receptacles	--	Evidence of litter problem at a stop Availability of sponsor for maintenance Room to install adjacent to the bus stop

Route Segments

Reliability

Several different measures of reliability are used by transit systems. The most common of these are:

- on-time performance,
- headway adherence (the consistency or “evenness” of the interval between transit vehicles),
- missed trips, and
- distance traveled between mechanical breakdowns.

On-time performance is the most widely used measure in the transit industry, is a measure that users can relate to, and encompasses several of the factors listed above that influence transit reliability. However, when vehicles run at frequent intervals, *headway adherence* becomes important to passengers, especially when vehicles arrive in bunches, causing overcrowding on the lead vehicle and longer waits than expected for the vehicles.

Most transit systems define a fixed-route transit vehicle as “late” when it is more than 5 minutes behind schedule.^(R2,R5) Some systems consider transit vehicles to be on time when they depart 1-3 minutes early, but the majority of systems consider an early departure as not being on time. From the perspective of a passenger waiting for a transit vehicle, an early departure is often equivalent to a vehicle being late by the amount of one headway. Reliability LOS considers “on-time” for fixed-route service to be a departure from a published timepoint 0-5 minutes after the scheduled time, or an arrival at the end of the route no more than 5 minutes after the scheduled time. Early departures are not considered “on-time.” Reliability data routinely collected by field supervisors may not be the best to use for determining on-time performance, as when a problem occurs that delays vehicles, the supervisor will generally be working to fix the problem, rather than continuing to collect data. As a result, the data may not include all late transit vehicles.

In the case of deviated fixed-route service, with a bus traveling to the rider, rather than the rider traveling to meet a bus, early arrivals and departures are not as critical. Also, maintaining a consistent schedule from day to day is harder. Therefore, reliability

LOS considers “on-time” for deviated fixed-route service to be a pickup within 10 minutes of the scheduled time.

The only paratransit on-time performance measure identified in the literature was that used by the Port Authority in Pittsburgh.^(R2) PA defines a pickup within 20 minutes of the scheduled time as “on-time”; this is the criterion used for reliability LOS for paratransit.

Exhibit 5-16 presents reliability LOS grades for transit service operating with frequencies greater than 10 minutes. The LOS thresholds are based on the system-wide on-time performance reported by 83 transit properties^(R2); the comments provided in the exhibit reflect a passenger’s perspective of the various LOS grades, based on five round trips per week with no transfers.

Exhibit 5-16
Reliability LOS: On-Time Performance

LOS	On-Time Percentage	Comments*
A	97.5-100.0%	1 late transit vehicle per month
B	95.0-97.4%	2 late transit vehicles per month
C	90.0-94.9%	1 late transit vehicle per week
D	85.0-89.9%	
E	80.0-84.9%	1 late transit vehicle per direction per week
F	<80.0%	

Applies to routes with headways greater than 10 minutes.

*user perspective, based on 5 round trips/week of their travel on a particular transit route with no transfers

“On-time” = 0-5 minutes late departing published timepoint (fixed route)
 arrival within 10 minutes of scheduled pick-up time (deviated fixed route)
 arrival within 20 minutes of scheduled pick-up time (paratransit)

At LOS A, passengers experience highly reliable service and are assured of arriving at their destination at the scheduled time except under highly unusual circumstances. Service is still very reliable at LOS B, but one transit vehicle a week will be late on average if a passenger must transfer. At LOS C, at least one ride a week will be late on average, more if transfers are involved. At LOS D and E, one becomes less and less assured of arriving at the scheduled time and one may choose to take an earlier trip to ensure not being late. At LOS F, the number of late trips is very noticeable to passengers.

For transit service operating at frequencies of 10 minutes or less, headway adherence is used to determine reliability, as shown in Exhibit 5-17. The measure is based on the coefficient of variation of headways of transit vehicles serving a particular route arriving at a stop, c_v , which is calculated as follows:

$$c_v = \frac{\text{standard deviation of headways}}{\text{scheduled headway}}$$

Equation 5-1

Exhibit 5-17
Reliability LOS: Headway Adherence

LOS	Coefficient of Variation
A	0.00-0.10
B	0.11-0.20
C	0.21-0.30
D	0.31-0.40
E	0.41-0.50
F	>0.50

Applies to routes with headways less than or equal to 10 minutes.

The coefficient of variation, a statistical measure, has the disadvantage of being difficult to visualize, but it provides a good measure of the transit vehicle “bunching” phenomenon. At LOS A, service is provided like clockwork, with very regular headways. At LOS B, a number of vehicles may be a minute early or late, or a few may be a couple of minutes off schedule. At LOS C, most vehicles are off the scheduled headway by several minutes. Headways between vehicles at LOS D levels are quite irregular, but bunching does not yet occur. Bunching occurs occasionally at LOS E and frequently at LOS F. The following examples illustrate some of these LOS ranges.

Calculation Examples

Example 1. A bus route is scheduled to operate at 10-minute headways. During the peak hour, the actual measured headways between buses are 12, 8, 14, 6, 7, and 13 minutes. The standard deviation of these values is 3.4 minutes and the coefficient of variation is 0.34, equivalent to LOS D.

Example 2. Another bus route is scheduled to operate at 5-minute headways. The route experiences problems with buses bunching together as they travel the route. During the peak hour, measured headways between buses are 5, 8, 2, 3, 2, 10, 5, 5, 2, 3, 7, and 8 minutes. The standard deviation of these values is 2.73 and the coefficient of variation is 0.55, equivalent to LOS F.

Example 3. A third route running every 5 minutes does not have bunching problems. Peak hour headways are measured at 5, 6, 5, 4, 4, 5, 6, 5, 6, 4, 5, and 5 minutes. The standard deviation is 0.74 and the coefficient of variation is 0.15, equivalent to LOS B.

Other Measures

Travel Speed

Travel speed is a useful route segment performance measure, because it reflects how long a trip may take, without depending on the length of a route segment. Transit priority measures, improvements to fare collection procedures, use of low-floor buses, and other similar actions implemented along a route segment will be reflected as improvements in travel speed. The procedures in Part 2, *Bus Transit Capacity* and Part 3, *Rail Transit Capacity* can be used to estimate transit travel speeds along a route segment. TCRP Report 26^(R17) provides suggested level of service ranges based on bus speeds for buses operating on arterial bus lanes.

Transit/Auto Travel Time

The transit auto/travel time measure introduced in the next section can also be used to evaluate the level of service of individual trips (for example, from a suburb to the CBD or between two suburbs).

System

Transit/Auto Travel Time

An important factor in a potential transit user’s decision to use transit on a regular basis is how much longer the trip will take in comparison to the automobile. Although some transit operators emphasize the “additional free time” aspect of riding transit in their promotional materials—to read, relax, catch up on extra work, etc.—without having to deal with the hassles of rush-hour driving, most people still prefer to drive their own cars unless high out-of-pocket costs (such as parking charges) provide a disincentive, or unless transit travel time is competitive with the automobile.

The level of service measure is the *door-to-door difference between automobile and transit travel times*, including walking, waiting, and transfer times (if applicable) for both modes. It is a measure of how much longer (or in some cases, shorter) a trip will take by transit. The trip length is not as important as the trip time—a 20-mile trip that takes an

hour longer by transit and a 5-mile trip that takes an hour longer both require an extra hour out of one’s day—although longer trips have a greater potential for taking longer.

Travel time for transit includes walk time from one’s origin to transit (assumed to be an average of 3 minutes), wait time (5 minutes), travel time on-board transit (varies), walk time from transit to one’s destination (3 minutes), and any transfer time required (varies). Travel time for automobiles includes travel time in the automobile and time required to park one’s car and walk to one’s destination (assumed to be an average of 3 minutes). Walk time is based on a maximum 0.4-km (0.25 mi) walk to transit at 5 km/h (3 mph), which will take about 5 minutes; not all transit users walk the maximum distance.

Smaller cities may find it harder than large cities to achieve high levels of service for this measure. In the San Francisco Bay Area, for example, it is faster to travel between downtown Oakland and downtown San Francisco by BART during the a.m. rush hour than it is to drive alone over the Bay Bridge. On the other hand, for a city with a population under 50,000, where it is possible to drive virtually anywhere in the city in 10-15 minutes, the walk and wait time for transit by itself is nearly as much as the total automobile travel time, and the calculated LOS will suffer as a result. In general, for small cities or for short trips, the total transit travel time will generally be significantly longer than the automobile travel time.

Since transit/auto travel time is a system measure, its data requirements are greater than those for transit stop and route segment measures. This section presents two methods for calculating transit/auto travel time LOS: one using a transportation planning model, another by hand.

As with many of the other service measures, transit/auto travel time can be measured at different times of the day, for example, at peak and off-peak times. Because peak hour traffic congestion tends to lengthen automobile trip times, the calculated LOS will often be *better* during peak hours than during the rest of the day.

Exhibit 5-18
Transit/Auto Travel Time LOS

LOS	Travel Time Difference (min)	Comments
A	≤0	Faster by transit than by automobile
B	1-15	About as fast by transit as by automobile
C	16-30	Tolerable for choice riders
D	31-45	Round-trip at least an hour longer by transit
E	46-60	Tedious for all riders; may be best possible in small cities
F	>60	Unacceptable to most riders

Door-to-door travel by transit is faster than by auto at LOS A. This level of service provides considerable incentive to potential riders to use transit. At LOS B, the in-vehicle travel times by auto and transit are comparable, but the walk and wait time for transit makes the total trip by transit slightly longer. Riders must spend an extra hour a day using transit at LOS C levels and up to 1½ hours at LOS D. At LOS E, individual trips take up to an hour longer by transit than by automobile; however, this may be the best possible in small cities where automobile travel times are low. Service at LOS F levels involve travel times so long as to be unacceptable to most riders.

Calculation Example—Transportation Planning Model Method

The advantage of using a transportation planning model is that all trips between all zones can be modeled, and different kinds of trip types can be compared. Since many urban areas only have a weekday p.m. peak hour model, though, travel times at other times of the day and week cannot be compared using this method. The transportation model used needs to include networks for both roadways and transit.

Step 1: Calculate travel time differences between zones. Use the transportation planning model to generate (1) a table of automobile travel times between each pair of zones and (2) a table of transit travel times between each pair of zones. Subtract the values in the transit table from the values in the automobile table to obtain travel time differences between each pair of zones.

Step 2: Calculate total person trips between zones. From the model, generate a table of total person trips (both automobile and transit) between each pair of zones.

Step 3: Calculate the weighted average of travel time differences. For each pair of zones, multiply the travel time difference between the zones by the number of person trips between the zones. Sum all of the resulting values and divide by the total number of person trips that took place. The result is a systemwide weighted average travel time difference, which can then be used with Exhibit 5-18 to calculate a systemwide LOS.

Calculation Example—Manual Method

The manual method is useful in areas without a transportation model or when a faster assessment of travel time LOS is desired. A sampling of about 10-15 locations should be used for the analysis. If a metropolitan area is being studied, the CBD and 10-15 suburbs should be used; if an individual city is being studied, the CBD and 10-15 important trip generators should be used. Unless there is a heavy reverse direction volume during the analysis period, or the reverse volume is of interest to the analysis (for example, for welfare-to-work applications), estimating peak direction travel times is usually sufficient.

Step 1: Estimate travel times between locations. Analysts may find it useful to sketch two simple network diagrams of the area being studied, one for transit and one for automobiles, and to indicate travel times on the links between locations. Analysts may also find it useful to create a spreadsheet of travel times between locations for use in subsequent steps. During Step 1, only travel times between locations and transfer times are considered; access and wait times are not considered. For an analysis of existing conditions, transit travel and transfer times can be derived from published schedules; automobile travel times can be determined by driving the main routes between locations. When a choice of transit routes is available, the fastest route (e.g., an express route) should be selected.

Step 2: Estimate travel time differences between locations. For each pair of locations, subtract the auto travel time from the transit travel time; add transit access, wait, and transfer times; and subtract any auto access time (e.g., walks to or from parking garages).

Step 3: Calculate the level of service. Average the travel time differences of each pair of locations and use the resulting system value with Exhibit 5-18, or calculate point-to-point LOS directly from Exhibit 5-18.

An example of the manual calculation method can be found in the example problems in Chapter 6.

Other Measures

Travel Time

Rather than compare transit and automobile travel times, the transit travel time can be used by itself as a performance measure. The maximum time that passengers will find reasonable will vary, depending on the size of the city or metropolitan area served by transit, and whether travel is occurring during peak or off-peak times.^(R6)

Safety

Safety reflects personal security on-board a transit vehicle, at a transit stop, and during the portion of the trip to and from transit. To a lesser extent, it also reflects the number of accidents that a transit system experiences. As might be imagined, there are many different factors that influence safety and it is not easy to pick a single factor as being representative. Safety performance measures include the number of crimes committed on transit property and the number of vehicular accidents (the equivalent per rider or per mile accident rates can also be used). Other measures include the percentage of bus stops with adequate lighting and the ratio of transit police officers to transit vehicles.

4. APPLICATIONS

INTRODUCTION

This chapter applies the quality of service framework and measures presented in Chapters 2 and 3 to issues faced by transportation and transit planners. Typical areas where the quality of service measures can be applied are service assessment, policy and goal setting, and planning and design. Some measures will have more applicability in some areas than others. For example, measures under the direct control of transit operators are easier to use for design and policy purposes than measures that are not.

Exhibit 5-19 summarizes some of the key factors that influence the six service measures.

Exhibit 5-19
Factors Influencing Transit Quality of Service

Service Measure	Ways To Improve Each Measure
AVAILABILITY	
Service Frequency	<ul style="list-style-type: none"> • Policy-based • Compare service frequency to population and job density along route
Hours of Service	<ul style="list-style-type: none"> • Policy-based • Compare operating hours of major passenger generators to transit service hours
Service Coverage	<ul style="list-style-type: none"> • Policy-based • Evaluate service provided to transit-supportive areas
QUALITY	
Passenger Loads	<ul style="list-style-type: none"> • Increase service frequency • Use larger buses or longer trains
Reliability	<ul style="list-style-type: none"> • Implement transit priority measures • Greater field-checking of schedule adherence by drivers • Improve maintenance procedures, replace old buses • Review schedules for realistic travel times
Transit/Auto Travel Time	<ul style="list-style-type: none"> • Implement transit priority measures • Consider cross-town routes to supplement radial service • Review need for express service to serve longer trips

SERVICE ASSESSMENT

The primary role for any performance measure is the assessment of something. The quality of service measures can be used to assess whether transit service is meeting an operator’s or jurisdiction’s goals, or to assess how passengers perceive or might perceive the quality of transit service offered or proposed to be offered. The LOS grades for each service measure assist in this task by categorizing an infinite number of values for a particular measure into six groups, to better assess how meaningful differences between two values may be. The grades can be used to answer questions relating to whether a value is “acceptable” to operators, jurisdictions, or passengers, and whether one value is significantly “better” or “worse” than another.

When a performance measure identifies a problem, the best solution may not be completely under the control of a transit operator. Often, solutions will require both (1) cooperation from the local agencies responsible for roadways and traffic signals and (2) operational changes on the part of the transit operator. Both parties should view themselves as being in the business of moving people efficiently and should jointly seek solutions that best accomplish this goal.

The *frequency and hours of service* measures answer how much service is provided between pairs of locations. They can be used in planning to help evaluate the kinds of trips that transit serves. A system with good service frequency during commute hours but not midday hours, for example, serves home-to-work trips, but may not serve the midday trips that workers often need to take. A system with service 12-13 hours a day serves workers who work 8-5 jobs, but not workers whose jobs require them to arrive earlier or later (for example, many of the kinds of jobs that welfare-to-work programs offer). This level of service also does not serve the needs of downtown workers who wish to stay downtown after work for dining, entertainment, or other activities. The combination of frequency and hours of service also illustrate that the quality of transit service is directly related to the weakest link in the transit trip—it does not matter if a medical center receives service every 15 minutes, 18 hours a day if the residential neighborhoods that supply the center’s patients and employees receive hourly service for only 12 hours a day.

Service coverage examines how well a transit system serves the areas that will generate the majority of its customers. It points out the relation between land use and transit, in that transit is more successful when population and employment densities are higher, and that both ends of a trip need to be served by transit for the trip to have a chance of occurring by transit. The LOS measure provides a general assessment of service coverage, while the secondary measures of percent person-minutes of availability and the two indexes can be used for more detailed examinations of the relationship between transit service provided, land use, and density.

Monitoring *passenger loads* identifies routes that are over- or under-utilized. An over-utilized route may require more frequent service or larger vehicles to serve demand and maintain comfortable conditions for passengers. An under-utilized route should be reviewed to determine the reasons why—low population and job density, poor frequency or hours of service that do not meet the needs of potential riders, inaccessibility due to busy streets and lack of sidewalks, etc.—to try to correct the causes of the under-utilization before a decision is made to cut service.

Reliability is another factor that should be monitored regularly to identify problem routes. If the source of the problem is traffic congestion, transit priority measures should be considered. If capacity problems at a bus stop are creating queues of buses, enlarging the stop, implementing measures to reduce dwell times, or operational changes to reduce the number of buses using the stop should be considered. If buses are dwelling at a stop and then waiting for red lights afterwards, signal timing adjustments, measures to reduce dwell time, transit priority measures, and alternating near-side/far-side bus stop patterns should be considered.

Routes with a poor *transit-auto travel time difference* should be reviewed to identify causes and possible solutions. Express service may be required to reduce the number of stops on long trips, the time spent waiting to transfer between routes may need to be reduced, or new routes may need to be considered that provide more direct service between two locations. Transit priority measures may be appropriate to reduce delays caused by congestion and traffic signals.

Although not service measures, the other performance measures presented in the quality of service framework shown in Exhibit 5-4 are also highly important and should be reviewed regularly. Planning efforts by local jurisdictions should assess the level of accessibility to transit routes that is provided and should make pedestrian and bicycle improvements in the vicinity of transit stops a priority. To make transit as attractive and comfortable as possible to customers, operators should regularly review the kinds, amounts, and condition of the transit amenities they provide, both at transit stops and on-board transit vehicles. Safety, both in terms of vehicular crashes and transit crime, is another area that should be monitored regularly. Transportation demand management efforts, such as employers subsidizing transit passes for their employees or charging their

employees the true cost of providing them with “free” parking spaces can help equalize some of the out-of-pocket cost differences between transit and auto use. Land use planning efforts that increase density or minimize out-of-direction travel by pedestrians can help transit serve more people with the same amount of resources.

POLICY AND GOAL SETTING

The counterpart to service assessment is policy and goal setting. In order to assess something, one needs a standard to compare it to. Inherent in service measures is the concept that LOS F represents an unacceptable condition to the user. However, there are many cases when a higher standard may be desirable. Using service and performance measures to set policy and goals allows transit operators, communities, states, and others to provide a consistent, quantitative means of defining the kind of transit service they wish to provide and to provide the basis for evaluating in the future how well their goals are being met.

Targets can be set for any of the measures presented as part of the quality of service framework. Potential policy and goal applications include the following:

- *Statewide mobility planning.* The availability measures can be used to establish goals for the amount of transit service provided between smaller communities and their larger neighbors that have essential services not found elsewhere. Targets can also be set for the amount of service provided to intermodal transfer centers such as bus terminals, train stations, and airports.
- *Congestion management.* The time- and speed-related measures can be used by areas experiencing traffic congestion to relate auto and transit levels of service. A worse automobile LOS than normally desired might be acceptable if transit provides sufficient capacity and acceptable levels of service.
- *Transit operations.* A transit operator, for comfort or liability reasons, may wish to limit the allowed passenger load on transit vehicles to the number of seats available. An operator may also wish to link the kinds of amenities provided at transit stops to the number of boarding passengers.

PLANNING AND DESIGN

Transit operator policy has direct impacts on capacity calculations used for planning and design. For example, an operator’s passenger load standard affects person capacity calculations, service frequency requirements to accommodate a given demand, equipment requirements, and the sizing of transit station elements. The design failure rate used in sizing bus stops impacts reliability. A policy on the service frequency to be provided to locations with a given population or employment density affects the person capacity that transit provides at the maximum load point between those locations.

Measures such as the Transit Orientation Index that link land use and transit service are appropriate for long-range service planning. Long-range transportation planning should model both roadway and transit networks, so that improvements to transit service and facilities can be compared with improvements to roadway facilities. Changes in equipment or fare-collection practices can be evaluated both in terms of capacity and speed improvements and in terms of quality of service improvements.

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6. EXAMPLE PROBLEMS

1. Service Frequency
2. Hours of Service
3. Service Coverage LOS (Manual Method)
4. Service Coverage LOS (GIS Method)
5. Transit/Auto Travel Time LOS (Manual Method)
6. Transit Report Card

Service frequency LOS.

Example Problem 1

The Situation

As part of an overall review its service, a transit operator wants to determine the level of transit availability it provides to its customers.

The Question

How often is service provided during peak hours between various locations within its service area?

The Facts

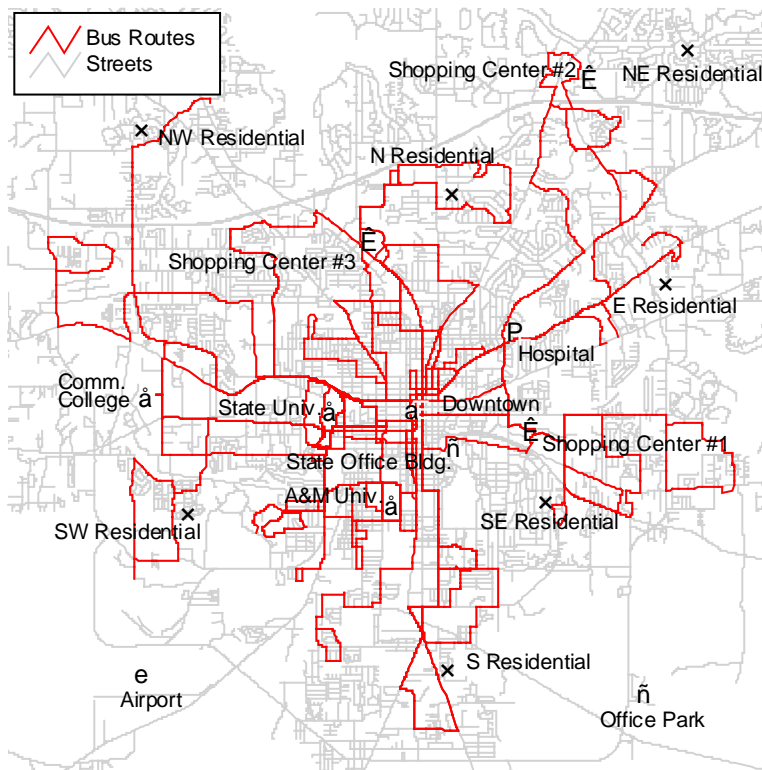
- ✓ The transit operator provides fixed-route bus service to a city of 125,000. Two universities, a community college, and numerous government offices are scattered about the city.

Comments

- ✓ Frequency LOS is determined between pairs of locations. The longest service frequency encountered along the trip controls the level of service. For example, if service is provided every 15 minutes at one's origin, but only 30 minutes at one's destination, LOS is based on the 30-minute frequency.
- ✓ All routes pass through a downtown transfer center. No trip requires more than one transfer.

Outline of Solution

A number of locations around the city, representing residential, commercial, office, and institutional land uses are selected for analysis. Their locations are illustrated on the map below. Each location is examined to determine the number of routes that pass by it and how frequently they run. If a location has several routes that pass by it within 3 minutes of each other, only one route is counted towards determining service frequency.



Steps

Develop a table listing the peak hour service frequency for each location. Since each trip involves no more than one transfer (i.e., a third bus is not taken in the middle of the trip), either the frequency at the origin or the destination will control LOS, whichever is longer. Exhibit 5-5 provides frequency LOS for urban scheduled transit service.

Location	Peak Hour Frequency (min)	Peak Hour LOS
Downtown	20	C
A&M University	20	C
State University	30	D
Community College	20	C
Hospital	20	C
State Office Building	60	E
Office Park	no service	F
Shopping Center #1	30	D
Shopping Center #2	60	E
Shopping Center #3	20	C
Airport	no service	F
E Residential	40	E
NE Residential	no service	F
N Residential	60	E
NW Residential	60	E
SW Residential	60	E
S Residential	40	E
SE Residential	60	E

Thus, the service frequency LOS between most of the city's residential areas and the community college is LOS E, even though the college itself receives service at 20-minute intervals. Service between downtown and Shopping Center #3 is LOS C, since both ends of the trip receive service at 20-minute intervals.

The Results

Trips from the residential areas to most employment, shopping, and educational locations have a service frequency LOS E, despite relatively frequent service at most of the trip destinations. This means that workers and patients at the hospital, for example, do not have nearly the number of travel opportunities that the hospital's 20-minute service frequency might indicate. On the other hand, trips originating in the downtown area receive fairly frequent service to a number of potential destinations. Travelers flying into and out of the city will have to find a mode other than transit to get to and from the airport.

Hours of service LOS.

Example Problem 2

The Situation Continuing the service review started in Example Problem 1.

The Question How long is service provided to various parts of the city?

The Facts
 ✓ Same assumptions as Example Problem 1.

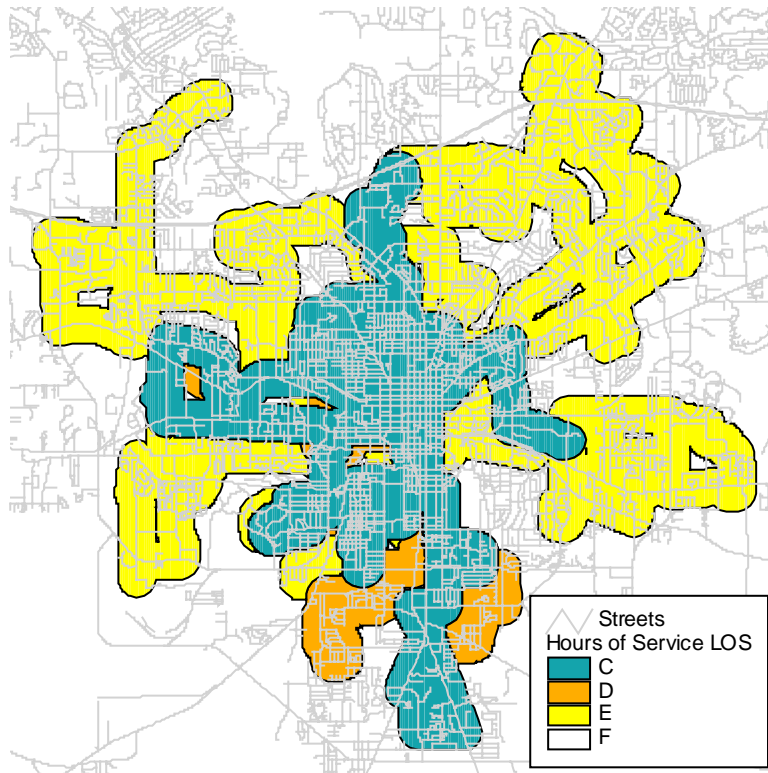
Outline of Solution
 The strategy is the same as Example Problem 1, in that a number of locations around the city, representing residential, commercial, office, and institutional land uses are selected for analysis. Each location is analyzed to determine how long during the day service is provided at least once an hour. This information can be summarized as a table (as in Example Problem 1), or on a map (with the help of GIS software). Both methods are illustrated.

Steps
 (a) *Table Summary*
 Develop a table listing hours of service for each location, from which the level of service can be determined directly from Exhibit 5-8.

Location	Hours of Service	LOS
Downtown	16	C
A&M University	16	C
State University	16	C
Community College	10	E
Hospital	15	C
State Office Building	11	E
Office Park	no service	F
Shopping Center #1	15	C
Shopping Center #2	7	E
Shopping Center #3	15	C
Airport	no service	F
E Residential	11	E
NE Residential	no service	F
N Residential	11	E
NW Residential	10	E
SW Residential	10	E
S Residential	16	C
SE Residential	12	D

(b) Map Summary

This method assumes that GIS software is available, along with an existing bus route theme. First, create a summary table of hours of service for each bus route and link (“join”) this information to the bus route theme. Then, have the GIS select all routes operating at LOS C (the best LOS provided in this city). Create an 0.4-km buffer around these routes, representing each route’s service coverage area (this assumes good pedestrian connections to these routes). Next, select and buffer all routes operating at LOS D and remove the area of overlap between the LOS C and LOS D areas from the LOS D area. Follow a similar procedure for routes operating at LOS E and F. When finished, the following map results:



The Results

The central part of the city, along with corridors running north-south and east-west from downtown, receive the most service, extending into the early evening. The outer edges of the city receive the least service, ranging from peak-hour only to service about 11 hours a day. City residents who do not work traditional 8 a.m. to 5 p.m. hours will not have transit as an option for their trips. However, university students will be able to go to a number of places around town in the evening hours using the bus system. A number of areas of the city receive no bus service; the next two example problems look at whether these areas can adequately support service.

Service coverage LOS (manual method).

Example Problem 3

The Situation

Continuing the service review from Example Problems 1 and 2.

The Question

Where are the city’s transit-supportive areas and how well are they currently being served?

The Facts

- ✓ Same assumptions as Example Problems 1 and 2.
- ✓ The city’s transportation model contains population and employment figures at the transportation analysis zone (TAZ) level.
- ✓ The transit operator does not have access to GIS software, so the manual calculation method will be used for this example.

Comments

- ✓ The TAZ map is available in an electronic form that allows the areas of each TAZ to be calculated.
- ✓ Census data for the area indicate an average household size of 2.5 people.

Outline of Solution

Under the manual calculation method, the transit-supportive area is identified first. Next, the coverage area of the routes serving the transit-supportive TAZs is identified. Third, the approximate percentage of each transit-supportive TAZ served by transit is identified. Finally, the percentage of the total transit-supportive area served by transit is calculated to determine LOS.

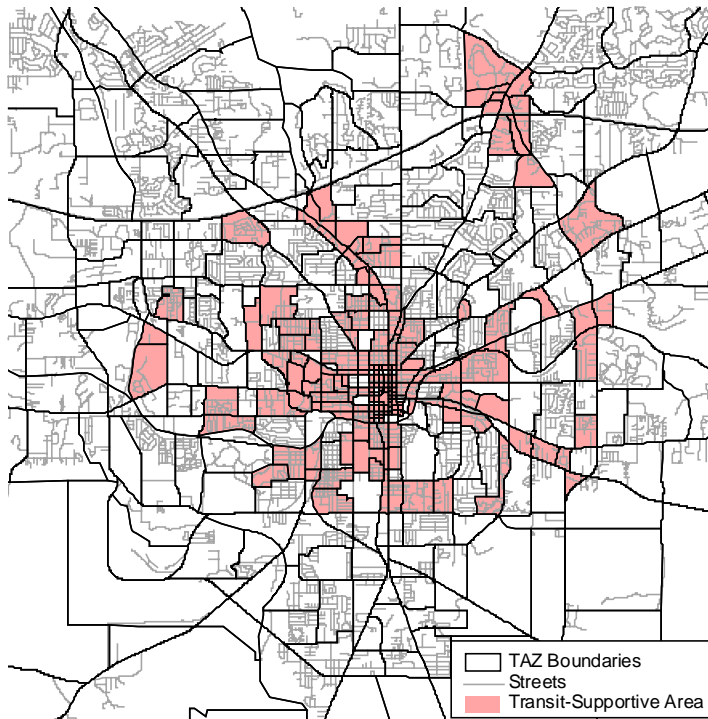
Steps

1. Develop a spreadsheet from the data used for the transportation model, listing population, jobs, and area for each TAZ. Convert population to households by dividing by 2.5. Calculate household density for each TAZ by dividing the number of households by the TAZ’s area; calculate job density similarly. A TAZ is transit-supportive if the household density is at least 7.5 households/gross hectare (3 households/gross acre) or the employment density is at least 10 jobs/gross hectare (4 jobs/gross acre).

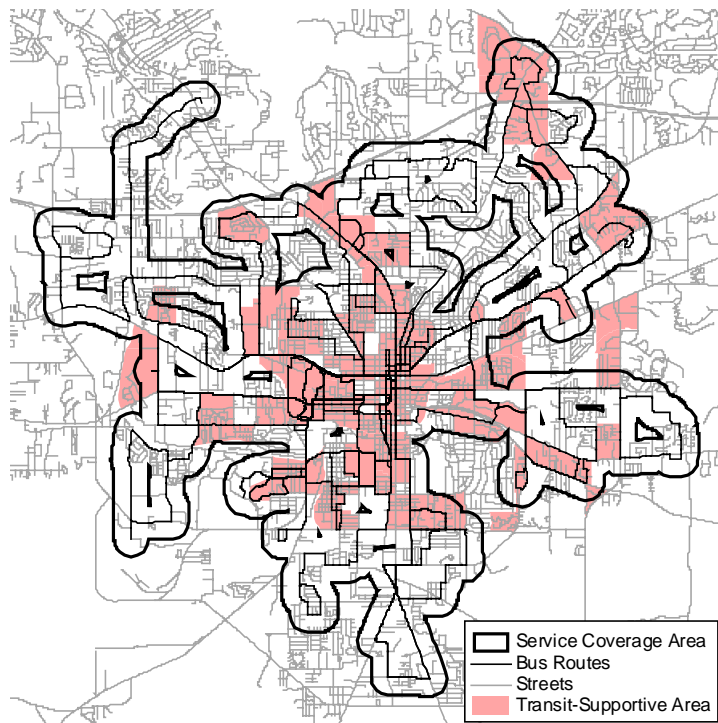
This process is illustrated for two TAZs:

TAZ	Pop	Jobs	Area (m ²)	Households	Area (hectares)	HH Density	Job Density
255	1134	308	1,017,046	453.6	101.7	4.46	3.03
399	345	852	497,767	138.0	49.8	2.77	17.1

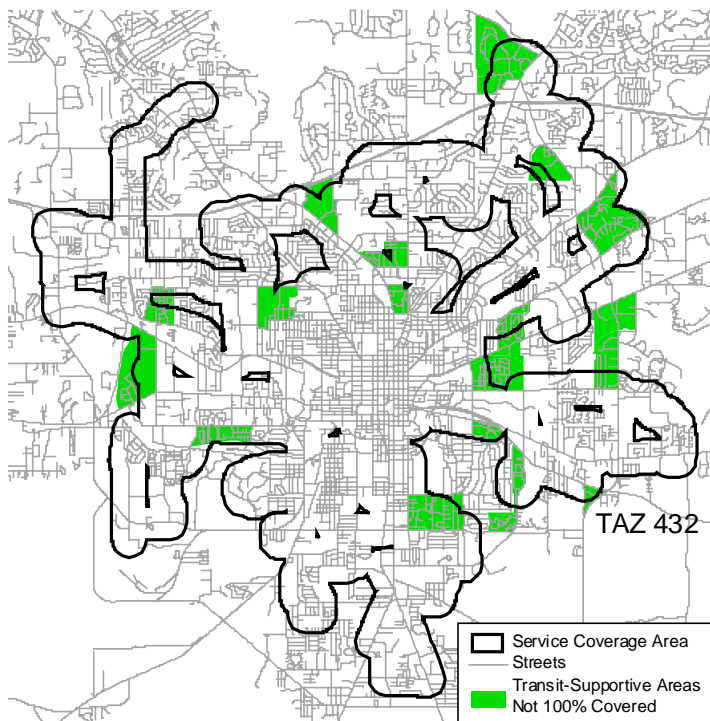
In this example, TAZ 255 is not transit-supportive, but TAZ 399 is. The map on the following page illustrates the transit-supportive TAZs. There are 174 transit-supportive TAZs in all.



2. For the transit-supportive TAZs identified in Step 1, draw the location of the bus routes serving those TAZs and draw 0.4-km buffers around each route, excluding any areas known not to have pedestrian access, as shown in the following map:



3. Twenty-four of the 174 transit-supportive TAZs are only partially served by transit, as depicted in the map below. Estimate the percentage of the area of each of these TAZs served by transit. For example, TAZ 432 is about 50% served by transit.



4. Divide the transit-supportive area served by transit by the total transit-supportive area to determine the percentage of the transit-supportive area served and the resulting service coverage LOS.

The Results

The total transit-supportive area is 34 km², and 29 km² of it is covered by transit. As a result, 85% of this system's transit-supportive area is covered, corresponding to LOS B. The parts of the city that can support at least hourly bus service for the most part receive at least some service during the day. For policy reasons, or simply to connect two higher-density areas, most operators will serve a considerably larger area than the transit-supportive area.

Example Problem 4

The Situation

The same as Example Problem 3, except that GIS software is used.

Service coverage LOS (GIS method).

The Question

Where are the city's transit-supportive areas and how well are they currently being served?

The Facts

- ✓ Same assumptions as Example Problem 3.

Comments

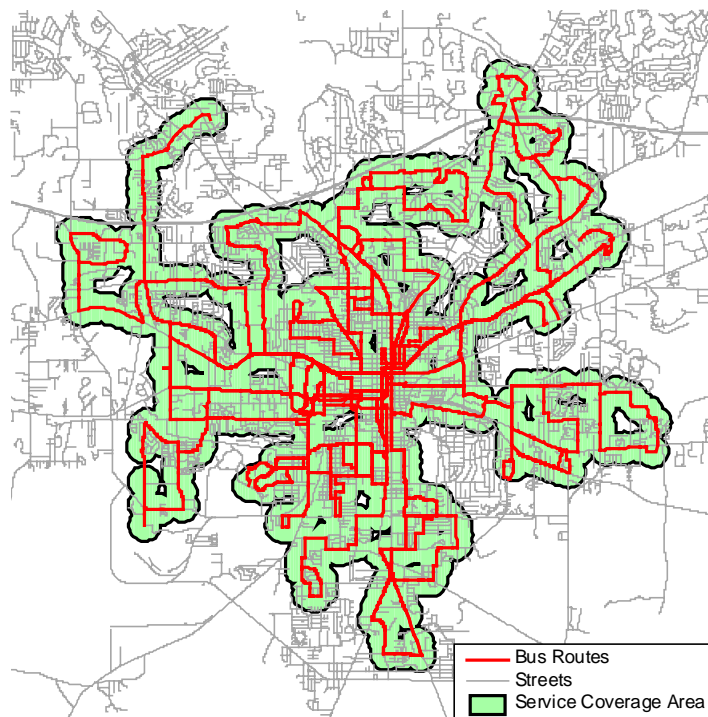
- ✓ The transit agency contacts the local MPO, which has GIS software in-house. Themes are obtained or created for streets (used as a base map), bus stops (used to identify the area served by transit) and TAZs (containing population and employment information).
- ✓ Census data for the area indicate an average household size of 2.5 people.

Outline of Solution

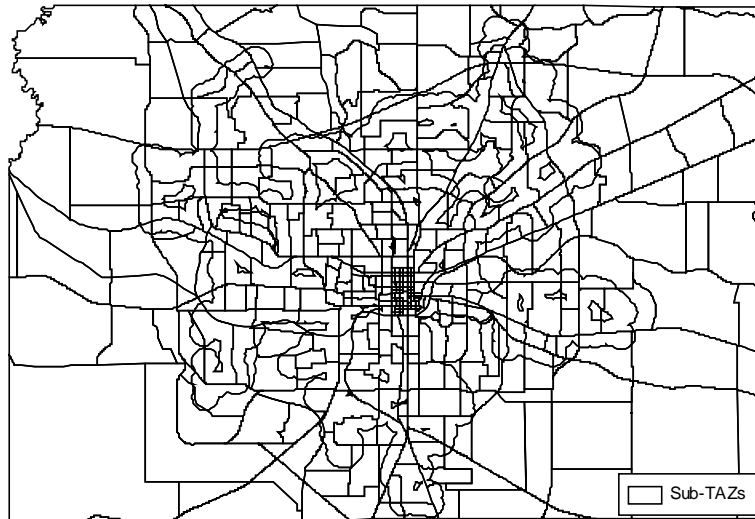
The area served by transit is identified by creating 0.4-km walk-distance buffers around each bus stop. This area is then intersected with the TAZ theme to create a new sub-TAZ theme that contains sub-TAZs that are entirely with or without transit service. Next, the GIS calculates the area of each sub-TAZ and the resulting household and employment density. Next, all sub-TAZs meeting the transit-supportive area criteria are identified and their areas summed. Finally, the sub-TAZs served by transit are identified and their areas summed. LOS is calculated by dividing the second area into the first.

Steps

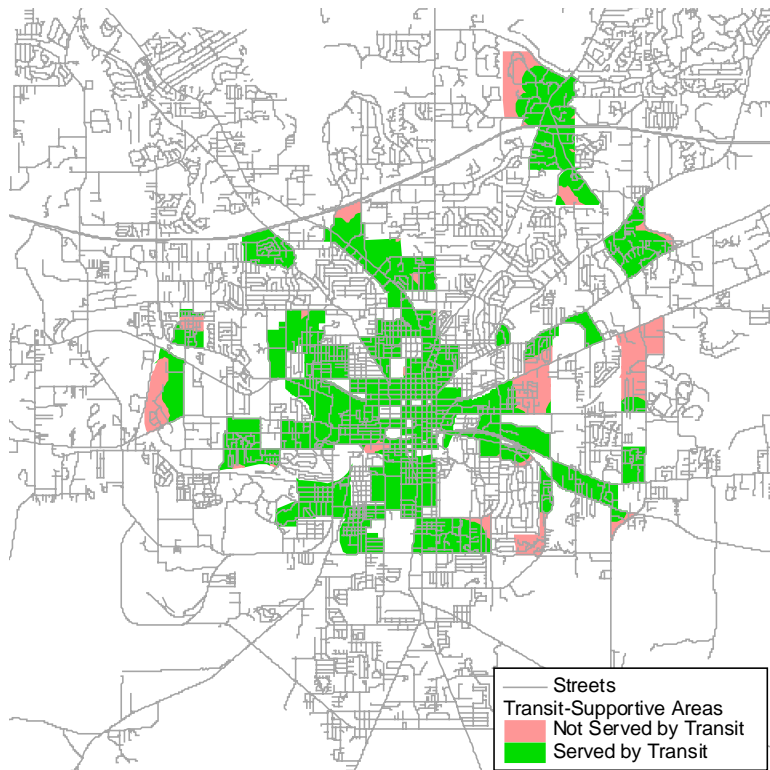
1. Create 0.4-km buffers around each bus stop. Remove any areas where pedestrian access is not possible. The following map results:



2. Create a new service coverage theme from this buffer area. Intersect this theme with the TAZ theme, resulting in the new sub-TAZ theme depicted below:



3. Calculate the area, household, and employment density for each sub-TAZ. Next, determine which sub-TAZs are transit-supportive and which are not. Finally, determine which transit-supportive TAZs are served by transit and which are not:



4. Sum the areas of the transit-supportive sub-TAZs served by transit and divide by the sum of the areas of all the transit-supportive sub-TAZs to obtain the service coverage LOS.

The Results

The total transit-supportive area is 33.8 km², and 29.1 km² of it is covered by transit. As a result, 86.1% of this system's transit-supportive area is covered, corresponding to LOS B. Using a service coverage area based on bus stop locations rather than bus routes results in a smaller area being served by transit than that calculated by the manual method.

Transit/auto travel time LOS (manual method).

Example Problem 5

The Situation

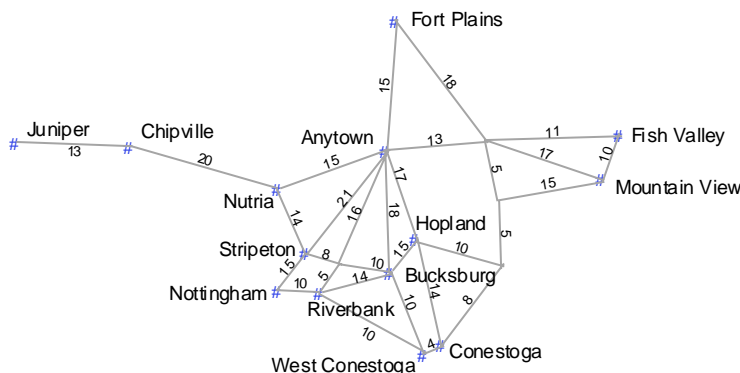
As part of a regional study of traffic congestion, the Anytown MPO wishes to compare existing travel times by transit and auto to help determine where transit service improvements or transit priority measures may be needed to make transit service more competitive with the automobile.

The Question

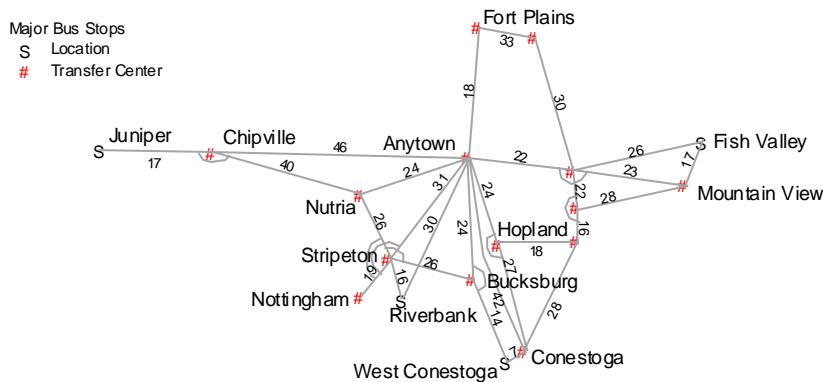
What are comparative travel times by transit and auto between city centers in the region during the a.m. peak hour, and what is the corresponding LOS?

The Facts

- ✓ Travel time data for key regional roadways indicate the following average peak direction travel times (in minutes) by auto between cities during the a.m. peak hour:



- ✓ Current scheduled peak direction travel times (in minutes) by transit between cities and major transfer centers are shown on the map below. "Bypasses" shown on the map around transfer centers indicate trips where no transfer needs to be made.



Comments

- ✓ Walk time to and from transit is assumed to average 3 minutes at each end of a trip.
- ✓ Wait time for transit is assumed to be 5 minutes at the start of a trip.
- ✓ Each transfer is assumed to add 10 minutes to a trip.
- ✓ Auto trips to Anytown add 5 minutes for parking in garages and 3 minutes average walk time from parking garages to offices.
- ✓ Plentiful free parking is available at all work locations outside Anytown.
- ✓ Congestion in central Nutria adds 5 minutes to access the freeway system by car.

Outline of Solution

Calculate the travel time between each pair of locations by auto and by transit. Adjust these times by the criteria listed above to obtain door-to-door travel times. Subtract the adjusted auto time from the adjusted transit time to obtain the travel time difference for each pair of locations and the resulting level of service.

Steps

1. Determine the auto travel times (not including parking and off-highway congestion mentioned in the comments) between each pair of locations. For example, travel time between Juniper and Anytown is 48 minutes, based on the map on the previous page.

	Nutria	Juniper	Mtn View	Chipville	Bucksburg	Hopland	Conestoga	Fish Valley	Nottingham	Stripeton	Riverbank	Fort Plains	West Cones.
Anytown	15	48	30	35	18	17	31	24	31	25	21	15	32
Nutria		33	45	20	32	32	41	39	29	14	27	30	42
Juniper			78	13	65	65	74	72	62	47	60	63	75
Mtn View				65	45	30	28	10	52	51	42	35	32
Chipville					52	52	61	59	49	34	47	50	62
Bucksburg						15	14	42	24	18	14	33	10
Hopland							14	31	38	33	28	38	18
Conestoga								29	24	27	14	36	4
Fish Valley									55	45	45	29	33
Nottingham										15	10	46	20
Stripeton											13	36	23
Riverbank												36	10
Fort Plains													40

2. Determine the transit travel times (including transfers but not including walk and wait time) between each pair of locations. For example, transit travel time between Juniper and Anytown is 63 minutes (from the map), and a 10-minute wait to transfer between routes occurs in Chipville, for a total transit travel time of 73 minutes.

	Nutria	Juniper	Mtn View	Chipville	Bucksburg	Hopland	Conestoga	Fish Valley	Nottingham	Stripeton	Riverbank	Fort Plains	West Cones.
Anytown	24	73	45	46	24	24	42	58	50	31	30	18	38
Nutria		57	79	40	52	58	76	92	55	26	42	52	72
Juniper			128	17	107	107	125	141	122	93	109	101	121
Mtn View				101	79	79	92	17	105	86	85	73	93
Chipville					80	80	98	114	105	76	92	74	94
Bucksburg						58	21	92	55	26	52	52	14
Hopland							27	92	84	65	64	52	44
Conestoga								110	86	57	82	70	7
Fish Valley									118	99	98	86	106
Nottingham										19	45	78	79
Stripeton											16	59	50
Riverbank												58	78
Fort Plains													66

- Adjust the travel times based on the comments to obtain door-to-door travel times, and calculate the travel time difference for each pair of locations. For example, the door-to-door auto time from Juniper to Anytown is 56 minutes, including the 8 minutes required to park and walk. The door-to-door transit time is 84 minutes, including the 11 minutes required to walk and wait. The difference in automobile and transit travel times is 28 minutes.

	Nutria	Juniper	Mtn View	Chipville	Bucksburg	Hopland	Conestoga	Fish Valley	Nottingham	Stripeton	Riverbank	Fort Plains	West Cones.
Anytown	7	28	18	14	9	10	14	37	22	9	12	6	9
Nutria		30	40	26	26	32	41	59	32	18	21	28	36
Juniper			61	15	53	53	62	80	71	57	60	49	57
Mtn View				47	45	60	75	18	64	46	54	49	72
Chipville					39	39	48	66	67	53	56	35	43
Bucksburg						54	18	61	42	19	49	30	15
Hopland							24	72	57	43	47	25	37
Conestoga								92	73	41	79	45	14
Fish Valley									74	65	64	68	84
Nottingham										15	46	43	70
Stripeton											14	34	38
Riverbank												33	79
Fort Plains													37

- Calculate the level of service for each pair of locations. For example, the travel time difference of 28 minutes between Juniper and Anytown equates to LOS C.

	Nutria	Juniper	Mtn View	Chipville	Bucksburg	Hopland	Conestoga	Fish Valley	Nottingham	Stripeton	Riverbank	Fort Plains	West Cones.
Anytown	B	C	C	B	B	B	B	D	C	B	B	B	B
Nutria		C	D	C	C	D	D	E	D	C	C	C	D
Juniper			F	B	E	E	F	F	F	E	E	E	E
Mtn View				E	D	E	F	C	F	E	E	E	F
Chipville					D	D	E	F	F	E	E	D	D
Bucksburg						E	C	F	D	C	E	C	B
Hopland							C	F	E	D	E	C	D
Conestoga								F	F	D	F	D	B
Fish Valley									F	F	F	F	F
Nottingham										B	E	D	F
Stripeton											B	D	D
Riverbank												D	F
Fort Plains													D

The Results

The radial route pattern serving Anytown provides good levels of service (B or C) from everywhere within the metro area except Fish Valley. Service between suburbs is generally poor, as is often the case with a radial pattern, although some suburbs (e.g., Nutria) have relatively good service. Because of the number of transfers involved, transit travel times from Fish Valley are very high compared to the automobile, making transit an unattractive option for potential riders.

Possible improvements to improve service include the following:

- Express service from distant suburbs to Anytown to reduce travel times.
- Express cross-town routes between suburbs where demand warrants.
- Decreasing the number of transfers required or improving timed transfers to reduce the average wait time when transferring between routes.
- Transit priority measures on high-volume routes serving Anytown, to make travel times even more competitive with the automobile.

Example Problem 6

The Situation The transit agency from Example Problems 1-4 would like to assess service to and from the hospital.

Transit service report card.

The Question What is the overall quality of service provided?

The Facts

- ✓ Same assumptions as Example Problems 1-4.

Comments

- ✓ A survey of peak hour bus passenger loads over several days at the hospital determines that all passengers are seated and that about 1/3 of the seats, on average, are empty. The agency uses standard 12-meter buses.
- ✓ The agency normally checks schedule reliability only for arrivals at the downtown transfer center. Over the previous year, buses serving the hospital arrived late 7% of the time, on average.
- ✓ Other than trips to downtown and Shopping Center #1, which take 10 minutes longer by bus, most trips to destinations around the city take 25-40 minutes longer by bus than by car.

Outline of Solution

Look at the levels of service for each category and assess how potential changes in service might affect them.

Steps

The following table summarizes LOS for the hospital, based on Example Problems 1-4 and the information presented above:

Category	LOS
Service Frequency	C to downtown, colleges, nearest shopping center E or F to most residential locations
Hours of Service	C to downtown, colleges E to most residential locations
Service Coverage	B system-wide, hospital is served
Passenger Loads	B
Reliability	B
Transit-Auto Travel Time Ratio	B to downtown, nearest shopping center C or D to other locations served by transit

The Results

The areas where service could be improved the most are service frequency, hours of service, and transit-auto travel time ratio. A many-to-one paratransit service to the hospital could address these areas. Such a service would be more convenient for patients, who would not have to wait as long before and after appointments for bus service. Workers who have to arrive early in the morning at the same time each day to prepare meals for patients could arrange for standing reservations for service. Travel times would likely be no longer than with the existing service using transfers and could possibly be shorter, particularly with at-the-door pickup of passengers.

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PART 6

GLOSSARY

There is inconsistency in the terminology used in North American transit. Many systems have their own specific, historically derived, terminology: a motorman and guard on one system can be an operator and conductor on another. Modal definitions can be confusing. What is clearly light rail by definition may be termed streetcar, semi-metro, or rapid transit in a specific city. It is recommended that in these cases local usage should prevail.

This part of the manual presents definitions for the various transit terms discussed and referenced in the manual. In addition, other important terms related to transit planning and operations are included.

A

AAADT – annual average daily traffic; see *traffic, annual average daily*.

AAR – Association of American Railroads; see *organizations, Association of American Railroads*.

AASHTO – American Association of State Highway and Transportation Officials; see *organizations, American Association of State Highway and Transportation Officials*.

AAWDT – annual average weekday traffic; see *traffic, annual average weekday*.

ABS – automatic block signal; see *control system, automatic block signal*.

AC – alternating current.

ADA – Americans with Disabilities Act of 1990; see – *legislation, Americans with Disabilities Act of 1990*.

ADB – advanced design bus; see *bus, advanced design*.

ADT – average daily traffic; see *traffic, average daily*.

ATTB – Advanced Technology Transit Bus.

AFC – automatic fare collection; see *fare collection system, automatic*.

AGT – automated guideway transit; automated guided transit; see *transit system, automated guideway*.

APTA – American Public Transit Association; see *organizations, American Public Transit Association*.

ATC system – automatic train control system.

ATO – automatic train operation.

ATP – automatic train protection.

ATS – automatic train supervision; automatic train stop system.

ATU – Amalgamated Transit Union; see *union, transit*.

AVL – automatic vehicle location system.

AW0, AW1, AW2, AW3 – see *car, weight designations*.

absolute block – see *block, absolute*.

absolute permissive block – see *block, absolute permissive*.

acceleration – increase in velocity per unit time; in transit, usually measured in feet per second squared (meters per second squared) or, in the

United States, sometimes in miles per hour per second.

access, limited (controlled access) – in transportation, to have entry and exit limited to predetermined points, as with rail rapid transit or freeways.

accessibility – **1.** A measure of the ability or ease of all people to travel among various origins and destinations. **2.** In transportation modeling and planning, the sum of the travel times from one zone to all other zones in a region, weighted by the relative attractiveness of the destination zones involved. **3.** In traffic assignment, a measure of the relative access of an area or zone to population, employment opportunities, community services, and utilities.

accessibility, handicapped (full accessibility) – the extent to which facilities are free of barriers and usable by mobile handicapped people, including wheelchair users.

accessibility, station – a measure of the ability of all people within a defined area to get to a specific transit station.

accessibility, transit – **1.** A measure of the availability to all people of travel to and from various origins and destinations by transit. **2.** A measure of the ability of all people to get to and from the nearest transit stop or station and their actual origin or destination. **3.** In common usage, often used to mean the ability of the physically handicapped to use transit.

accessible station – see *station, accessible*.

accessible vehicle – see *vehicle, accessible*.

accessible transit system – see *transit system, accessible*.

accessible transportation facilities – transportation facilities that are barrier-free, allowing their use by all travelers, including the mobile physically handicapped, elderly, and transportation disadvantaged.

access mode – see *mode, access*.

access time – see *time, access*.

active vehicle – see *vehicle, active*.

activity center – see *major activity center*.

act – see *legislation*.

add fare – **1.** an additional fare to upgrade an existing ticket. **2.** an additional fare paid on exit from a distance based fare system when there are

insufficient funds remaining on a stored value ticket, see also *fare, differential*.

adult cash fare – see *fare, adult cash*.

advanced design bus – see *bus, advanced design*.

advisory committee – see *organizations, citizen advisory committee*.

aerial structure – in transportation, any structure other than a culvert that carries a roadway or track or other guideway above an earth or water surface; see also *guideway, elevated* (viaduct in older British terminology).

aerial tramway – in passenger transportation, a mode consisting of cabins suspended from a stationary cable and towed by a moving, usually closed-loop, cable. The cable system is powered by engines or motors at a central. Some systems have detachable cabins that can slow to a crawl at terminals for boarding and alighting.

agencies, federal – see *U.S. Government*.

agency, regional planning – see *organizations, regional planning agency*.

agency, transit – see *transit district*.

air brake – see *brake, air*; and *brake, automatic air*.

alight – to get off or out of a transportation vehicle.

alignment – in transportation, the horizontal and vertical ground plan of a roadway, railroad, transit route, or other facility as it would appear in plan and profile. The alignment is usually described on the plans by the use of technical data, such as grades, coordinates, bearings, and horizontal and vertical curves, see also *roadbed* and *formation*.

all-or-nothing trip assignment – see *trip assignment, all-or-nothing*.

all-stop station – see *station, all-stop*.

alternate fuel – alternatives to conventional diesel fuel for urban transit buses, intended to reduce pollution, includes methanol, propane, CNG (compressed natural gas), LNG (liquefied natural gas), hydrogen (for fuel cells) and biomass derived fuels. All carry premium costs that have produced a trend in larger or more cost conscious operators towards “clean diesel” solutions. See also *buses, hybrid*.

alternating-current motor – see *motor, alternating-current*.

alternative fuel – see *fuel, alternative*.

Amalgamated Transit Union – see *union, transit*.

ambulatory handicapped – see *handicapped, ambulatory*.

amenity, passenger — see *passenger amenity*.

American Association of State Highway and Transportation Officials – see *organizations, American Association of State Highway and Transportation Officials*.

American Public Transit Association – see *organizations, American Public Transit Association*.

a.m. peak – see *peak*.

Amtrak – see *U.S. Government, National Railroad Passenger Corporation*.

annual average daily traffic – see *traffic, annual average daily*.

annual average weekday traffic – see *traffic, annual average weekday*.

area, auto-free – see *auto-free zone*.

area, auto-restricted – see *auto-restricted zone*.

area, coverage – in transit operations, the geographical area that a transit system is considered to serve, normally based on acceptable walking distances (e.g., ¼ mile, 0.4 km) from loading points. For suburban rail transit that depends on automobile access (park and ride or kiss and ride), coverage may extend several kilometers. See also *area, service*.

area, free – a portion of a transportation facility that people are permitted to enter without the payment of a fare.

area, fringe – the portion of a municipality immediately outside the central business district or the portion of an urban area outside of a central city or cities (urban fringe) that is characterized by a variety of business, industrial, service, and some residential activity.

area, loading – see *bus bay*.

area, paid area – **1.** An area that a passenger may enter only after having paid a fare or with proper credentials. **2.** The area in a station that is set off by barriers, gates, or other structures to permit ready access to transit only by those who have paid fares or secured passes before entering.

area, service – **1.** The jurisdiction in which the transit property operates. **2.** The geographic region in which a transit system provides service or that a transit system is required to serve. See also *area, coverage*.

area, transit-supportive – an area with sufficient population and/or employment density to warrant at least hourly transit service.

area, urbanized (UA) – as defined by the Bureau of the Census, a population concentration of at least 50,000 inhabitants, generally consisting of a central city and the surrounding, closely settled, contiguous territory (*suburbs*). The boundary is based primarily on a population density of 1,000 people/mi² but also includes some less densely settled areas, as well as such areas as industrial parks and railroad yards, if they are within areas of dense urban development. The boundaries of UAs, the specific criteria used to determine UAs, or both may change in subsequent censuses. It should be noted that some publications abbreviate urbanized area *UZA*.

area occupancy – in station and other facility design and in pedestrian movement, the area provided per person.

arterial service – see *service, arterial*.

articulated bus or articulated trolleybus – an extra-long, high-capacity bus or trolleybus that has the rear body section or sections flexibly but permanently connected to the forward section. The arrangement allows the vehicle to bend in curves and yet have no interior barrier to movement between the two parts. The *puller* type features a powered center axle while the *pusher* type features a powered rear axle. Articulated buses with powered center and rear axles exist but are not common. Typically, an articulated bus is 16-18 m (54-60 ft) long with a passenger seating capacity of 60 to 80 and a total capacity of 100 to 140.

articulated rail vehicle (articulated car) – **1.** An extra-long rail vehicle with two or more bodies connected by joint mechanisms that allow bending in curves yet provide a continuous interior. Typically, the vehicle is 17-33 m (56-100 ft) long. It is common on light rail but is also found on several heavy rail systems. **2.** Rapid

transit cars with separate bodies that share a common center truck.

aspect, signal – see *signal aspect*.

assignment, traffic or trip – see *trip assignment*.

Association of American Railroads – see *organizations, Association of American Railroads*.

attributes, service – see *service attributes*.

authority, transit – see *transit district*.

auto-free zone (AFZ, auto-free area) – an area in which normal automobile traffic is prohibited. Vehicular traffic is restricted to public transit, emergency vehicles, taxicabs, and delivery of goods (the latter usually confined to certain time periods), or some combination thereof.

automated guideway transit – see *transit system, automated guideway*.

automatic block signal – see *signal, automatic block*.

automatic block signal control system – see *control system, automatic block signal*.

automatic coupler – see *coupler, automatic*.

automatic fare collection – see *fare collection system, automatic*.

automatic signal – see *signal, automatic*.

automatic train control system (ATC system) – **1.** A system for automatically controlling train movement, enforcing train safety, and directing train operations by computers; see also *automatic train operation, automatic train protection, and automatic train supervision*. **2.** A trackside system working in conjunction with equipment installed on the train, arranged so that its operation will automatically result in the application of the brakes to stop or control a train's speed at designated restrictions, should the operator not respond. The system usually works in conjunction with cab signals (more correctly called *automatic train stop*).

automatic train operation (ATO) – the subsystem within automatic train control that performs such functions as speed control, programmed stopping, and (sometimes) door operation.

automatic train protection (ATP) – the subsystem within automatic train control that provides fail-safe protection against collisions, and sometimes against excessive speed or other hazardous conditions.

automatic train stop system (ATS) – a system that works in conjunction with equipment installed on the electric rail car or locomotive to apply the brakes at designated restrictions or on a dispatcher's signal, should the operator not respond properly.

automatic train supervision (ATS) – the subsystem within automatic train control that monitors trains, adjusts the performance of individual trains to maintain schedules, and provides data for adjusting service to minimize the inconveniences otherwise caused by irregularities. May also be used for systems that merely display train status and rely on staff intervention for any corrective action.

automatic vehicle location system (AVL) – a system that determines the location of vehicles carrying special electronic equipment that communicates a signal back to a central control facility. AVLs are used for detecting irregularity in service and are often combined with a computer-aided dispatch system.

automobile or auto occupancy – see *vehicle occupancy*.

auto-restricted zone (ARZ, auto-restricted area) – an area in which vehicular traffic is regulated by time of day and type of vehicle. Normal automobile traffic and, sometimes, delivery of goods are limited to certain times; public transit, emergency vehicles, and (usually) taxicabs are permitted unrestricted access.

availability, transit system – see *transit system availability*.

average daily traffic – see *traffic, average daily*.

average fare – see *fare, average*.

average speed – see *velocity, effective*.

average trip length – passenger miles divided by unlinked passenger trips.

Barn – older term for streetcar storage building (also known as a *carhouse*), or for buses (*garage*), infrequently applied for light and heavy rail vehicles (alternates — *yard, depot, shop, maintenance and storage facility*.)

barrier-free – containing no obstacles that would prevent use by a mobile physically handicapped or any other person.

barrier-free fare collection system – see *fare collection system, self-service barrier free*.

base fare – see *fare, base*.

base headway – see *headway, base*.

base period (off-peak period) – in transit, the time of day during which vehicle requirements and schedules are not influenced by peak-period passenger volume demands (e.g., between morning and afternoon peak periods). At this time, transit riding is fairly constant and usually moderate in volume when compared with peak-period travel. See also *off peak*.

base-period fleet – in transit, the number of transit units (vehicles or trains) required to maintain base-period schedules.

base-period service – see *service, base-period*.

basic fare – see *fare, base*.

basic operating unit – in rail rapid transit, the smallest number of rapid transit vehicles that can operate independently in revenue service, usually one to three (exceptionally more) cars.

battery bus – see *bus, electric*.

bay, bus – see *bus bay*.

belt, passenger – see *moving walkway*.

berth, bus – see *bus bay*.

berth, train – see *train berth*.

bicycle locker – a lockable, enclosed container used for storing a bicycle. Typically provided at major transit stops and stations and rented on a monthly basis.

bicycle rack – **1.** A fixed post or framework to which bicycles may be secured and locked, typically provided on a first-come, first-served basis. **2.** A device mounted to a transit vehicle that allows bicycles to be transported outside the passenger compartment. Typically provided on a first-come, first-served basis; many transit operators require that passengers obtain a permit to use them.

bidirectional car – see *car, bidirectional*.

bidirectional transit unit – see *double-ended transit unit*.

bilevel car – see *car, bilevel*.

blister – see *bus bay*.

block – **1.** A section of track or guideway of defined limits on which the movement of trains is governed by block signals, cab signals, or both; also known as a *signal block*. **2.** A section of track of defined length, the occupancy of which is regulated by fixed signal(s), telephone or radio orders, or timetables; also known as a *block section*. **3.** The daily operating schedule of a transit unit (vehicle or train) between pull-out and pull-in, including scheduled and deadhead service. A block may consist of a number of runs.

block, absolute – a block that no train may enter while the block is occupied by another train.

block, absolute permissive – a signal system for a single track or guideway that prevents simultaneous opposing train movements between sidings but permits following movements at a safe distance.

block, signal – a standard railroad signal system that uses a fixed signal at the entrance of a block to govern the separation of trains entering the block; see also *block*.

block control system, dynamic – see *control system, moving block*.

block control system, fixed – see *control system, fixed block*.

block control system, manual – see *control system, manual block*.

block control system, moving – see *control system, moving block*.

block indicator – a device, generally located near a turnout switch, that is used to indicate the presence of a train in the block or blocks leading to that switch.

block section – see *block*.

block signal – see *signal, block*.

block signal control – see *control system, block signal*; and *control system, automatic block signal*.

board – to go on to or into a transportation vehicle.

bollard – an upright fixed block (usually concrete) used to prevent the unauthorized or unintended entry of vehicles into an area.

box, fare – see *farebox*.

brake, air – a brake in which the mechanism is actuated by manipulation of air pressure. The term is often used to describe brakes that employ air under pressure above brake atmospheric, in contrast to vacuum brakes, which employ pressure below atmospheric.

brake, blended – see *brake, dynamic*.

brake, continuous (trainlined brake) – a system of brakes interconnected among rail cars so that the brakes on all cars in the train can be operated simultaneously from the locomotive or from any car in a multiple-unit train.

brake, disc – a brake used primarily on rail passenger cars that uses brake shoes clamped by calipers against flat steel discs.

brake, dynamic (electric brake, electrodynamic brake, motor brake) – a system of electrical braking in which the traction motors, used as generators, retard the vehicle by converting its kinetic energy into electrical energy. This energy is absorbed by resistors. See

also *brake, regenerative*. Dynamic brakes may be used to control train speed and to brake a train to a low speed, after which air brakes are blended in to bring the train to a full stop.

brake, electric or electrodynamic – **1.** alternate to air brake for some streetcars and light rail vehicles—most notably immediately post-war PCC cars. **2.** braking through electric motors, see *brake, dynamic*.

brake, electromagnetic – see *brake, track*.

brake, electropneumatic (pneumatic brake) – an automatic air brake that has electrically controlled valves to expedite applying and releasing the brakes.

brake, friction (mechanical brake) – a brake that presses brake shoes against the running wheel tread or pads against inboard or outboard disc surfaces.

brake, hydraulic – hydraulically operated brake typical of automotive practice, used on small buses and vans and entering use on some rail vehicles as alternate to air brake.

brake, magnetic – see *brake, track*.

brake, mechanical – see *brake, friction*.

brake, motor – see *brake, dynamic*.

brake, pneumatic – see *brake, electropneumatic*.

brake, regenerative – a form of dynamic brake in which the electrical energy generated by braking is returned to the power supply line instead of being dissipated in resistors. In rare cases the traction sub-stations can return this power to the electric utility or burn it in resistors, then the line is always receptive, eliminating on-board resistors.

brake, service – **1.** The primary train brake system. **2.** The braking rate used for normal deceleration requirements, in contrast to emergency braking, which may provide greater retardation. Typically 0.13g, 3.0 mph/s, 1.3 m/s², a level beyond which standing passengers become uncomfortable or may lose their balance.

brake, slip-slide control – an electronic control used on most current rail vehicles to sense and correct wheel slip or slide by modulating braking or reducing acceleration.

brake, track (electromagnetic brake, magnetic brake) – a brake that consists of electromagnets suspended above the track rail between the two wheels on both sides of a truck. When applied, the brakes are attracted onto the steel rails, exerting braking force through friction. The brakes are difficult to apply gradually and so are reserved for emergencies (often from battery power) and are always supplementary to another braking system. This type of brake is used on most light rail vehicles and streetcars and on some heavy rail cars (modulated electromagnetic track brakes are used on the Vancouver SkyTrain.)

brake, trainlined – see *brake, continuous*.

brake shoe – the non-rotating portion of a tread or disc brake assembly. The shoe is pressed against the tread, disc, or drum when the brake is applied.

braking, closed loop – braking under continuous modulation by means of feedback from the train control system.

braking, emergency (emergency application) – in rail operations, applying the brakes to stop in the minimum distance possible for the equipment, usually at a higher retardation rate than that

obtained with a maximum service brake application. Once the brake application is initiated, it often cannot be released until the train has stopped or a predetermined time has passed.

braking, full service – see *braking, maximum service*.

braking, maximum service (full service braking) – in rail operations, a non-emergency brake application that obtains the maximum brake rate that is normally regarded as comfortable for passengers and consistent with the design of the primary brake system.

braking, open-loop – unmodulated braking without feedback control from the train control system.

braking, programmed – automatically controlled braking that causes a train to stop or reduce its speed to a predetermined level at a designated point within a specified range of deviation.

braking rate – see *deceleration*.

braking, service (service application) – in rail operations, retardation produced by the primary train braking system at the maximum rate of retardation regarded as comfortable for repeated use in service stopping. See *brake, service* for rates.

broad gauge – see *gauge, broad*.

bulge – see *bus bulge*.

bunching – with transit units, a situation that occurs when passenger demand is high and dwell times at stops are longer than scheduled. Headways become shorter than scheduled, and platoons of transit units (vehicles or trains) develop, with longer intervals between platoons. The same effect (one transit unit caught by the following) can also be caused by lack of protection from general road traffic congestion or by traffic signal timing. Bunching can become cumulative and can result in delay to passengers and unused capacity.

bus – a self-propelled, rubber-tired road vehicle designed to carry a substantial number of passengers (at least 16, various legal definitions may differ slightly as to minimum capacity), commonly operated on streets and highways. A bus has enough headroom to allow passengers to stand upright after entering. Propulsion may be by internal combustion engine, electric motors or hybrid, see also, *alternate fuels*. Smaller capacity road transit vehicles, often without full headroom, are termed vans.

bus, advanced design (ADB) – a prototype bus, originally introduced in the mid-1970s, that incorporates new styling and design features specified by the then Urban Mass Transportation Administration.

bus, articulated – see *articulated bus or articulated trolleybus*.

bus, battery – see *bus, electric*.

bus, commuter – see *service, commuter*.

bus, cruiser – name for highway coaches used in transit service (probably a contraction of ScenicrUISer or AmericrUISer), high floor over luggage compartments with depressed aisle, usually with single, swing front door.

bus, double-decker – a high-capacity bus that has two levels of seating, one over the other, connected by one or two stairways. Total bus height is usually 4.0-4.4 m (13-14.5 ft), and

typical passenger seating capacity ranges from 60 to 80 people.

bus, dual-mode – 1. A bus designed to operate both on city streets and on rails or other types of guideway; also known as a *dual-control bus*. **2.** Sometimes used to refer to a trolleybus with a diesel or gasoline engine that can operate away from overhead wires; also known as a *dual-powered bus*.

bus, electric (battery bus) – a bus that is propelled by electric motors mounted on the vehicle. The power source, usually a battery or battery pack, is located in the vehicle or on a trailer.

bus, express – see *service, express bus*.

bus, hybrid – a bus combining two power sources, usually a small diesel, gas, or Sterling engine and batteries. The engine drives an electrical generator at constant speed, optimizing efficiency and minimizing pollution. When maximum power is required the generator plus batteries feed the traction motor(s), often hub type. At other times the generator and regenerative braking power charges the batteries. Combinations can include fuel cells and/or flywheels.

bus, intercity (over-the-road coach) – a large bus with luggage space, used primarily for transportation between cities. It usually has reclining seats and restroom facilities.

bus, local – see *service, local bus*.

bus, low floor – a bus without steps at entrances and exit. The low floor may extend throughout the bus or may use a ramp or steps to access the raised rear portion over a conventional axle and drive train. Wheelchair access is provided by a retracting ramp.

bus, motor (motor coach) – a bus that has a self-contained source of motive power, usually a diesel engine.

bus, New Look – generally refers to a bus model manufactured by General Motors in the United States and Canada between 1959 and 1983. New Look buses are characterized by large slanting windows, often with an additional row of small windows to allow standing passengers to see out. Also similar designs from other makers. Colloquial term—*fishbowl*.

bus, owl – see *run, owl*.

bus, school – 1. A vehicle operated by a public or private school or by a private contractor for the purpose of transporting children (through grade 12) to and from school or to and from other school-sponsored activities. The vehicle is externally identifiable as a school bus, typically by color (yellow) and lettering that identifies the school or school district served by the vehicle. This definition includes vehicles designed and built as school buses as well as other vehicles, such as vans and station wagons. See also *service, school bus*. **2.** A vehicle designed and built as a school bus, typically with body-on-chassis construction. Such a vehicle may be used for other purposes than school bus service (e.g., military or church service.)

bus, small – bus that is less than 6 m (20 ft) long.

bus, standard urban (transit coach, urban transit bus) – a bus for use in frequent-stop service with front and (usually) center doors, normally with a rear-mounted engine and low-back seating. Typically 10-12 m (35-40 ft) long.

bus, subscription – see *service, subscription bus*.

bus, suburban transit (suburban coach) – a bus with front doors only, normally with high-backed seats, reading lights, and without luggage compartments or restroom facilities for use in longer-distance service with relatively few stops.

bus, trolley – see *trolleybus*.

bus, trolley replica – a bus with an exterior (and usually an interior) designed to look like a vintage streetcar.

bus, urban transit – see *bus, standard urban*.

bus bay – **1.** A branch from or widening of a road that permits buses to stop, without obstructing traffic, while laying over or while passengers board and alight; also known as a *blister*, *bus duckout*, *bus turnout*, *pull-off* or *lay-by*. As reentry of the bus into the traffic stream can be difficult, many agencies discourage their construction. **2.** A specially designed or designated location at a transit stop, station, terminal, or transfer center at which a bus stops to allow passengers to board and alight; also known as a *bus dock* or *bus berth*. **3.** A lane for parking or storing buses in a garage facility, often for maintenance purposes.

bus bay, angle — a bus bay design similar to an angled parking space that requires buses to back up to exit; allows more buses to stop in a given linear space. Typically used when buses will occupy the berth for a long period of time (for example, at an intercity bus terminal).

bus bay, drive-through (pull-through) — a bus bay design providing several adjacent loading islands, between which buses drive through, stop, and then exit. Allows bus stops to be located in a compact area. Sometimes used at intermodal transfer centers, as all buses can wait with their front destination signs facing the direction passengers will arrive from (e.g., from a rail station exit).

bus bay, linear — a bus bay design where buses stop directly behind each other; requires the bus in front to leave its bus bay before the bus behind it can exit. Often used when buses will use the bus bay only for a short time (e.g., at an on-street bus stop).

bus bay, sawtooth — a bus bay design where the curb is indented in a sawtooth pattern, allowing buses to enter and exit bus bays independently of other buses. Often used at transit centers.

bus berth – see *bus bay*.

bus bulge (curb bulge) – an extension of the sidewalk into the roadway for passenger loading without the bus pulling into the curb, gives priority to buses and eases reentry into traffic, often landscaped and fitted with bus shelter and other passenger amenities.

bus dock or duckout – see *bus bay*.

bus gate – **1.** A bus priority signal control for intersection approaches. Signals located upstream from the intersection stop traffic in regular lanes while the bus lane remains open, allowing buses to proceed to any lane at the intersection signal ahead of other traffic. **2.** In some areas, a crossing gate on highway ramps that opens only for buses. **3.** A bus only passageway between suburban subdivisions, controlled by a gate, or a pit that is too wide for automobiles to pass—examples in Calgary, also known as a vehicle trap.

business district – see *central business district* and *outlying business district*.

bus lane – see *lane, bus*.

bus mile (bus kilometer) – one bus operated for 1 mile (kilometer.)

bus-only street – see *street, bus-only*.

bus platoon – several buses operating together as a convoy, with each bus following the operating characteristics of the one in front.

buspool – group of people who share the use and cost of bus transportation between designated origins and destinations on a regular basis, for example, daily trips to work.

bus priority lane – see *lane, bus*.

bus priority system – a system of traffic controls in which buses are given special treatment over the general vehicular traffic (e.g., bus priority lanes or preemption of traffic signals.)

bus priority system, metered freeway – a means of giving buses preferential access to enter a freeway by restraining the entrance of other vehicles through the use of ramp metering; see also *freeway, metered*.

bus rapid transit – see *transit system, bus rapid*.

bus run – see *run, bus*.

bus shelter – see *transit shelter*.

bus stop – see *stop, transit*.

bus turnout – see *bus bay*.

busway – a special roadway designed for exclusive use by buses. It may be constructed at, above, or below grade and may be located in separate rights-of-way or within highway corridors.

bypass, queue – see *queue jumper*.

bypass lane – see *queue jumper*.

C

CBD – central business district.

CNG – Compressed natural gas.

CTC – Centralized traffic control; see *control system, centralized traffic*.

centralized traffic.

CUTA – Canadian Urban Transit Association; see *organizations, Canadian Urban Transit Association*.

cab – **1.** The space or compartment in a locomotive or a powered rail car containing the operating controls and providing shelter and seats for the engine crew or motor operator **2.** A taxicab.

cab car – see *car, cab*.

cable car – see *car, cable*.

cab signal – see *control system, cab signal*.

call, road – see *road call*.

cam controller – a device to regulate direction, accelerating, running, and braking of an electric vehicle with switched resistor control. Cams on a rotating shaft open or close spring-loaded contacts that make or break electric circuits between the power supply and the traction motors.

Canadian Urban Transit Association – see *organizations, Canadian Urban Transit Association*.

cancellor – see *validator*.

capacity, achievable (capacity, practical) – the maximum number of passengers that can be transported over a given section of a transit line in one direction during a given time period — factored down to reflect the uneven passenger

demand during the peak hour, uneven vehicle occupancy and, for rail, the uneven loading of cars within a train. Usually the maximum capacity with unlimited vehicles, if constrained by number of vehicles this must be clearly stated. *Achievable capacity* is preferred usage as practical capacity has been defined in different ways in different studies.

capacity, crush (crush load) – the maximum feasible passenger capacity of a vehicle, that is, the capacity at which one more passenger cannot enter without causing serious discomfort to the others. Note that the crush load specification for some rail transit vehicles does not relate to an achievable passenger loading level but is an artificial figure representing the additional weight for which the car structure is designed or for which the propulsion and braking system will meet minimum performance criteria.

capacity, design – **1.** For highways, the maximum number of vehicles that can pass over a given section of a lane or roadway in one or both directions during a given time period under prevailing environmental (e.g., weather, light), roadway, and traffic conditions. **2.** For transit, the maximum number of passengers that can be transported over a given section of a transit line in one direction during a given time period (usually 1 hr) under prevailing traffic conditions and design comfort standards. **3.** For vehicles, the total number of spaces or people a vehicle can accommodate.

capacity, fleet (rolling stock capacity) – **1.** the total number of passenger spaces in all vehicles of a transit fleet. **2.** Maximum system or line capacity when the entire fleet, less maintenance spares, are deployed, *not in common use*.

capacity, line – the maximum number of passenger spaces that can be moved past a fixed point in one direction per unit of time (usually 1 hr) without station stops or dwells; see also *capacity, achievable* and *capacity, design*. (Real operating conditions will reduce this capacity. Except for busways without stops, this is an academic measure that should be avoided.)

capacity, normal vehicle – see *capacity, vehicle*.

capacity, practical – see *capacity, achievable*.

capacity, rolling stock – see *capacity, fleet*.

capacity, seating (seated capacity) – the number of passenger seats in a vehicle.

capacity, standing – the number of standing passengers that can be accommodated in a vehicle under specified comfort standards, expressed in area per standee.

capacity, theoretical line – see *capacity, line*.

capacity, person – the maximum number of persons that can be carried past a given location during a given time period under specified operating conditions without unreasonable delay, hazard, or restriction. Usually measured in terms of persons per hour.

capacity, productive – a measure of efficiency or performance. The product of passenger capacity along a transit line and speed.

capacity, vehicle – **1.** The maximum number of passengers that the vehicle is designed to accommodate comfortably, seated and standing; may sometimes refer to number of seats only. Also known as *normal vehicle capacity* or *total vehicle capacity*. **2.** The maximum number of vehicles that can be accommodated in a given time by a transit facility.

capital cost – nonrecurring or infrequently recurring costs of long-term assets, such as land, guideways, stations, buildings, and vehicles. These costs often include related expenses, for example, depreciation and property taxes. See also *operating costs*.

captive (transit) rider – see *rider, captive transit*.

car – **1.** A vehicle running on rails, for example, streetcar, light rail car, rapid transit car, railroad car. **2.** An automobile.

car, articulated – see *articulated rail vehicle*.

car, bidirectional (double-ended) (DE) – a powered rail car that has controls at both ends and symmetrically designed sides and ends for operation in either direction.

car, bilevel – a rail car that has two levels for passenger accommodation. The upper level may extend through the entire length of the car or only over a part of it. In this latter case the car has three different levels, two in the middle and an intermediate level over the trucks at each end, hence the term *tri-level* is occasionally seen. Bilevel cars include double-deck and gallery cars.

car, cab – **1.** A rail car with a driving cab. **2.** A passenger-carrying car used in push-pull service and fitted with a cab at one end, to be used to operate the train when the locomotive is pushing; see also *car, commuter rail*.

car, cable – an individually controlled rail passenger vehicle operating in mixed street traffic and propelled by gripping a continuously moving endless cable located in an underground slot between the rails. The cable (which can draw many cable cars simultaneously) is powered by a large stationary motor at a central location.

car, commuter rail – a passenger rail car designed for commuter rail services, usually with more seats than a conventional long-distance rail passenger car. The car may be hauled by a locomotive, have a self-contained internal combustion engine, or be electrically propelled by power from a third rail or overhead wire. See also *car, cab*.

car, diesel multiple-unit – see *car, multiple-unit*.

car, diesel rail – see *car, rail diesel*.

car, double-deck – a bilevel rail car with a second level that covers the full width of the car but may or may not extend the full length.

car, electric multiple-unit – see *car, multiple-unit*.

car, electric rail – an electric rail car powered by current from an overhead wire or third rail.

car, gallery – a bilevel rail car that has seating and access aisles on a second level along each side of an open well. Tickets of passengers on the second level can be inspected or collected from the lower level. Now unique to Chicago and Montreal.

car, light rail (LRV, light rail vehicle) – a streetcar or rail vehicle similar to a streetcar, often articulated, operating on light rail systems with substantial amounts of segregated track and higher speeds than traditional *on-street* streetcar operation. Designs available with folding steps, capable of boarding and discharging passengers at either track or car-floor level, as in San Francisco and Hannover. See also *car, streetcar*.

car, light rail vehicle, low floor – a light rail vehicle with low floor for level boarding and exiting. Floor height is 250 to 350 mm (10-14 in)

requiring a platform or raised curb at this height. Wheelchair access is provided directly or by a hinged or removable bridge plate, or by an electrically operated retractable plate. Partial low floor light rail vehicles have internal steps to access high-floor area(s) over trucks and (rarely) any articulations. In this way conventional trucks and propulsion equipment can be used.

car, motor – see *car, rail motor*.

car, multiple-unit (MU) – a powered rail car arranged either for independent operation or for simultaneous operation with other similar cars, when connected to form a train of such cars. It may be designated as *DMU (diesel multiple-unit)* or *EMU (electric multiple-unit)*, depending on the source of power.

car, PCC (PCC, Presidents' Conference Committee car) – a streetcar first produced in 1935. Its performance and efficiency were significantly improved over those of any streetcar previously built. The PCC car, characterized by lightweight construction, smooth and rapid acceleration and deceleration, and soft ride, became the standard for U.S. streetcars for many years. About 5,500 cars were manufactured in North America, 16,000 in Europe, and many using PCC features in Russia—as recently as 1997. See *organizations, Presidents' Conference Committee*.

car, powered – see *car, rail motor*.

car, rail diesel (RDC, diesel rail car) – a self-powered rail car, usually with two diesel engines capable of multiple-unit operation. (DMU)

car, rail motor (motor car, powered car, self-powered car, self-propelled car) – a rail car that is propelled by an electric motor or internal combustion engine located on the car itself, see *car, electric rail* and *car, rail diesel*.

car, rail rapid transit (rapid transit car, subway car, heavy rail car) – bidirectional rail car for rapid transit systems, usually powered, multiple unit equipped, and with a control cab at one or both ends. Characterized by multiple double doors per side, designed for fast boarding and alighting from high-level platforms.

car, self-propelled or self-powered – see *car, rail motor*.

car, single-unit (SU) – a powered rail car, equipped with a control cab at one or both ends, that operates alone.

car, streetcar – an electrically powered rail car, with width and turning radius suitable for operating on city streets and equipped with lower skirt and safety devices to protect pedestrian falling under car, see also *car, light rail*.

car, track – a self-propelled rail car (e.g., burro crane, highway rail car, detector car, weed burner, tie tamper) that is used in maintenance service and that may or may not operate signals or shunt track circuits.

car, trailer – **1.** An unpowered rail car operated in trains with powered cars (rapid transit) or towed by locomotives (regional rail). **2.** In some rail rapid transit systems, a trailer may be powered; however, it does not have operator's control and thus can only be operated in consists with cars that do.

car, trolley – **1.** A local term for a streetcar. **2.** Recently, also a local term for a bus with a body simulating that of an old streetcar.

car, unidirectional – a rail car (usually light rail or streetcar) that has doors on one side and an

operating cab at only one end so that it must be turned around by separate means at terminals.

car, urban rail – a light rail, rail rapid transit, or commuter rail car.

car, weight designations – AW0, empty weight, AW1, weight with seated passenger load, AW2, weight with average peak-hour passenger load, AW3, crush loaded weight. Passengers are usually assumed to weigh an average of 70 kg (155 – 160 lb). Peak-hour passenger load is normally based on standing 4 passengers/m² (0.4 p/ft²) of floor space in North America, 4-5 p/m² (0.4-0.5 p/ft²) in Europe and 5-6 p/m² (0.5-0.6 p/ft²) in Asia—after discounting space used for cabs, stairwells and seated passengers at 2/m² (0.2/ft²). Crush loads are 6, 6-7 and 8 p/m² (0.6, 0.6-0.7, and 0.8 p/ft²) respectively. **Caution:** some systems and manufacturers use different designations, some systems report loading in excess of 8 standing passengers per m² (0.8 p/ft²).

car equivalence, passenger – see *passenger car equivalence*.

carhouse – see *barn*.

car operator – see *operator, train*.

carpool – an arrangement in which two or more people share the use, cost, or both of traveling in privately owned automobiles between fixed points on a regular basis; see also *vanpool*.

carpool, casual — an informal carpool where commuters gather at a location to be picked up at random by motorists who do not have sufficient passengers to use an HOV facility (U.S. West Coast usage). See also *slug*.

carpool lane – see *lane, carpool*; and *lane, exclusive carpool*.

carrier – a person or company in the business of transporting passengers or goods.

carrier, common – in urban transportation, a company or agency certified by a regulatory body to carry all passengers who fulfill the contract (e.g., pay the required fare). The service is open to the public.

catenary system – that form of electric overhead contact system (OCS) in which the overhead contact wire is supported from one or more longitudinal wires or cables (*messengers*), either directly by hangers (*simple catenary*) or by hangers in combination with auxiliary conductors and clamps (*compound catenary*). Attachment of the contact wire to the messenger is made at frequent and uniform intervals to produce a contact surface nearly parallel to the top of the running rails.

center, major activity – see *major activity center*.

center, modal interchange – see *transit center transfer or transit* – see *transit center*.

center platform – see *platform, center*.

central business district (CBD) – defined by the Bureau of the Census, an area of high land valuation characterized by a high concentration of retail businesses, service businesses, offices, hotels, and theaters, as well as by a high traffic flow. A CBD follows census tract boundaries; that is, it consists of one or more whole census tracts. CBDs are identified only in central cities of MSAs and other cities with populations of 50,000 or more. See also *outlying business district*.

central city – as defined by the Bureau of the Census, the largest city, or one of the largest

cities, in a metropolitan statistical area or urbanized area. The criteria for designating a central city vary with the type of area and the particular census.

centralized traffic control system – see *control system, centralized traffic*.

centre – British, Canadian spelling of “center.”

challenged – see *handicapped*.

check – in transit operations, a record of the passenger volume on all transit units that pass a specific location or time point (also known as a *passenger riding count or check*), the actual time the unit passes it (also known as a *schedule check*), the number of passengers who board and alight at each stop on a route or line (also known as an *on-and-off count or check*), or any combination of these items. The checker may ride the transit unit (an *on-board check*), follow it in another vehicle, or check the transit units from a particular location (a *point or corner check*).

choice rider – see *rider, choice*.

chopper – solid-state electronic device that controls electric current flow to traction motors by rapidly turning the power on and off, resulting in gradual vehicle acceleration at reduced current use. Replaced less efficient switched resistor controls from 1960s. Now replaced with more advanced power conversion units (PCU) feeding three phase alternating current motors—which may themselves contain a “chopper”, usually to control regenerative braking.

circuit, track – see *track circuit*.

circulator service – see *service, circulator*.

city, central – see *central city*.

city transit service – see *service, city transit*.

civil speed limit – in rail operations, the maximum speed authorized for each section of track, as determined primarily by the alignment, profile, and structure.

clearance time — see *time, clearance*.

clock headway— see *headway, clock*.

close-up – in rail transit operations the process where a train approaching a station will close-up to the train berthed in the station to the minimum distance permitted by the signaling or train control system. This is usually the critical line condition that, combined with the dwell at the maximum load point station, establishes the minimum headway.

closed-loop braking – see *braking, closed-loop*.

coach, motor – see *bus, motor*.

coach, over-the-road – see *bus, intercity*.

coach, suburban – see *bus, suburban transit*.

coach, transit – see *bus, standard urban*.

coach, trolley – see *trolleybus*.

coasting (freewheeling) – of a vehicle, running without influence of either the propulsion or braking systems, that is, with tractive and braking forces at zero. Use of coasting on rail transit sometimes increased outside peak periods to reduce energy consumption. Desirable feature of automatic train operation.

coefficient, riding frequency or habit – see *riding frequency coefficient*.

coefficient, utilization – see definition of *load factor*.

coefficient of directness – **1.** The ratio of the length (measured in units of either distance or time) of a transit trip between two points and the

length of the most direct highway route between the two points. **2.** The ratio of the length (measured in units of either distance or time) of a trip between two points by one mode and the length of the trip by another mode.

cog railway (rack railway, mountain railway) – a rail transportation mode with auxiliary or full traction provided by a geared wheel in the middle of a powered axle that is engaged with a rack (toothed bar) installed along the track center. This system used to overcome steep gradients. Similar *Fell system* uses adhesion grip on center rail without gear teeth.

collector, current – see *current collector*.

command and control system (C&C) – in rail system any means of adjusting and maintaining prescribed headways; effecting starting and stopping, merging, and switching; and controlling other such functions. It is usually considered to include transit unit (car or train) protection, transit unit operation, and line supervision to ensure safe movement of the transit unit within the system. Preferred usage is *train control system*. See also *control system*.

common carrier – see *carrier, common*.

commission – **1.** Eastern Canadian term for transit agency—particularly in Ontario. **2.** to prepare new transit vehicles or other hardware for revenue service.

communication based control system – see *control system, moving block*.

commutation ticket – in rail systems, a ticket sold at a reduced rate for a fixed or unlimited number of trips in a designated area during a specified time period.

commute – regular travel between home and a fixed location (e.g., work, school). The term is often applied only to travel in the direction of the main flow of traffic, to distinguish from reverse commute.

commute, reverse – a commute in the direction opposite to the main flow of traffic, for example, from the central city to a suburb during the morning peak. Increasingly common with growth in suburban employment. Valuable to operator as provides additional passengers and revenue at little or no marginal cost.

commuter – a person who travels regularly between home and a fixed location (e.g., work, school.)

commuter bus – see *service, commuter*.

commuter lane – see *lane, high-occupancy vehicle*.

commuter rail – see *transit system, commuter rail*.

commuter rail car – see *car, commuter rail*.

commuter service – see *service, commuter*.

compound catenary – see *catenary system*.

concession – in transit, the right to operate a transit service for a given number of years. May or may not include: public contribution to capital and operating costs; regulation of service standards and fares charged; design or construction of any facilities.

conductor – **1.** In rail transit operations, the operating employee who may control the doors on rail transit vehicles, or who may have fare-collecting duties, or both. Also called a *guard* on some systems. **2.** In railroad operations, the operating employee in charge of the train and train crew. **3.** In some bus operations, an

operating employee (other than the bus driver) who collects fares and may control doors.

confidence level – a statement of assurance of the accuracy of a statistical statement, e.g., if it is asserted that a population parameter is indeed within the computed confidence interval at confidence level α this means that the risk of error is $1-\alpha$.

confidence limit – a boundary of the confidence interval, usually referred to as lower and upper confidence limits.

connectivity – the ability of a public transportation network to provide service to the maximum number of origin-and-destination trip pairs through the optimal integration of routes, schedules, fare structures, information systems, and modal transfer facilities.

consist – in rail systems, the makeup or composition (number and specific identity) of individual units of a train.

contact rail – see *rail, third*.

contact shoe, overhead – see *overhead contact shoe*.

contact wire (trolley wire) – an overhead electric conductor that supplies power to electric rail vehicles and trolleybuses.

continuous brake – see *brake, continuous*.

continuous inductive train control system – see *control system, continuous train*.

continuous train control system – see *control system, continuous train*.

continuous welded rail – see *rail, continuous welded*.

contraflow – movement in a direction opposite to the normal flow of traffic. The term usually refers to flow opposite to the heavier flow of traffic. See also *commute, reverse*.

contraflow lane – see *lane, contraflow*.

control, deadman – see *deadman control*.

control, quality – see *quality control*.

control device, grade crossing traffic – see *grade crossing traffic control device*.

controlled access – see *access, limited*.

controlled access right-of-way – see *right-of-way, limited*.

controller, cam – see *cam controller*.

controls, passenger – see *passenger controls*.

control system, automatic block signal (ABS) – a system of governing train separation in which the signals are controlled by the trains themselves. The presence or absence of a train in a block is determined by a track circuit. If the circuitry fails, a restrictive signal is displayed.

control system, automatic train – see *automatic train control system*.

control system, block signal – a standard railroad signal system that uses a fixed signal at the entrance of a block to govern the separation of trains entering the block.

control system, cab signal – in rail systems, a signal located in the cab, indicating a condition affecting the movement of a train and used in conjunction with interlocking signals and in conjunction with or in lieu of block signals. Can indicate status of next signal(s) or show designated maximum speed.

control system, centralized traffic (CTC) – in rail systems, a traffic control system in which signals and switches are controlled from a

remotely located (centralized traffic control) panel.

control system, communication based – see *control system, moving block*.

control system, fixed block – an automatic train control system that records the presence of a train (or a part of it) in each track section (block) and activates the signals on the line to indicate the block is occupied. In some cases, a following train is prevented from entering the block by a forced emergency stop, see *automatic train stop*.

control system, manual block – a system of manually governing train movement in a block or a series of consecutive blocks by means of signals, train orders, telephone, or radio.

control system, manual train – system in which train movement is controlled by the operator (motorman) or engineer.

control system, moving block – an automatic train control system that spaces trains according to their location and relative velocity, and stopping performance, plus a safety distance. Often includes automatic train operation. Moving-block signaling systems are also called transmission or communication based systems. The latter is becoming the preferred term.

control system, multiple-unit – a system that controls the operation of two or more rail motor cars in a train through the simultaneous control of the train by one operator.

control system, overlay – A train control system, usually software controlled, that is overlaid on top of a conventionally fixed block control system. Permits closer headway of trains equipped for the overlay while providing operation and safe separation of non-equipped trains.

control system, traffic – see *control system, centralized traffic*.

control system, transmission based – see *control system, moving block*.

controlling dwell – the dwell, usually at the busiest station on a rail transit line, that, added to the minimum separation time of the train control system for the applicable speed, sets the closest headway possible.

conventional rail transport – transportation systems that consist of steel-wheeled trains running on duo-rail tracks. Trains may be self-propelled or hauled by locomotive, with diesel or electric propulsion.

conveyor, passenger or pedestrian – see *moving walkway*.

cordon count – in planning, a count of vehicles and people across a designated (cordon) line to determine the total flow (people and vehicles by mode and time period) into and out of the study area.

cordon line – in planning, an imaginary line circumscribing a specific geographic study area.

corner check – see *check*.

corridor – in planning, a broad geographical band that follows a general directional flow or connects major sources of trips. It may contain a number of streets and highways and transit lines and routes.

cost recovery ratio – the ratio of total revenues to total costs; the inverse of operating ratio. It is often used for evaluation of alternative plans. Usually total direct operating and maintenance costs are used although outside the United States

many agencies include annualized capital costs and/or depreciation in the calculation.

costs – see *capital costs* and *operating costs*.

count – **1.** In transportation, a process that tallies a particular movement of people or vehicles past a given point during a stated time period. It may be a directional or a two-way value and is also known as a *traffic count*. **2.** In transportation, a volume of people or vehicles.

count, cordon – see *cordon count*.

count, on-and-off – see *check*.

count, passenger – see *passenger count*.

count, passenger riding – see *check*.

count, traffic – see *traffic count*.

coupler – a device for connecting one rail vehicle to another. The mechanism is usually placed in a standard location at both ends of all rail cars and locomotives.

coupler, automatic – **1.** A coupler that operates automatically. It may also be capable of uncoupling automatically. May have to take place on tangent track although some designs have automatic centering and can be used on curves. **2.** An automatic connector that joins electric or pneumatic train lines together between rail cars.

coverage area – see *area, coverage*.

critical line condition – in rail transit operations the factor that constrains headway. This is usually the close-in at the maximum load point station or the terminal turnback process, occasionally at junctions.

crossing, grade (railroad grade crossing) – a crossing or intersection of highways, railroad tracks, other guideways, or pedestrian walks, or combinations of these at the same level or grade.

crossing, highway/railroad – a place, at grade or grade separated, where highway traffic crosses railroad tracks.

crossing, railway – see *crossing, track*.

crossing, track (railway crossing) – an assembly of rails and frogs that allows crossing of two tracks at grade.

crossing control device, grade – see *grade crossing traffic control device*.

crossover – **1.** In rail systems, a track with two switches that connects two parallel tracks. **2.** Pedestrian or vehicular links (at grade or grade separated) across a transportation facility.

crosstie (railroad tie, tie) – the transverse member of the track structure to which the rails are fastened. Its function is to provide proper gauge and to cushion, distribute, and transmit the stresses of traffic through the ballast to the roadbed, normally wood or concrete, can be metal or plastic. Known as a *sleeper* in Britain.

cross-town service – see *service, cross-town*.

cruise speed or velocity – see *velocity, cruise*.

cruiser – see *bus, cruiser*.

curb bulge – see *bus bulge*.

curb extension – see *bus bulge*.

current collector – the mechanical component on an electric rail car that makes contact with the conductor that distributes the electric current; see also *overhead contact shoe, pantograph, third-rail shoe, and trolley pole*.

cut-and-cover – a method of construction that consists of excavating the terrain from ground level, placing a structure in the excavation, and then filling over the structure.

cutting – see *run cutting*.

D

DC – **1.** District of Columbia. **2.** direct current.

DE – double ended, rail or streetcar with driving positions at both ends.

DHV – design hourly

volume.

DMU – diesel multiple-unit car; see *car, multiple-unit*.

DOT – department of transportation; see *organizations, department of transportation; and U.S. Government, Department of Transportation*.

DPM – downtown people mover; see *people mover, downtown*.

day pass or daypass – ticket for unlimited travel for one day, usually to end of service the following day, may be for one or more zones of travel, may be restricted in morning peak period, may be good for one adult, one concession rider or for a family or similar group. Can be valid through a weekend. Often contains "scratch" panels for user to designate day and month of use.

deadhead – an unproductive or non-revenue move without passengers aboard – often to and from a garage, or from one route to another. (Some agencies carry passengers on these runs and still use the term deadhead.)

deadman control – a pedal, handle, or other form of switch, or combination thereof, that the operator must keep in a depressed or twisted position while a rail vehicle (or train) is moving. If the control is released, the power is cut off and the brakes are applied.

deceleration, retardation, braking rate – decrease in velocity per unit time; in transit practice, often measured in m/s^2 (ft/s^2) or, in the United States, mph/s .

default value – a design value that is based on experience or on studied conclusions and that is used as a substitute value when an actual value is not available.

defensible space – a concept in architecture and urban design that precludes designs resulting in dark alleys, corners, or spaces where visibility and openness to other people is severely limited.

delay time – see *time, delay*.

demand – **1.** The quantity (of transportation) desired. **2.** In an economic sense, a schedule of the quantities (of travel) consumed at various levels of price or levels of service offered (by the transportation system.)

demand, effective – the number of people or vehicles prepared to travel in a given situation, at a given price.

demand jitney service – see *service, jitney*.

demand-responsive transportation system – see *transportation system, demand-responsive*.

density, train – see *train density*.

department of transportation – see *organizations, department of transportation; and U.S. Government, Department of Transportation*.

departments, U.S. – see *U.S. Government*.

dependent, transit – see *transit dependent*.

depot – see *garage, terminal, carhouse and barn*.

derail – **1.** To run off the track. **2.** A track safety device designed to guide a rail car off the rails at a selected location to prevent collisions or other

accidents, commonly used on spurs or sidings to prevent unattended rolling cars from fouling the main line; also known as a *derailer*.

derailment – an instance of the wheels of a rail vehicle coming off the track.

design capacity – see *capacity, design*.

design hourly volume (DHV) – the amount of traffic a transportation facility is designed to carry in 1 hr.

desire line – a straight line on a map that connects the origin and destination of a trip (theoretically, the ideal or most desirable route) and may indicate by its width or density the volume of trips between that origin and destination.

destination – **1.** The point at which a trip terminates. **2.** In planning, the zone in which a trip ends.

destination sign or blind – a sign on a transit unit (vehicle or train) indicating the route and/or route number or letter, direction, destination of the unit, or any combination thereof. Destination signs are most commonly located on the front of the transit unit but may also be located on the back, side, or both. Includes roll signs printed on cloth or plastic and electronic signs, most usually dot matrix. See also *head sign*.

deviation, point-to-point – see *point-to-point deviation*.

device, grade crossing traffic control – see *grade crossing traffic control device*.

device, signal-actuating – see *pedestrian signal-actuating device* and *vehicle signal-actuating device*.

device, traffic control – see *traffic control device*.

dial-a-bus or dial-a-ride – see *transportation system, dial-a-ride*.

diamond lane – see *lane, diamond*.

diesel-electric locomotive – see *locomotive, diesel-electric*.

diesel multiple-unit car (DMU) – see *car, multiple-unit*.

diesel rail car – see *car, rail diesel*.

differential fare – see *fare, differential*.

direct current (DC) – fixed polarity electrical distribution system universally used for heavy rail, light rail and trolleybuses. For a given load at the voltages used, there are lower losses and longer distances possible between feeder points and sub-stations than with alternating current (AC).

direct current motor – see *motor, direct current*.

directional route miles – see *route miles*.

directional split – the proportional distribution between opposite flows of traffic on two-way facilities.

directness, coefficient of – see *coefficient of directness*.

disability, public transportation – see definition of *handicapped*.

disadvantaged, transportation – see *transportation disadvantaged*.

disc brake – see *brake, disc*.

discharge – in transit operations, to let passengers exit the vehicle.

disincentive – something that discourages people from acting in a certain way. For example, high

parking fees or tolls are disincentives to automobile use.

dispatcher – **1.** In bus operations, the individual who assigns buses to runs, makes up work assignments to fill runs, directs the operators at the start of their assignments, and in some cases, maintains a constant awareness of status of the operation, via radio, telephone, or other means. **2.** In rail operations, an operating person whose function it is to dispatch transit units (cars or trains), monitor their operation, and intervene in the event of disruption of schedule or when any change in service or routing is required. **3.** In demand-responsive transportation, the person who assigns the vehicles to customers and notifies the appropriate drivers and who may schedule and route vehicles and monitor their operation.

dispatching – **1.** In rail operations, the process of starting a transit unit (car or train) into service from a terminal, yard, or transfer track. **2.** In demand-responsive transportation systems, the process of relaying service instructions to drivers. The procedure may include vehicle scheduling, routing, and monitoring, and it can be manual or partly or fully automated. **3.** The relaying of service instructions to vehicle drivers or operators.

distance, linked trip – see *trip distance, linked*.

distance, total travel – see *trip distance, linked*.

distribution, flow – see *trip assignment*.

distribution, trip – see *trip distribution*.

district, central business – see *central business district*.

district, outlying business – see *outlying business district*.

diversity, loading – a measure of the unevenness of the passenger loading of transit vehicles in time (e.g., between buses or trains on the same route) or location (e.g., between cars of a train). See also *peak hour factor*.

door, double-stream – a door on a transit vehicle with sufficient width (generally 1.14–1.37 m or 3.75–4.5 ft) to permit two passengers to board and/or alight simultaneously. A handrail may or may not be provided to separate the two passenger streams.

door, single-stream – a door on a transit vehicle that allows passenger flow in only one direction at a time.

district, transit – see *transit district*.

door-to-door service – see *service, door-to-door*.

double – see *extra section*.

double-deck car – see *car, double-deck*.

double-decker bus – see *bus, double-decker*.

double-ended car – see *car, bidirectional*.

double-ended transit unit (bidirectional transit unit) – rail car or train with an operating cab at each end.

downtown people mover – see *people mover, downtown*.

driving wheels – wheels that are powered by a motor or engine and that provide the tractive effort, through contact with the running surface, that propels the vehicle.

dual control or mode – see *transit system, dual-mode*; and *bus, dual-mode*.

dual-mode bus – see *bus, dual-mode*.

dual-mode light rail – see *transit system, light rail, dual-mode*.

dual-mode transit system – see *transit system, dual-mode*.

dual-mode vehicle – see *vehicle, dual-mode*.

dual-powered bus – see *bus, dual-mode*.

dual-powered locomotive – see *locomotive, dual-powered*.

dual-power propulsion system – see *propulsion system, dual-power*.

duckout – see *bus bay*.

dwelt time – see *time, dwell*.

dynamic block control system – see *control system, moving block*.

dynamic brake – see *brake, dynamic*.

dynamic routing – in demand-responsive transportation systems, the process of constantly modifying vehicle routes to accommodate service requests received after the vehicle began operations, as distinguished from predetermined routes assigned to a vehicle.

E **E&H** – Elderly and handicapped.
EMU – electric multiple-unit car; see *car, multiple-unit*.
EPA – Environmental Protection Agency; see *U.S. Government, Environmental Protection*

Agency.

effective demand – see *demand, effective*.

effectiveness – **1.** In transportation, the correspondence of provided service to intended output or objectives, particularly the character and location of service; in other words, producing the intended result (doing the right things). **2.** In transit, the degree to which the desired level of service is being provided to meet stated goals and objectives; for example, the percentage of a given service area population that is within the desired 0.4 km (¼ mi) of a transit stop.

effectiveness, measure of – see *performance indicator*.

effective operating speed – see *speed, overall trip*.

effective velocity – see *velocity, effective*.

egress time – see *time, egress*.

el – abbreviation for elevated (railway), mainly east coast, see *transit system, rail rapid*.

elderly and handicapped (E&H) – people who may have special needs for services such as transportation. Transportation especially provided for their benefit is called *elderly and handicapped (E&H) transportation*. Transit operations may provide discounted *E&H* fares or include *E&H* in a more general concession fare. Minimum age varies by program—55+, 60+, 65+. See also *handicapped*.

electric brake – see *brake, dynamic*.

electric bus – see *bus, electric*.

electric locomotive – see *locomotive, electric*.

electric motor – see *motor*.

electric multiple-unit car – see *car, multiple-unit*.

electric rail car – see *car, electric rail*.

Electric Railway Presidents' Conference Committee – see *organizations, Presidents' Conference Committee*.

electric sub-station – transformers, breakers (and rectifiers) to convert supply from electric utility to

direct current supply for rapid transit, streetcar or trolleybus systems.

electric trolleybus – see *trolleybus*.

electrification (railway electrification) – in rail systems, a term used to describe the installation of overhead wire or third-rail power distribution facilities to enable operation of electrically powered transit vehicles.

electrodynamic brake – see *brake, dynamic*.

electromagnetic brake – see *brake, track*.

electropneumatic brake – see *brake, electropneumatic*.

elevated, the – see *transit system, rail rapid*.

elevated guideway – see *guideway, elevated*.

elevated-on-fill guideway – see *guideway, elevated-on fill*.

emergency application or braking – see *braking, emergency*.

end, head – see *head end*.

end, trip – see *trip end*.

end wall – see *station end wall*.

engine, gas turbine – an internal combustion engine in which the hot compressed gases of combustion drive a turbine.

engine, internal combustion (ICE) – an engine in which the power is developed through the expansive force of fuel that is fired or discharged within a closed chamber or cylinder.

equity – in transportation, a normative measure of fairness among transportation users.

equivalence, passenger car – see *passenger car equivalence*.

exact fare – see *fare, exact*.

excess time – see *time, excess*.

exclusive bus lane – see *lane, exclusive transit*.

exclusive carpool lane – see *lane, exclusive carpool*.

exclusive right-of-way – see *right-of-way, exclusive*.

exclusive transit facilities – transportation system infrastructure elements that are set aside for the use of transit vehicles only. Examples include some freeway ramps, queue jumpers, bus lanes, off-street bus loading or unloading areas, and separated and fully controlled rights-of-way.

exclusive transit lane – see *lane, exclusive transit*.

exclusive transit right-of-way – see *right-of-way, exclusive transit*.

express bus – see *service, express bus*.

express service – see *service, express*.

expressway – a divided arterial highway for through traffic. An expressway has full or partial control of access and generally has grade separations at major intersections.

extra section (double) (overload) (duplicate Br.) – a second bus added to accompany a regularly scheduled bus to handle passenger overloads.

F **FHWA** – Federal Highway Administration; see U.S. Government, Federal Highway Administration.

FRA – Federal Railroad Administration; see U.S. Government, Federal Railroad Administration.

FTA – Federal Transit Administration; see U.S. Government, Federal Transit Administration.

facilities, accessible transportation – see *accessible transportation facilities*.

facilities, exclusive transit – see *exclusive transit facilities*.

facility, intermodal transfer – see *transit center*.

factor, K – see *K factor*.

factor, load – see *load factor*.

factor, peak-hour – see *peak-hour factor*.

factor, travel time – see *travel time factor*.

fail-safe – incorporating a feature that ensures that malfunctions that affect safety will cause the system to revert to a state that is safe.

far-side stop – see *stop, far-side*.

fare – **1.** The required payment for a ride on a public transportation vehicle. It may be paid by any acceptable means, for example, cash, token, ticket, transfer, farecard, voucher, or pass or user fee. **2.** A passenger who pays a fare.

fare, adult cash – basic full fare paid by one adult for one ride, may exclude transfer and zone charges.

fare, average – the arithmetic average of all fares paid by all revenue passengers, including those who received special or reduced fares. It is usually derived by or generally equivalent to dividing total fare revenue by total origin-to-destination trips, although it may be based on unlinked trips.

fare, base (basic fare, regular fare, full fare) – the price (with no discounts) charged to an adult for regular local service or, for systems with zone pricing, a one-zone fare with no discounts, that is, what it costs an adult paying a single cash fare to take a one-zone ride. On systems with time-based fares it is normally the peak period fare.

fare, concession – a reduced fare for various classes or passengers—children, students, seniors. A single concession fare reduces the complexity of having multiple fares for different classes of passengers into two, full and concession.

fare, E&H – see definition of *elderly and handicapped*.

fare, exact – a transit operations policy that precludes the making of change for passengers. A passenger must therefore have the correct change for the fare or else overpay it. Almost universal on North American transit except where ticket kiosks or ticket vending machines make change.

fare, flat – method of travel pricing that uses a single fare for the entire service area regardless of the trip’s distance, time of day, area of travel, or other characteristics.

fare, graduated – a fare that is proportional to the distance traveled (also known as mileage fare) or to the length of time that a passenger may ride on a service.

fare, mileage – see *fare, graduated*.

fare, off-peak or peak – see *fare, time-of-day*.

fare, peak period surcharge – see *fare, time-of-day*.

fare, pre-paid — any fare not paid on-board a transit vehicle (e.g., a transit pass, a ticket purchased at a machine prior to boarding a vehicle, or a fare paid prior to entering a fare-paid area).

fare, reduced – a special fare for children, students, senior citizens, or others that is less than the regular fare.

fare, regular – see *fare, base*.

fare, time-of-day – a fare that varies by time of day. It is usually higher during peak travel periods (peak fare) and lower during non-peak travel periods (off-peak fare).

fare, zone (zoned fare) – a method of transit pricing that is based on the geographical partitioning of the service area. The price is determined by the location and number of zones traversed. Zone fares are frequently used as a method of charging graduated or distance-based fares but may also be used to provide for differential fares for certain markets.

farebox – a device that accepts coins, bills, tickets, tokens, or other fare media given by passengers as payment for rides.

farebox, registering – a farebox that counts the money and fare media processed and records fare information.

farebox recovery ratio – see *fare recovery ratio*.

farebox revenue – see *revenue, farebox*.

farecard – see *magnetic farecard*.

farecard reader – a device that determines the value stored in a farecard when the farecard is inserted. A farecard reader may also be used for appropriately altering the value stored in a farecard when used in conjunction with a passenger turnstile, gate or registering farebox.

fare collection system – the procedures and devices used to collect fares and to accumulate and account for fares paid.

fare collection system, automatic (AFC) – the controls and equipment that automatically admit passengers on insertion of the correct fare in an acceptable form, which may be coins, tokens, tickets, or farecards—magnetically encoded or smart card. On systems with distance based fares stored value farecards must be inserted again on exit, at which point an additional fare may be subtracted. The system may include special equipment for transporting and counting revenues.

fare collection system, proof of payment, self-service, barrier-free, open – various names for an open fare collection system that has no turnstiles or fare gates. *Proof of payment is the preferred name*. It requires that the passenger display proof of payment (e.g., validated ticket, prepaid pass, valid transfer) while on board the transit vehicle or in other designated *fare paid* areas. Enforced through random checking by specific transit employees, security staff or police with the power to collect premium “on-board” fares (more common in Europe) or issue tickets or citations, typically resulting in revenue loss below 2-3%. Widely used in Europe and on North American light rail systems, the system combines flexibility and low cost with the fewest impediments to passengers with disabilities. Often combined with “self-service” ticket vending machines. Erroneously called an “honor” system, a name that applies only to systems without enforcement.

fare recovery ratio (farebox recovery ratio) – the ratio of fare revenue to direct operating expenses; see also *operating ratio*.

fare-registering faregate (turnstile) – a faregate that records the fares paid.

fare structure – the system set up to determine how much is to be paid by various categories of passengers using the system in any given circumstance.

faregate – a device that unlocks to allow a passenger to enter the paid area after a pass, smartcard, farecard, or the correct amount of money or tokens has been inserted into it.

federal agencies – see *U.S. Government*.

Federal Highway Administration – see *U.S. Government, Federal Highway Administration*.

Federal Railroad Administration – see *U.S. Government, Federal Railroad Administration*.

Federal Transit Act of 1964 – see *legislation, Federal Transit Act of 1964*.

Federal Transit Administration – see *U.S. Government, Federal Transit Administration*.

feeder service – see *service, feeder*.

ferryboat – a vessel that carries passengers, vehicles, or both over a body of water, usually for short distances and with frequent, regular service. A ferryboat is generally a conventional shallow-draft boat, but hydrofoils, catamarans, and hovercraft are also used. Often such vessels are double-ended with a pilot house at each end for control purposes so that the vessel need not be turned around for the next trip.

ferryboat, urban – Ferryboats that have at least one terminal within an urbanized area, excluding international, rural, rural interstate, island, and urban park ferries.

few-to-few service – see *service, few-to-few*.

few-to-many service – see *service, few-to-many*.

first-track miles or kilometers – see *right-of-way miles*.

fishbowl – see, *bus, New Look*.

fixed block control system – see *control system, fixed block*.

fixed guideway transit system – see *transit system, fixed guideway*.

fixed route – see *transportation system, fixed route*.

fixed signal – see *signal, fixed*.

flag stop service – see *service, flag stop*.

flange, wheel – see *wheel flange*.

flat fare – see *fare, flat*.

fleet, (rolling stock) – the vehicles in a transit system. Usually, “fleet” refers to highway vehicles and “rolling stock” to rail vehicles.

fleet, base-period – see *base-period fleet*.

fleet capacity – see *capacity, fleet*.

flow, passenger – see *passenger flow*.

flow distribution – see *trip assignment*.

flow rate (rate of flow) – in transportation, the number of units (passengers or vehicles) passing a point on a transportation facility during some period of time, usually counted or recomputed in units per hour. For example, if 8 buses pass a point in the first half hour and 15 in the second, the volume for the hour is 23. However, the flow rate for the first half hour is 16 buses/hr, and for the second half hour the flow rate is 30 buses/hr. See also *volume*.

flying junction – see *junction, flying*.

force, tractive – see *tractive effort*.

forecasting – in planning, the process of determining the future conditions, magnitudes, and patterns within the urban area, such as future

population, demographic characteristics, travel demand.

free area – see *area, free*.

free transfer – see *transfer, free*.

freeway – a divided highway for through traffic that has full access control and grade separations at all intersections. In some countries, it is also known as a motorway.

freeway, metered – a freeway to which access is controlled by entrance ramp signals that use fixed-time signal settings or is regulated by a computerized surveillance system. This procedure is used to prevent freeway congestion. See also *bus priority system, metered freeway*.

freewheeling – see *coasting*.

frequency, service – see *service frequency*.

frequency coefficient, riding – see *riding frequency coefficient*.

frequency distribution, trip length – see *trip length frequency distribution*.

friction brake – see *brake, friction*.

fringe, urban – see *urban fringe*.

fringe area – see *area, fringe*.

frog – a track component used at the intersection of two running rails to provide support and guidance for the wheels. It allows wheels on each rail to cross the other rail. Also applied to similar overhead components on electric rail or trolleybus systems. On streetcar systems the flangeway at the frog can be ramped up. Cars run on their flanges substantially reducing track noise.

fuel, alternative – a non petroleum fuel with lower pollution than traditional diesel—includes alcohol fuels, mineral fuels, methanol, propane, hydrogen, compressed and liquefied natural gas.

full accessibility – see *accessibility, handicapped*.

full service braking – see *braking, maximum service*.

funicular railway – a passenger transportation mode consisting of a pair of rail vehicles (or short trains) permanently attached to two ends of the same cable, counterbalancing each other. It may have a single track with a turnout or a double track. In the former wheels on one side of the car(s) will have double flanges, on the other side, no flanges. This system is used to overcome steep gradients. See also *inclined plane*.

furniture, street – see *street furniture*.

G

GRT – group rapid transit; see *transit system, group rapid*.

GTO – Gate turn off thyristor, used in chopper controls for electric rail cars

and trolleybuses.

gallery car – see *car, gallery*.

garage – in bus systems, the location in which buses are stored and serviced and where operators report for work and receive supplies and assignments. Also sometimes known as a *depot* or *barn*.

gas turbine engine – see *engine, gas turbine*.

gate, bus – see *bus gate*.

gather service – see *service, many-to-one*.

gauge, broad (wide gauge) – a rail track gauge greater than standard, wide gauge is slightly greater, broad gauge is substantially greater.

gauge, narrow – rail track gauge that is less than standard, commonly 1000 mm or 3ft 3–2/5 in (meter gauge), or 1067 mm or 3 ft 6 in (Cape gauge).

gauge, standard – a rail track gauge that is 1435 mm (4 ft 8.5 in) wide.

gauge, track – the distance between the inside faces of the two rails of a track measured 16 mm (5/8 in) below the top of the rails and perpendicular to the gauge line.

gauge, wide – see *gauge, broad*.

gear, running – see *running gear*.

generation, trip – see *trip generation*.

generator, trip – see *trip generator*.

government, U.S. – see *U.S. Government*.

governor – **1.** A device that keeps a transit vehicle from exceeding a set (maximum) speed. **2.** A device that holds the rotational speed of an engine approximately constant regardless of the load or prevents it from exceeding a predetermined value.

grade – or gradient, rise in elevation within a specified distance. As an example, a 1% grade is a 1 m (ft) rise in elevation in 100 m (ft) of horizontal distance, in Britain expressed as 1/100 or 1 in 100, and in Europe 10⁰/1000.

grade crossing – see *crossing, grade*.

grade crossing protection signal – see *signal, grade crossing protection*.

grade crossing traffic control device – any form of protective or warning device installed at a railroad or transit guideway grade crossing for the protection of highway or street traffic.

grade separation – a vertical separation of intersecting facilities (road, rail, etc.) by the provision of crossing structures.

graduated fare – see *fare, graduated*.

grid network – see *network, grid*.

group, low mobility – see *transportation disadvantaged*.

group rapid transit – see *transit system, group rapid*.

group riders – see *riders, group*.

guided busway – see *busway, guided*.

guideway – in transit systems, a track or other riding surface (including supporting structure) that supports and physically guides transit vehicles specially designed to travel exclusively on it.

guideway, elevated – a grade-separated guideway on a structure that provides overhead clearance for vehicles at ground level; see also *aerial structure*.

guideway, elevated-on-fill – a grade-separated guideway above the prevailing surface of the terrain that is supported by an embankment instead of by a structure.

guideway, open cut – a guideway below the prevailing surface of the terrain in a trench like excavation (cut or cutting).

H **HCM** – *Highway Capacity Manual*.

HEP – head end power, see *locomotive, passenger*.

HOV – high-occupancy vehicle; see *vehicle, high-occupancy*.

HOV lane – high-occupancy-vehicle lane; see *lane, high-occupancy-vehicle*.

habit coefficient, riding – see *riding frequency coefficient*.

handicapped – people who have physical or mental impairments that substantially limit one or more major life activities. In the context of transportation, the term usually refers to people for whom the use of conventional transit facilities would be impossible or would create a hardship. These people are also known as *transportation handicapped*, as people who have a *public transportation disability* and, more currently, *physically or mentally challenged*.

handicapped accessibility (full accessibility) – the extent to which facilities are free of barriers and usable by mobile handicapped people, including wheelchair users.

handicapped, ambulatory – handicapped people who are able to move around without assistance. In the context of transportation, the term usually refers to people who, although handicapped, are able to use regular transportation services without assistance or special equipment such as wheelchair lifts.

handicapped, nonambulatory – handicapped people who are unable to move about without assistance, for example, those confined to a wheelchair.

handicapped accessibility – see *accessibility, handicapped*.

head end – the beginning or forward portion of any train.

head sign – a sign indicating the destination of the transit unit (vehicle or train), usually located above the windshield.

headway – the time interval between the passing of the front ends of successive transit units (vehicles or trains) moving along the same lane or track (or other guideway) in the same direction, usually expressed in minutes; see also *service frequency*.

headway, base – the scheduled headway between transit unit (vehicle or train) trips, between peak periods.

headway, clock – the scheduled headway between transit unit (vehicle or train) trips, based on even times, i.e. 60, 30, 20, 15, 10 and 7½ minutes.

headway, interference – headway that is so close that one vehicle or train interferes with or delays the next.

headway, non-interference – headway such that in normal operations one train does not delay another.

headway, policy – **1.** Headway prescribed by reasons other than matching capacity to demand. **2.** The maximum permissible headway as established by the transit agency or (often) the policy board, usually for off-peak, low-demand periods.

headway management – a technique for managing the operation of transit units (vehicles or trains) that focuses on maintaining a certain spacing between units on the same line, instead of on adhering to a timetable. For example, if units become bunched, corrective measures might include delaying the units at the rear of the bunch to provide regular headways and hence load distribution, even at the expense of reducing timetable adherence.

heavy rail – see *transit system, rail rapid*.

high-occupancy vehicle – see *vehicle, high-occupancy*.

high-occupancy-vehicle lane – see *lane, high-occupancy-vehicle*.

high platform – see *platform, high*.

high voltage – see *voltage, high*.

highway, street, or road – **1.** General terms denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way. The recommended usages are as follows: in urban areas, highway or street; in rural areas, street or road. **2.** Street, in common general usage, refers to the vehicular travel way, as distinguished from the sidewalk (the pedestrian travel way).

Highway Capacity Manual — TRB Special Report 212; a standard reference used to calculate the capacity and quality of service of roadway facilities.

highway/RR crossing – see *crossing, highway/railroad*.

home-based trip – see *trip, home-based*.

honor system (*honour in Britain, Canada*) – type of fare collection system without controls or checks, once common only in the Soviet Union and Eastern Europe but now rapidly disappearing. Often incorrectly used to describe enforced proof of payment fare collection system, see *fare collection system, open, proof of payment, self-service, barrier-free*.

hot, running – see *running hot*.

hour(s), rush – see *peak*.

hours of service – **1.** The number of hours during the day between the start and end of service on a transit route, also known as the *service span*. **2.** For calculating transit level of service, the number of hours during a day when service is provided at least hourly on a transit route.

hub (timed transfer focal point) – transit center or interchange for connections or transfers between modes and/or routes. Connections are usually timed in clock-headway pulses and allow convenient transfer between local routes and to express routes. The express routes can connect to the city center and to other hubs, thus offering better suburb to suburb trips than possible with a radial route system. Hubs are best located at activity centers such as shopping malls, suburban town centers and campuses.

hub and spoke – type of route structure based on timed connections that increases connectivity and productivity, see *hub*.

hub miles (hub kilometers) – actual logged miles (kilometers) of vehicle operation, usually read from a hubometer or odometer.

I **ICE** – internal combustion engine; see *engine, internal combustion*.

ISTEA – Intermodal Surface Transportation Efficiency Act of 1991.

ITE – Institute of Transportation Engineers; see *organizations, Institute of Transportation Engineers*.

impedance – **1.** In transportation generally, any condition that restricts or discourages travel, or a measure of that condition. **2.** In transportation modeling, any such condition explicitly accounted for within the model. Time and costs are the factors usually considered, but others may also be examined.

inbound trip – see *trip, inbound*.

inclined plane (incline, inclined railway) – a special type of rail vehicle permanently attached to and hauled by a cable, used for steep gradients, operating on one or two tracks. When two counter-balanced vehicles operate on railway-type tracks, it is also known as a *funicular railway*.

index – a performance measure developed by weighting two or more other performance measures.

indication, signal – see *signal indication*.

indicator, block – see *block indicator*.

indicator, performance – see *performance indicator*

induced demand or traffic – see *traffic, induced*.

induction loop sensor – a loop of wire (inductor) embedded in the roadbed that carries a small electric current used to sense a passing vehicle and to yield information about the presence of the vehicle. Induction loops are also used to actuate traffic signals.

induction motor – see *motor, induction*.

information, service or user – see *user information*.

information services – see *Railroad Research Information Service, Transportation Research Information Services, and Urban Mass Transportation Research Information Service*.

infrastructure – **1.** In transit systems, all the fixed components of the transit system, such as rights-of-way, tracks, signal equipment, stations, park-and-ride lots, bus stops, maintenance facilities. **2.** In transportation planning, all the relevant elements of the environment in which a transportation system operates.

inspector (road supervisor, route supervisor, street supervisor, road foreman) – a transit employee who evaluates performance, enforces safety and work rules, and attempts to solve problems; an inspector may be mobile (covering several districts in a radio-equipped vehicle) or fixed (assigned to a post at a designated intersection).

Institute of Transportation Engineers – see *organizations, Institute of Transportation Engineers*.

insulated rail joint – see *rail joint, insulated*.

integration, intermodal – see *intermodal integration*.

interchange – **1.** facility for passenger transfers or connection between routes or modes, see *hub*. **2.** The system of interconnecting ramps between two or more intersecting travel ways (highways, transit guideways, etc.) that are grade separated.

interchange center, modal – see *transit center*
intercity bus – see *bus, intercity*.

intercity transportation – **1.** Transportation between cities. **2.** Transportation service provided between cities by certificated carriers, usually on a fixed route with a fixed schedule.

interface, transportation – see *transportation interface*.

interline – **1.** interchange of passengers between one or more bus lines, rail transit lines, or railroads. **2.** transfer of transit vehicles or trains between routes during a day to improve staff or vehicle assignment efficiency.

interlocking – in rail systems, an arrangement of switch, lock, and signal devices that is located

where rail tracks cross, join, separate, and so on. The devices are interconnected in such a way that their movements must succeed each other in a predetermined order, thereby preventing opposing or conflicting train movements.

interlocking limit – the track length between the most remote opposing home signals of an interlocking.

interlocking, solid-state – an interlocking with logic based on computers rather than traditional relays or, now obsolete, mechanical locks.

intermodal – those issues or activities which involve or affect more than one mode of transportation, including transportation connections, choices, cooperation and coordination of various modes.

intermodal integration – service coordination between two or more different transportation modes. This arrangement may include joint (transfer) stations, coordinated scheduling, joint fares, and combined public information activities.

intermodal transfer facility – see *transit center*.

internal combustion engine – see *engine, internal combustion*.

International Union of Public Transport – see *organizations, International Union of Public Transport*.

interrupted flow - transit vehicles moving along a roadway or track and having to make service stops at regular intervals.

intersection – the point at which two or more roadways meet or cross.

intersection, point of – see *point of intersection*.

interurban – see *transit system, interurban*.

iron maiden – full height tri-part turnstile with interlocking metal bars, impervious to fraud or vandalism, used mainly on older east coast rapid transit systems, mainly for exiting station platforms, also on Toronto subway for unattended, token actuated, entrances.

island platform (*British*) – see *center platform*.

island, loading or pedestrian – see *loading island*.

J **jaywalk** – to illegally cross a street in the middle of the block or against a pedestrian signal.

jerk – time rate of change of acceleration or deceleration of a vehicle, measured in m/s^3 (ft/s^3).

jitney – privately owned vehicle (typically, a relatively small vehicle, such as a small van) operated on a fixed route but not on a fixed schedule; see also *transportation system, jitney, and service, jitney*.

journey, linked – see *trip, linked*.

journey time – see *time, journey*.

jumper, queue – see *queue jumper*.

junction – 1. In transit operations, a location at which transit routes or lines converge or diverge. 2. In traffic engineering, an intersection.

junction, flying – a grade-separated rail junction, allowing merging and diverging movements to be made without conflict and with minimal impact on capacity.

K **K&M** – see *pendulum suspension*.

K&R – kiss and ride.

K factor –in vehicle operations, the ratio of the minimum operating separation between two vehicles to the maximum emergency stopping distance. Normally, the factor is greater than 1 to provide a margin of safety.

kilometer, kilometre – for all terms containing “kilometer or kilometre” see equivalent term with “mile”.

kiss and ride (kiss ‘n’ ride, K&R) – An access mode to transit whereby passengers (usually commuters) are driven to a transit stop and left to board a transit unit and then met after their return trip. Transit stations, usually rail, often provide a designated area for dropping off and picking up such passengers.

L **“L”** – abbreviation for elevated (railway), mainly Chicago, see *transit system, rail rapid*.

LIM – linear induction motor; see *motor, linear induction*.

LNG – Liquefied Natural Gas.

LOS – level of service.

LRT – light rail transit; or light rapid transit (*mainly British*) see *transit system, light rail*.

LRV – light rail vehicle; see *car, light rail*.

labour – Canadian, British spelling of “labor.”

lane, bus (bus priority lane, preferential bus lane, priority bus lane) – a highway or street lane reserved primarily for buses, either all day or during specified periods. It may be used by other traffic under certain circumstances, such as making a right or left turn, or by taxis, motorcycles, or carpools that meet specific requirements described in the traffic laws of the specific jurisdiction.

lane, bypass – see *queue jumper*.

lane, carpool – a highway or street lane intended primarily for carpools, vanpools, and other high-occupancy vehicles, including buses, either all day or during specified periods. It may be used by other traffic under certain circumstances, such as while making a right turn. Minimum occupancy is contentious, many requirements for a minimum of three passengers have been reduced to two through political pressure or legal action.

lane, contraflow – a highway or street lane on which vehicles operate in a direction opposite to what would be the normal flow of traffic in that lane. Such lanes may be permanently designated contraflow lanes, or, more usually, they may be used as contraflow lanes only during certain hours of the day. Frequently, the use of a contraflow lane is restricted to public transit and (possibly) other specially designated vehicles.

lane, diamond – a high-occupancy-vehicle lane physically marked by diamonds painted on the pavement and often indicated by diamond-shaped signs as well. Often used synonymously with high-occupancy-vehicle lane.

lane, exclusive carpool – a highway or street lane reserved for carpools and vanpools.

lane, exclusive transit (reserved transit lane) – a highway or street lane reserved for buses, light rail vehicles, or both.

lane, high-occupancy-vehicle (HOV lane) – a highway or street lane reserved for the use of high-occupancy vehicles (HOVs), see *lane, carpool*.

lane, priority – a highway or street lane reserved (generally during specified hours) for one or more specified categories of vehicles, for example, buses, carpools, vanpools.

lane, ramp meter bypass – a form of preferential treatment in which a bypass lane on metered freeway on-ramps is provided for the exclusive use of high-occupancy vehicles.

lane, reserved transit – see *lane, exclusive transit*.

lane, reversible – a highway or street lane on which the direction of traffic flow can be changed to use maximum roadway capacity during peak-period demands.

lane, reversible bus – a highway or street lane that is reserved for the exclusive use of buses and other high-occupancy vehicles and that can be operated in alternate directions during the two peak-hour periods. It may be the center lane in an arterial street that is used for left-turning traffic in off-peak hours. Usually, bus operators who use this facility are required to have special training and a permit, and the buses may be subject to access or operation controls or both, see *lane, contraflow*.

lay-by – **1.** In rail systems, a side track. **2.** In bus systems, see *bus bay*.

layover, vehicle – see *time, layover*.

layover time – see *time, layover*.

layover zone – a designated stopover location for a transit vehicle at or near the end of the route or line or at a turnback point.

legislation, Americans with Disabilities Act of 1990 (ADA) – federal civil rights law which assures people with disabilities equal opportunity to fully participate in society, the ability to live independently, and the ability to be economically sufficient.

legislation, Federal Transit Act of 1964 – federal legislation enacted in 1964 that established the federal mass transportation program. Formerly known as the Urban Mass Transportation Act of 1964. Repealed in 1994 and reenacted as chapter 53 of title 49, United States Code.

legislation, Intermodal Surface Transportation Efficiency Act (ISTEA) – signed into federal law on December 18, 1991, it provided authorizations for highways, highway safety and mass transit for 6 years and serves as the basis of federal surface transportation programs. Renewed and amended in 1998 for six years as TEA-21, see *legislation, TEA-21*.

legislation, National Environmental Policy Act of 1969 (NEPA) – a comprehensive federal law requiring an analysis of the environmental impacts of federal actions, such as the approval of grants, and the preparation of an environmental impact statement for every major federal action that significantly affects the quality of the human environment.

legislation, TEA-21 – 1998 Transportation Efficiency Act for the 21st Century, provides authorizations for highways, highway safety and mass transit for 6 years and is the basis of federal surface transportation programs, replaces ISTEA.

legislation, Title 49 United States Code, Chapter 53-Mass Transportation – federal legislation establishing the federal mass transportation program. Formerly known as the Federal Transit Act of 1964, and before that, the Urban Mass Transportation Act of 1964.

legislation, Title 49 United States Code, Chapter 53-Mass Transportation, Section 5335 – the section of the United States Code that authorizes the Secretary of Transportation to request and receive statistical information about the financing and operations of public mass transportation systems eligible for Section 5307 grants on the basis of a uniform system of accounts and records. This information is compiled in the *National Transit Database*. Formerly Section 15 of the Federal Transit Act of 1964.

legislation, Urban Mass Transportation Act of 1964 – see *legislation, Federal Transit Act of 1964*.

level of service (LOS) – **1.** A set of characteristics that indicate the quality and quantity of transportation service provided, including characteristics that are quantifiable (*system performance*, e.g., frequency, travel time, travel cost, number of transfers, safety) and those that are difficult to quantify (*service quality*, e.g., availability, comfort, convenience, modal image).

2. For highway systems, a qualitative rating of the effectiveness of a highway or highway facility in serving traffic, in terms of operating conditions.

The *Highway Capacity Manual* identifies operating conditions ranging from A, for best operation (low volume, high speed), to F, for worst conditions. **3.** For paratransit, a variety of measures meant to denote the quality of service provided, generally in terms of total travel time or a specific component of total travel time. **4.** For pedestrians, sets of area occupancy classifications to connect the design of pedestrian facilities with levels of service (A for best through F for worst). **5.** The amount of transit service provided.

levels of service (transit) – six designated ranges of values for a particular service measure, graded from “A” (best) to “F” (worst) based on a transit passenger’s perception of a particular aspect of transit service.

levitation, magnetic – see *magnetic levitation*.

lift, wheelchair – see *wheelchair lift*.

light rail – see *transit system, light rail*; and *transit system, light rail rapid*.

light rail car – see *car, light rail*.

light rail, dual mode – see *transit system, light rail, dual mode*.

light rail rapid transit – see *transit system, light rail rapid*.

light rail transit – see *transit system, light rail*.

light rail vehicle – see *car, light rail*.

limit, civil speed – see *civil speed limit*.

limited access – see *access, limited*.

limited or limited stop service – see *service, limited*.

limits, interlocking – see *interlocking limits*.

limits, yard – see *yard limits*.

line – **1.** A transportation company (e.g., a bus line). **2.** A transit service operated over a specified route or combination of routes. **3.** An active (in-use) railroad track or AGT guideway. **4.** In network coding, a route and its service level, including mode designation (type of service), line

number, headway, and sequence of transfer points (nodes). These factors describe the line's route as an ordered set.

line, cordon – see *cordon line*.

line, desire – see *desire line*.

line, main – the principal roadway, rail tracks, or other types of transportation rights-of-way over which all or most of the traffic moves.

linear electric motor – see *motor, linear electric*.

linear induction motor – see *motor, linear induction*.

line capacity – see *capacity, line*; and *capacity, theoretical line*.

line-clear – in rail transit, operation such that trains do not have to stop or slow down due to the train ahead but receive a succession of green signals. See also *headway, non-interference*.

line haul – see *service, line haul*.

line miles (line kilometers, miles or kilometers of directional roadway) – the sum of the actual physical length (measured in only one direction) of all streets, highways, or rights-of-way traversed by a transportation system (including exclusive rights-of-way and specially controlled facilities), regardless of the number of routes or vehicles that pass over any of the sections; see also *route miles*.

line volume – see *passenger volume*.

link – in planning, a section of a transportation system network defined by intersection points (nodes) at each end; that is, a link connects two nodes. It may be one way or two way.

linked journey or trip or passenger trip – see *trip, linked*.

linked trip distance – see *trip distance, linked*.

linked trip time – see *time, linked trip*.

link load – in planning, the assigned volume of traffic on a link; see also *link volume*.

link volume – in planning, the total number of highway vehicles or transit passengers assigned to a network link.

load, crush – see *capacity, crush*.

load, link – see *link load*.

load, passenger – see *passenger load*.

load factor – **1.** The ratio of used capacity to offered capacity of equipment or a facility during a specified time period. It is usually expressed as a percentage of seats occupied at a given point or (in continuous form) passenger kilometers (miles) divided by seat kilometers (miles). For rail services, the load factor is sometimes expressed as passenger kilometers (miles) per train kilometer (mile) to account for the ability to couple rail cars together to achieve efficiency. **2.** The ratio of passengers actually carried versus the total passenger capacity of a vehicle; also known as a *utilization coefficient*.

load point, maximum – see *maximum load point*.

load section, maximum – see *maximum load section*.

load shedding – **1.** reducing the amount of conventional transit service at peak hours by encouraging the use of paratransit operations to carry some of the peak-period passengers. **2.** disconnecting part of electric traction network at time of power shortage or sub-station failure. Available power will then be rotated from section to section of line to move all trains into a station — or to keep part of the line operating normally.

loading, link – see *link loading*.

loading area – see *bus bay*.

loading island – **1.** A pedestrian refuge within the right-of-way and traffic lanes of a highway or street. It is provided at designated transit stops for the protection of passengers from traffic while they wait for and board or alight from transit vehicles; also known as a *pedestrian or boarding island*. **2.** A protected spot for the loading and unloading of passengers. It may be located within a rail transit or bus station. **3.** On streetcar and light rail systems a passenger loading platform in the middle of the street, level with the street or more usually raised to curb height, often protected with a *bollard* facing traffic, also known as a *safety island*.

local bus or service – see *service, local bus*.

local train – see *train, local*.

location, vehicle – see *automatic vehicle location system*.

locomotive – a powered rail vehicle used for towing rail cars. It does not carry passengers and is usually powered by electric motors or diesel engines.

locomotive, diesel-electric – a locomotive that uses one or more diesel engines to drive electric generators that in turn supply electric motors geared to the driving axles. By far the dominant type of locomotive in North America.

locomotive, dual-powered – a locomotive that is capable of both diesel and electric operation, generally specific to services entering New York City where diesel operation is limited.

locomotive, electric – a locomotive in which the propulsion is effected by electric motors mounted on the vehicle. The electric power comes from an external source, usually overhead catenary.

locomotive, passenger – a locomotive commonly used for hauling passenger trains and generally designed to operate at higher speeds and lower tractive effort than a freight locomotive of equal power. Usually equipped with head end power that, through power take-off from the existing generator, a separate generator, or power conversion unit(s), provides heat, light and air conditioning power for the passenger cars.

loop – **1.** A transit route or guideway layout that is of a closed continuous form, such as a circle. **2.** A terminal track layout or bus driveway that reverses the direction of a vehicle without the vehicle's reversing.

loop, induction – see *induction loop sensor*.

low floor bus – see *bus, low floor*.

low floor light rail vehicle – see *car, light rail vehicle, low floor*.

low floor streetcar – see *car, light rail vehicle, low floor*.

low mobility group – see *transportation disadvantaged*.

low platform – see *platform, low*.

low voltage – see *voltage, low*.

M

MAC – major activity center.

MAC system – major activity center system; see *transit system, major activity center*.

MAGLEV – magnetic levitation.

MG set – see *motor-generator*.

MLP – maximum load point.

MLS – maximum load section.

MU – multiple unit; see *car, multiple-unit*.

MUTCD – *Manual on Uniform Traffic Control Devices*.

magnetic brake – see *brake, track*.

magnetic farecard – a card containing a magnetic tape strip or other electronic means of indicating the value purchased. The card is usually obtained from a vending machine and must be inserted into a farecard reader to gain access to the paid area of the transit system. In systems with fares by distance the card must also be inserted into a farecard reader to exit the paid area, see also *smartcard* and *fare collection system, automatic*.

magnetic levitation (MAGLEV) – support technology that keeps a vehicle vertically separated from its track or riding surface by magnetic force, either attractive or repulsive. After interest in the 1970s and 1980s this technology has been discredited for urban transit use and is essentially moribund.

main line – see *line, main*.

maintenance – the upkeep of vehicles, plant, machinery, and equipment. It may be scheduled, planned, progressive, or periodic on the basis of pre-established intervals of time, hours, or mileage, and employ preprinted checklists (*preventive maintenance*), or it may be unscheduled or corrective, in which case it is generally not interval based.

major activity center (MAC, activity center) – a geographical area characterized by a large transient population and heavy traffic volumes and densities; for example, central business district, major air terminal, large university, large shopping center, industrial park, sports arena.

major activity center transit system – see *transit system, major activity center*.

mall, transit – see *street, transit*.

management, headway – see *headway management*.

management, transportation system – see *transportation system management*.

manual block control system – see *control system, manual block*.

Manual on Uniform Traffic Control Devices – standard reference published by the U.S. Department of Transportation guiding the usage of traffic and (in the future) transit control devices.

manual train control – see *control system, manual train*.

many-to-few service – see *service, many-to-few*.

many-to-many service – see *service, many-to-many*.

many-to-one service – see *service, many-to-one*.

market – **1.** The potential or actual consumers (or both) of a (transportation) product or service. A general market denotes the entire population of a designated geographical area, whereas a specialized market denotes particular groups, such as the elderly, handicapped, students. **2.** The extent of demand for a transportation commodity or service.

market share – the percentage of a (transportation) market realized by or available to a particular (transportation) provider.

married pair – two semi-permanently coupled rail cars (A car and B car) that share some mechanical and electrical equipment and must be operated together as a unit.

mass transit, mass transportation – urban public transport by bus, rail, or other conveyance, either publicly or privately owned, providing general or special service to the public on a regular and continuing basis (not including school bus, charter, or sightseeing service). The term has developed a negative connotation and its use is discouraged in favor of urban transport, transit, public transit, public transport or public transportation.

maximum load point (MLP) – the point on a transit line or route at which the passenger volume is the greatest. There is one maximum load point in each direction.

maximum load section (MLS) – the section of a transit line or route that carries the highest total number of passengers for that line or route and direction.

maximum service braking – see *braking, maximum service*.

maximum theoretical velocity – see *velocity, maximum theoretical*.

measure of effectiveness – see *performance measure* and *service measure, transit*.

mechanical brake – see *brake, friction*.

median (median strip) – the portion of a divided highway or guideway that separates the opposing flows of traffic.

messenger – see definition of *catenary system*.

metered freeway – see *freeway, metered*.

metered freeway bus priority system – see *bus priority system, metered freeway*.

metering, ramp – see *ramp metering*.

métro, metro – short for metropolitan railway, the most common international term for subway, heavy rail, rail rapid transit, increasingly used in North America, see *transit system, rail rapid*.

metropolitan railway – see *transit system, rail rapid*.

midblock stop – see *stop, midblock*.

midibus – a bus with a passenger capacity of approximately 20-30 people.

mileage fare – see *fare, graduated*.

miles of route or roadway – see *route miles*.

miles of travel, vehicle – see *vehicle miles of travel*.

mini-high platform – see *platform, mini-high*.

minibus – a small bus, typically capable of carrying 20 passengers or fewer. It is most often used for making short trips, demand-responsive transportation, community services or bus pools.

mixed mode street – see *street, mixed mode*.

mixed or mixed flow traffic – see *traffic, mixed*.

mixed traffic operations – the operation of transit vehicles on nonexclusive rights-of-way with non-transit vehicles.

mobility – the ability to satisfy the demand to move a person or good.

modal interchange center – see *transit center*.

modal split (mode split) – **1.** The proportion of total person trips that uses each of various specified modes of transportation. **2.** The process of separating total person trips into the modes of

travel used; see also *urban transportation modeling system* and *model, sequential*.

mode – **1.** a transport category characterized by specific right-of-way, technological and operational features, **2.** a particular form of travel, for example, walking, traveling by automobile, traveling by bus, traveling by train.

mode, access – a feeder mode to the principal mode of transportation; for example, walking, kiss and ride, park and ride.

mode, dual – see *transit system, dual-mode*.

mode, transit – a category of transit systems characterized by common characteristics of technology, right-of-way, and type of operation. Examples of different transit modes are regular bus service, express bus service, light rail transit, rail rapid transit, and commuter rail.

model – **1.** A mathematical or conceptual presentation of relationships and actions within a system. It is used for analysis of the system or its evaluation under various conditions; examples include land use, economic, socioeconomic, transportation. **2.** A mathematical description of a real-life situation that uses data on past and present conditions to make a projection about the future.

mode split – see *modal split*.

monorail – see *transit system, monorail*.

monthly pass – see *pass, monthly*.

motor (electric motor) – a machine that transforms electrical energy into mechanical energy (torque).

motor, alternating-current – an electric motor (asynchronous, synchronous, induction, etc.) that operates on alternating current, generally three phase. The dominant motor type on modern electric transit vehicles from the mid 1990s.

motor, direct current – an electric motor (shunt, compound, etc.) that operates on direct current.

motor, electric – see *motor*.

motor, induction – an asynchronous alternating-current rotary motor that converts alternating-current electric power, delivered to the primary winding (usually the stator) and carried as induced current by the secondary winding (usually the rotor), into mechanical power.

motor, linear induction (LIM), single-sided linear induction, linear electric – an electric motor that produces mechanical force through linear, instead of rotary, motion, used to propel vehicles along a track or other guideway. The vehicle borne motor creates a "moving" magnetic field that is translated into linear motion via an inert steel guideway reaction rail, often laminated and aluminum covered. Used on the ALRT systems in Vancouver, Toronto (Scarborough), Detroit, New York JFK Airport and Kuala Lumpur.

motor, series-wound – a motor in which the field circuit is connected in series with the armature circuit, often called a *traction motor*.

motor, shunt – a type of rotary electric motor in which the field coils are connected in parallel with the motor armature.

motor, synchronous – a synchronous machine that transforms electrical power from any alternating-current system into mechanical power. The average speed of normal operation is equal to the frequency of the power system to which it is connected.

motor, traction – an electric motor, usually direct current and series wound, that propels a vehicle by exerting its torque through the wheels; see also *motor, series-wound*.

motor brake – see *brake, dynamic*.

motor bus – see *bus, motor*.

motor car, rail – see *car, rail motor*.

motor coach – see *bus, motor*.

motor-generator (MG set) – an electrical motor, usually at line voltage, mechanically coupled to a direct current generator to provide low voltage (12, 24 or 32 volts, sometimes higher) supply for rail transit cars and trolleybuses. Now replaced with solid-state DC-DC convertors.

motor operator or motorman – see *operator, train*.

move, reverse – see *reverse move*.

mover, people – see *people mover*.

moving block control system – see *control system, moving block*.

moving ramp – see *ramp, moving*.

moving sidewalk – see *moving walkway*.

moving walkway (moving sidewalk, passenger or pedestrian conveyor, passenger belt, traveler) – a fixed conveyor device (usually a flexible belt) on which pedestrians may stand or walk while being transported; see also *ramp, moving*.

multimodal – see *intermodal*.

multimode transit agency – a transit agency operating more than one mode of service.

multiple-unit car – see *car, multiple-unit*.

multiple-unit control system – see *control system, multiple-unit*.

N

NCHRP – National Cooperative Highway Research Program.

NCTRP – National Cooperative Transit Research and Development Program.

NEPA – National Environmental Policy Act; see *legislation, National Environmental Policy Act of 1969*.

NFPA – NFPA 130 – National Fire Prevention Association 130. Standards for fire and life safety on fixed guideway transit systems. Adopted into law in Canada and the United States, and, in part or whole, in some other jurisdictions. Even where not adopted the standards are generally applied in designing new fixed guideway systems worldwide. Older rail transit systems are not required to retrofit to these standards, first issued in 1983. Separate standards issued in 1998 for automated guideway transit. Available from NFPA, Batterymarch Park, Quincy, MA 02269 USA.

NPTS – Nationwide Personal Transportation Study.

NTD – National Transit Database.

NTSB – National Transportation Safety Board; see *U.S. Government, National Transportation Safety Board*.

narrow gauge – see *gauge, narrow*.

National Cooperative Highway Research Program (NCHRP) – a program established by the American Association of State Highway Officials (now American Association of State Highway and Transportation Officials) to provide

a mechanism for a national coordinated program of cooperative research employing modern scientific techniques. The NCHRP is administered by the Transportation Research Board.

National Environmental Policy Act of 1969 – see *legislation, National Environmental Policy Act of 1969*.

National Railroad Passenger Corporation – see *U.S. Government, National Railroad Passenger Corporation National Transit Database (NTD)* – a database compiled by the Federal Transit Administration of operating and financial statistics for medium and large transit agencies in the United States (those systems eligible for grants under Title 49 United States Code, Chapter 53-Mass Transportation, Section 5307.) The collection of information for the database is authorized under Title 49 United States Code, Chapter 53-Mass Transportation, Section 5335. Formerly known as Section 15 of the Federal Transit Act.

National Transportation Safety Board – see *U.S. Government, National Transportation Safety Board*.

Nationwide Personal Transportation Study (NPTS) – the NPTS, conducted (at this time) in 1969, 1977, and 1983 by the Bureau of the Census, has been the primary source of national data on travel patterns and frequency, transit use for all purposes, and the characteristics of transit users versus all travelers.

near-side stop – see *stop, near-side*.

network – **1.** In planning, a system of links and nodes that describes a transportation system. **2.** In highway engineering, the configuration of highways that constitutes the total system. **3.** In transit operations, a system of transit lines or routes, usually designed for coordinated operation.

network, grid – **1.** In planning, an imaginary network of evenly spaced horizontal and vertical bars or lines that divides a study area into small geographic zones. **2.** In transit operations, a service pattern in which two sets of parallel routes intersect each other at right angles.

network, radial – in transit operations, a service pattern in which most routes converge into and diverge from a central hub or activity center (e.g., central business district), like the spokes of a wheel. The hub may serve as a major transfer point.

New Look bus – see *bus, New Look, fishbowl*.

node – in planning, a point that represents an intersection of two or more links, highways, or transit lines or routes or a zone centroid; used in trip assignment.

nonambulatory handicapped – see *handicapped, nonambulatory*.

non-fixed route – see *transportation system, non-fixed route*.

non-home-based trip – see *trip, non-home-based*.

non transportation revenue – see *revenue, non transportation*.

normal vehicle capacity – see *capacity, vehicle*.

not-in-service time – see *time, deadhead*.

O

OBD – outlying business district.

OCS – overhead contact system.

O-D study – origin-destination study.

occupancy, area – see *area occupancy*.

occupancy, vehicle – see *vehicle occupancy*.

off-line – not in the main flow of traffic or not on the main line of traffic, for example, off-line station.

off-line station – see *station, off-line*.

off peak – the periods of time outside the peak periods; see also *base period*.

off-peak fare – see *fare, time-of-day*.

off-peak period – see *base period*.

off-street terminal – see *terminal, off-street*.

on-and-off check or count – see *check*.

on-board check – see *check*.

one-to-many service – see *service, one-to-many*.

one-way trip – see *trip*.

one-zone ride – a transit ride within the limits of one fare zone.

on-line – in the main flow of traffic.

on-line station – see *station, on-line*.

on-time performance – the proportion of the time that a transit system adheres to its published schedule times within stated tolerances; for example, a transit unit (vehicle or train) arriving, passing, or leaving a predetermined point (time point) along its route or line within a time period that is no more than *x* minutes earlier and no more than *y* minutes later than a published schedule time. (Values of 0 minutes for *x* and 5 minutes for *y* are the most common. On frequent rail services the headway can be used for *x* — with greater values the late train interferes with (delays) the following one.)

open cut guideway – see *guideway, open cut*.

open-loop braking – see *braking, open-loop*.

open fare system – see *fare collection system, proof of payment, self-service, barrier-free, open*.

operating costs – the sum of all recurring costs (e.g., labor, fuel) that can be associated with the operation and maintenance of the system during the period under consideration. Operating costs usually exclude such fixed costs as depreciation on plant and equipment, interest paid for loans on capital equipment, and property taxes on capital items. See also *capital costs*.

operating employees (operating personnel) – **1.** Employees whose major function is operating the service, such as station employees, switchmen, bus drivers, train operators, conductors. **2.** In rail operations, those employees that have direct and supervisory responsibility for the movement of transit units (cars or trains), embodying both on-board and wayside duties.

operating expenses – the total of all expenses associated with operation of an individual mode by a given operator. In the United States, total operating expense is reported on line 14 of Form 301 for a single mode system, and is derived from Form 310 for a multimodal system. Operating expenses include distributions of “joint expenses” to individual modes, and exclude “reconciling items” such as interest expenses and depreciation. Do not confuse with “vehicle operations expense.”

operating margin – **1.** the amount of time that a train can run behind schedule without interfering with following trains. **2.** imprecise reference to operating ratio.

operating ratio – the ratio of operating expenses to operating revenue; the inverse of cost recovery ratio. It is used as a measure of financial efficiency. See also *fare recovery ratio*.

operating revenue, total – see *revenue, total operating*.

operating speed – see *speed, running*; and *speed, schedule*.

operating speed, effective – see *speed, overall trip*.

operating time – see *time, operating*.

operating unit – see *basic operating unit*.

operation – see *operator* and *property*.

operation, automatic train – see *automatic train operation*.

operation, train – see *train operation*.

operational characteristic – any characteristic of transit service operation, i.e., this route is frequently overcrowded.

operations, mixed traffic – see *mixed traffic operations*.

operator – **1.** An employee of a transit system whose workday is spent in the operation of a transit unit (vehicle or train); examples include bus driver, gripman, motorman, train operator. Such an employee may also be known as a *platform operator*. **2.** The organization that runs a transportation system on a day-to-day basis. also known as an *operation, property, agency* or *system*; see also *property*.

operator, car – see *operator, train*.

operator, motor – see *operator, train*.

operator, rapid transit – see *operator, train*.

operator, streetcar – see *operator, train*.

operator, train (motor operator, motorman, engineer) – the operating employee who controls the movement of a rail transit unit (vehicle or train.) Specific titles are also used, such as *car operator, rapid transit operator, streetcar operator*.

order, slow – see *slow order*.

orders – authorization to move a train, as given by a train dispatcher either in writing or orally.

organizations – see also *U.S. Government* and *union, transit*.

organizations, American Association of State Highway and Transportation Officials (AASHTO) – membership includes state and territorial highway and transportation departments and agencies and the U.S. Department of Transportation. Its goal is to develop and improve methods of administration, design, construction, operation, and maintenance of a nationwide integrated transportation system. It studies transportation problems, advises Congress on legislation, and develops standards and policies.

organizations, American Public Transit Association (APTA) – a nonprofit international industry association made up of transit systems and other organizations and institutions connected to or concerned with the transit industry. It performs a variety of services for the industry, and its objectives include promotion of transit interests, information exchange, research, and policy development.

organizations, Association of American Railroads (AAR) – an industry association made up of individual railroads in the United States, Canada, and Mexico. It performs a variety of technical services for the railroads, and its purposes include the promotion of railroad interests and the standardization and coordination of operating and mechanical activities within the railroad industry.

organizations, Canadian Urban Transit Association (CUTA) – an industry association made up of individual transit operators and suppliers in Canada.

organizations, department of transportation (DOT) – a municipal, county, state, or federal agency responsible for transportation; see also *U.S. Government, Department of Transportation*.

organizations, Institute of Transportation Engineers (ITE) – a society of professionals in transportation and traffic engineering. It promotes education, research, the development of public awareness, and the exchange of professional information in these areas with the goal of contributing individually and collectively toward meeting human needs for mobility and safety.

organizations, International Union of Public Transport (UITP) – an association that pools information and experience of urban and interurban transportation undertakings for joint study and research and promotes technical and economic development.

organizations, Presidents' Conference Committee (PCC, Electric Railway Presidents' Conference Committee) – a group of leading streetcar producers and operators who, between 1930 and 1935, sponsored the development of the PCC car. This car had performance characteristics superior to any previous model of streetcar and became the standard of U.S. streetcars for many years. See also *car, PCC*.

organizations, Public Utilities Commission (PUC, Public Service Commission, PSC) – a state agency whose responsibilities include regulation of for-hire (public and private) carriers of passengers and goods within a state. Other jurisdictions (e.g., a city) may also have a PUC or PSC that regulates for-hire carriers within that jurisdiction.

organizations, regional planning agency (RPA) – a nonprofit, quasi-public organization whose policy board is composed of member municipal government representatives. It makes recommendations related to land use, the environment, human resources, housing, and transportation for a specific region.

organizations, Transportation Research Board – a unit of the National Research Council, operating under the corporate authority of the private and nonprofit National Academy of Sciences. The purpose of TRB is to advance knowledge concerning the nature and performance of transportation systems by stimulating research and disseminating the information derived therefrom. Its affiliates and participants include transportation professionals in government, academia, and industry.

origin – **1.** The point at which a trip begins. **2.** In planning, the zone in which a trip begins.

origin-destination service – see *service, origin-to-destination*.

origin-destination study (O-D study) – a study of the origins and destinations of the trips of

vehicles or travelers. It may also include trip purposes and frequencies.

out-of-service (not in service) – a transit vehicle or facility that is not available for transporting passengers.

outbound trip – see *trip, outbound*.

outlying business district (OBD) – the portion of an urban area that is normally separated from the central business district and fringe area but that supports considerable business activity and has its own traffic circulation, superimposed on some through traffic.

overall travel time – see *time, linked trip*.

overall trip speed – see *speed, overall trip*.

overhead – colloquial abbreviation for overhead contact system in electric traction, see *OCS*.

overhead contact shoe (contact shoe, trolley shoe) – a metal bar, usually with graphite insert, for collecting current from an overhead conductor along which it slides. It is held in place by a trolley pole, pantograph or bow.

overhead contact system (OCS) – the overhead electric supply system for rail and trolleybus systems, including contact wire, catenary, messenger wires, supporting masts, span wires and bracket arms.

overload – see *extra section*.

over-the-road coach – see *bus, intercity*.

owl bus or run – see *run, owl*.

owl service – see *service, owl*.

P **P&R** – park and ride.
PCC – Presidents' Conference Committee; see *organizations, Presidents' Conference Committee*; and *car, PCC*.
PCC car – Presidents' Conference Committee car; see *car, PCC*.

PCE – passenger car equivalence.

PRT – personal rapid transit; see *transit system, personal rapid*, and *transit system, automated guideway transit*.

PSC – Public Service Commission; see *organizations, Public Utilities Commission*.

PUC – Public Utilities Commission; see *organizations, Public Utilities Commission*.

paid area – see *area, paid*.

paid area transfer – see *transfer, paid area*.

paid miles – see *revenue vehicle miles*.

paid transfer – see *transfer, paid*.

pair, married – see *married pair*.

pantograph – a device for collecting current from an overhead conductor, characterized by a hinged vertical arm operated by springs or compressed air and a wide, horizontal contact surface that glides along the wire. Older versions usually consist of two parallel, hinged, double-diamond frames.

paratransit – forms of transportation services that are more flexible and personalized than conventional fixed route, fixed schedule service but not including such exclusory services as charter bus trips. The vehicles are usually low- or medium-capacity highway vehicles, and the service offered is adjustable in various degrees to individual users' desires. Its categories are public, which is available to any user who pays a predetermined fare (e.g., taxi, jitney, dial-a-ride),

and semipublic, which is available only to people of a certain group, such as the elderly, employees of a company, or residents of a neighborhood (e.g., vanpools, subscription buses).

paratransit, complementary — paratransit service provided within a certain distance of fixed-route transit service, to accommodate disabled passengers unable to use the fixed-route service. Required by the Americans with Disabilities Act.

park and ride (park 'n' ride, P&R) – an access mode to transit in which patrons drive private automobiles or ride bicycles to a transit station, stop, or carpool/vanpool waiting area and park the vehicle in the area provided for that purpose (park-and-ride lot, park-and-pool lot, commuter parking lot, bicycle rack or locker). They then ride the transit system or take a car or vanpool to their destinations.

parking facility – an area, which may be enclosed or open, attended or unattended, in which automobiles may be left, with or without payment of a fee, while the occupants of the automobiles are using other facilities or services.

parking turnover – the ratio of the total number of parked vehicles accommodated during a given period in a specified area to the total number of parking spaces in that area.

pass – 1. A means of transit prepayment, usually a card, that a transit passenger displays to the operator, conductor, or fare inspector or processes through automatic fare collection equipment instead of paying a cash fare. Passes are usually sold by the week or month. In some areas, to encourage tourism, they are also sold for shorter periods, sometimes with restricted hours for their use. **2.** A means, usually a card, of granting free access to a transit system. This type of pass is issued to employees, visiting dignitaries, police, and so on. Employee passes usually carry some form of identification. see also *daypass*.

pass, monthly – a pass valid for unlimited riding within certain designated zones for a 1-month period, or sometimes for a 30 day period from purchase or initial use.

passenger – a person who rides a transportation vehicle, excluding the operator or other crew members of that transportation vehicle; see also *customer*.

passenger, revenue – a passenger who pays (or has prepaid) a fare.

passenger, transfer – a passenger who changes from one route or line to another route or line.

passenger amenity — an object or facility (such as a shelter, telephone, or information display) intended to enhance passenger comfort or transit usability.

passenger belt – see *moving walkway*.

passenger car equivalence (PCE) – the representation of larger vehicles, such as buses, as equal to a quantity of automobiles (passenger cars) for use in level of service and capacity analyses.

passenger controls – 1. a system of railings, booths, turnstiles, faregates and other fixtures for collecting fares and otherwise directing the movement of passengers. The controls may also be used to maintain the distinction between fare-paid and unpaid people. **2.** on proof-of-payment fare collection systems, the process of checking and enforcing fare payment.

passenger conveyor – see *moving walkway*.

passenger count – a count of the passengers on a vehicle or who use a particular facility.

passenger flow (passenger traffic) – the number of passengers who pass a given location in a specified direction during a given period.

passenger load – the number of passengers on a transit unit (vehicle or train) at a specified point.

passenger locomotive – see *locomotive, passenger*.

passenger mile (passenger kilometer) – the transportation of one passenger a distance of 1 mile (km)

passenger miles (passenger kilometers) – the total number of passengers carried by a transit system for a unit of time multiplied by the number of miles they travel. The ratio of passenger miles (kilometers) and seat or place miles (kilometers) provides a measure of efficiency.

passenger miles per train mile (passenger kilometers per train kilometer) – the number of passenger miles (kilometers) accomplished by a given train mile (kilometer). The measure is the equivalent of load factor for buses, boats, or aircraft, but it also adjusts for distortions introduced as cars are added to trains. As an example, 100 people in one rail car of 100-passenger capacity is a load factor of 100 percent. If a car is added for 10 more passengers, the load factor drops to 55 percent – yet in many ways, productivity has gone up, not down.

passenger platform – see *platform*.

passenger riding count or check – see *check*.

passenger service time - see *time, passenger service*.

passenger station – see *station*.

passenger traffic – see *passenger flow*.

passenger trip – see *trip, linked; trip, passenger; and trip, unlinked*.

passenger vehicle – see *vehicle, passenger*.

passenger volume (line volume) – the total number of passengers carried (boarded) on a transit line during a given period.

passing track – see *siding*.

path – in planning, any series of links where each succeeding link has the ending node of a previous link as its beginning node.

patron – see *rider*.

patronage – see *ridership*.

peak (peak period, rush hours) – **1.** The period during which the maximum amount of travel occurs. It may be specified as the morning (a.m.) or afternoon or evening (p.m.) peak. **2.** The period when demand for transportation service is heaviest.

peak/base ratio (peak/off-peak ratio) – **1.** The ratio between the number of vehicles operating in passenger service during the peak hours and that during the base period. **2.** The ratio between the number of passengers carried during the peak hours and during the base period. A low ratio (<2 – 3) characterizes large cities with healthy transit systems.

peak fare – see *fare, time-of-day*.

peak-hour conversion factor – see *peak-hour factor*.

peak-hour factor (peak-hour conversion factor) – **1.** the ratio of the volume during the peak hour to the maximum rate of flow during a

selected period within the peak hour, usually 15 or 20 minutes. **2.** the ratio of the volume during the peak hour to the volume during the peak period, usually the peak two hours, typically 60%.

peak-hour pricing – see *pricing, peak-hour*.

peak period – see *peak*.

peak period surcharge – see *fare, time-of-day*.

peak service – see *service, peak*.

pedestrian – a person traveling on foot.

pedestrian conveyor – see *moving walkway*.

pedestrian island – see *loading island*.

pedestrian refuge – a space designed for the use and protection of pedestrians, including both the safety zone and the area at the approach that is usually outlined by protective deflecting or warning devices; see also *loading island*.

pendulum suspension (K&M) – type of overhead suspension for trolleybuses that provides more flexible wire and allows faster speeds — particularly around curves. Attributed to dominant Swiss manufacturer, Kummeler+Matter.

people mover – an automated transportation system (e.g., continuous belt system or automated guideway transit) that provides short-haul collection and distribution service, usually in a major activity center. Preferred term is *automated guideway transit* although some regard people-mover as a subset of AGT.

people mover, downtown (DPM) – a people mover that primarily serves internal movements in a central business district.

performance, on-time – see *on-time performance*.

performance measure (performance indicator, measure of effectiveness) – a quantitative measure of how well an activity, task, or function is being performed. In transportation systems, it is usually computed by relating a measure of service output or use to a measure of service input or cost.

period, base or off-peak – see *base period*.

period, peak – see *peak*.

peripheral parking – see *parking, fringe*.

permissive block – see *block, absolute permissive*.

person capacity – see *capacity, person*.

person trip – see *trip, person*.

personal rapid transit – see *transit system, personal rapid*.

Personal Transportation Study, Nationwide – see *Nationwide Personal Transportation Study*.

personnel, operating – see *operating employees*.

plan, sketch – see *sketch planning*.

plan, system – see *system planning*.

platform – the front portion of a bus or streetcar where passengers board.

platform – the front portion of a bus or streetcar where passengers board.

platform, passenger – that portion of a transit facility directly adjacent to the tracks or roadway at which transit units (vehicles or trains) stop to load and unload passengers. Within stations, it is often called a *station platform*.

platform, center (British island) – a passenger platform located between two tracks or guideways so that it can serve them both.

platform, high – a platform at or near the floor elevation of the transit unit (vehicle or train), eliminating the need for steps on the transit unit.

platform, low – a platform at or near the top of the running surface of the transit unit (vehicle or train), requiring the passenger to use steps to board and alight.

platform, mini-high (high block platform) – a small high level platform that usually provides access only to the first door of a light rail train in order to allow boarding by wheelchairs, scooters, etc.

platform, side – a passenger platform located to the outside of the tracks or guideways, as distinguished from a center platform located between the tracks or guideways.

platform operator – see *operator*.

platform time – see *time, platform*.

platoon, bus – see *bus platoon*.

p.m. peak – see *peak*.

pneumatic brake – see *brake, electropneumatic*.

pocket track – a third track to store spare or disabled trains, to act a crossover or a turn-back, often between the two main tracks and often with switches at both ends.

point, maximum load – see *maximum load point*.

point, time – see *time point*.

point, turnover – see *turnover point*.

point check – see *check*.

point deviation service – see *service, point deviation*.

point-to-point deviation – a transit routing pattern in which the vehicle passes through pre specified points in accordance with a prearranged schedule but is not given a specific route to follow between these points. It may provide door-to-door or curb-to-curb service. See also *service, point deviation*.

points – a pair of linked, movable tapered rails used in rail switches that allow a train to pass from one line to another. Points are also used for the same function in overhead wiring for trolleybuses.

pole, trolley – see *trolley pole*.

policy headway – see *headway, policy*.

pool – see *buspool, carpool, and vanpool*.

power, dual – see *propulsion system, dual-power and bus, hybrid*.

powered car – see *car, rail motor*.

power rail – see *rail, third*.

preemption, signal – see *signal preemption*.

preferential bus lane – see *lane, bus*.

pre-metro system – see *transit system, pre-metro*.

Presidents' Conference Committee – see *organizations, Presidents' Conference Committee; and car, PCC*.

Presidents' Conference Committee car – see *car, PCC*.

preventive maintenance – see definition of *maintenance*.

pricing – a strategy for charging users. It may be used to ration demand (change behavior), cover costs, or achieve other policy objectives.

pricing, peak-hour – charging higher prices for peak-period service than for off-peak service.

pricing, time-of-day – varying the price of service during the day.

priority lane – see *lane, priority*.

priority lane, bus – see *lane, bus*.

priority system, bus – see *bus priority system*.

private transportation – **1.** Any transport service that is restricted to certain people and is therefore not open to the public at large. **2.** Owned or operated by an individual or group, for his or its own purposes or benefit, not by a governmental entity.

productions, trip – see *trip productions*.

productive capacity – see *capacity, productive*.

productivity – the ratio of units of transportation output to units of input (consumed resource); for example, vehicle miles (vehicle kilometers) per operator hour, or passenger miles (passenger kilometers) per unit cost of operation.

program, National Cooperative Research – see *National Cooperative Highway Research Program and National Cooperative Transit Research and Development Program*.

program, Research, Development, and Demonstration – see *Research, Development, and Demonstration Program*.

program, Service and Methods Demonstration – see *Service and Methods Demonstration Program*.

programmed braking – see *braking, programmed*.

progression, automatic – see *automatic progression*.

proof-of-payment – see *fare collection system, proof of payment*.

property (operation, operator, system) – in the transit industry, a public transit agency or a private transit company with responsibility for transportation services such as bus, ferry, rail; see also *transit district*.

propulsion system – the motors, driving mechanism, controls, and other devices that propel a vehicle, frequently assumes electric operation.

propulsion system, dual-power – a propulsion system that is capable of operation from two different types of power sources, for example, an internal combustion engine and electricity.

protection, train – see *automatic train protection*.

proximity card – see *smart card*.

public automobile service system – see *transportation system, public automobile service*.

publicly owned transit system – see *transit system, publicly owned*.

Public Service or Utilities Commission – see *organizations, Public Utilities Commission*.

public service vehicle – see *vehicle, public service*.

public transit – passenger transportation service, usually local in scope, that is available to any person who pays a prescribed fare. It operates on established schedules along designated routes or lines with specific stops and is designed to move relatively large numbers of people at one time. Examples include bus, light rail, rapid transit.

public transit agency – see *property, transit district*.

public transportation – transportation service to the public on a regular basis using vehicles that

transport more than one person for compensation, usually but not exclusively over a set route or routes from one fixed point to another. Routes and schedules of this service may be predetermined by the operator or may be determined through a cooperative arrangement. Subcategories include public transit service and paratransit services that are available to the general public.

public transportation, urban – see *urban public transportation*.

public transportation disability – see *handicapped*.

public way – any public street, road, boulevard, alley, lane, or highway, including those portions of any public place that have been designated for use by pedestrians, bicycles, and motor vehicles.

puller – an articulated bus with the center axle powered.

purpose, trip – see *trip purpose*.

push-pull train – see *train, push-pull*.

push-through – a bus-operating technique used in busy peak-hour street operations when heavy passenger loads can combine with general road traffic delays to create bunching. A push-through is an unscheduled bus that is held at a key point, to be inserted by an inspector or street supervisor into a route when a serious gap occurs. It is used to prevent worsening of service.

pusher – an articulated bus with the rear axle powered.

Q **quality, ride** – see *ride quality*.
quality, service – see definition of *level of service*.

quality control – the system of collection, analysis, and interpretation of measurements and other data concerning prescribed characteristics of a material, process, or product, for determining the degree of conformance with specified requirements.

quality of service (transit) – the overall measured or perceived quality of transit service from the user or passenger's point of view.

queue – A line of vehicles or people waiting to be served by the system in which the rate of flow from the front of the line determines the average speed within the line. Slowly moving vehicles or people joining the rear of the queue are usually considered a part of the queue.

queue jumper – **1.** A short section of exclusive or preferential lane that enables specified vehicles to bypass an automobile queue or a congested section of traffic. A queue jumper is often used at signal-controlled freeway on-ramps in congested urban areas to allow high-occupancy vehicles preference. It is also known as a *bypass lane* or *queue bypass*. **2.** A person who violates passenger controls.

R **RDC** – rail diesel car; see *car, rail diesel*.

ROW – right-of-way.

RPA – regional planning agency; see *organizations, regional planning agency*.

RRIS – Railroad Research Information Service.

rack railway – see *cog railway*.

radial network – see *network, radial*.

rail, contact – see *rail, third*.

rail, continuous welded (CWR) – a number of standard length rails welded together into a single length of 122 or more m (400 or more ft). It provides a smoother running surface and ride than jointed rail.

rail, girder – rail with a built in flange groove used on streetcar and light rail lines that are laid in-street where other motor vehicles must travel.

rail, power – see *rail, third*.

rail, running – a rail that supports and guides the flanged wheels of the rail vehicle.

rail, standard – an 11.89-m (39-ft) section of rail.

rail, third (contact rail, power rail) – an electric conductor, located alongside the running rail, from which power is collected by means of a sliding shoe attached to the truck of electric rail cars or locomotives. Traditionally made of mild steel, composite rail, often aluminum with a stainless steel cover, is appearing on some new systems.

rail, welded – two or more rails welded together at their ends to form a length less than 122 m (400 ft); see also *rail, continuous welded*.

railbus – a light, self-propelled rail vehicle with a body resembling that of a bus or using bus components, two-axle versions are noted for poor ride quality.

rail car, electric – see *car, electric rail*.

rail car, type – see *car, type designations*.

rail car, urban – see *car, urban rail*.

rail car, weight – see *car, weight designations*.

rail diesel car – see *car, rail diesel*.

rail motor car – see *car, rail motor*.

rail rapid transit – see *transit system, rail rapid*.

rail rapid transit car – see *car, rail rapid transit*.

railroad, commuter – see *transit system, commuter rail*.

railroad grade crossing – see *crossing, railroad grade*.

Railroad Research Information Service (RRIS) – a computer-based information storage and retrieval system developed by the Transportation Research Board with financial support from the Federal Railroad Administration. It consists of summaries of research projects in progress and abstracts of published works.

railroad tie – see *crosstie*.

rail transit system – see *transit system, rail*.

rail transport, conventional – see *conventional rail transport*.

rail vehicle, articulated – see *articulated rail vehicle*.

railway – alternate term for railroad, especially Canadian and British.

railway, cog – see *cog railway*.

railway, funicular – see *funicular railway*.

railway, inclined plane (incline) – see *incline railway*.

railway, metropolitan – see *transit system, rail rapid*.

railway, rack – see *cog railway*.

railway, street – old term for streetcar system, see *transit system, streetcar*.

railway crossing – see *crossing, track*.

railway electrification – see *electrification*.

ramp, moving – an inclined moving walkway.

ramp, meter bypass lane – see *lane, ramp meter bypass*.

ramp metering – **1.** The process of facilitating traffic flow on freeways by regulating the amount of traffic entering the freeway through the use of control devices on entrance ramps. **2.** The procedure of equipping a freeway approach ramp with a metering device and traffic signal that allow the vehicles to enter the freeway at a predetermined rate.

rapid bus – see *transit system, bus rapid*.

rapid, the – see *transit system, rail rapid*.

rapid rail transit – see *transit system, rail rapid*.

rapid transit – generic term introduced in the 1890s to denote any transit that was faster than its predecessor—most particularly for the replacement of horsecars with electric streetcars, now generally used for rail systems on exclusive right-of-way, i.e. heavy rail or metro. See adjacent listings and specific entries under *transit systems*.

rapid transit car – see *car, rail rapid transit*.

rapid transit operator – see *operator, rapid transit*.

rapid transit system – see *rapid transit* and specific entries under *transit systems: bus rapid, group rapid, light rail rapid, personal rapid, rail rapid, rapid*.

rate of flow – see *flow rate*.

ratio, cost recovery – see *cost recovery ratio*.

ratio, fare or farebox recovery – see *fare recovery ratio*.

ratio, operating – see *operating ratio*.

ratio, peak/base or peak/off-peak – see *peak/base ratio*.

ratio, travel time – see *travel time ratio*.

reader, farecard – see *farecard reader*.

recovery ratio – see *cost recovery ratio* and *fare recovery ratio*.

recovery time – see *time, layover*.

rectifier station – see *electric sub-station*.

reduced fare – see *fare, reduced*.

refuge, pedestrian – see *pedestrian refuge*.

regenerative brake – see *brake, regenerative*.

regional planning agency – see *organizations, regional planning agency*.

regional rail service – see *service, regional rail*.

regional transit service – see *service, regional transit*.

register or registering farebox – see *farebox, registering*.

regular fare – see *fare, base*.

relationship, speed-flow – see *speed-flow relationship*.

relay, track – see *track relay*.

relay time – see *time, layover*.

reroute – to divert to a route other than the scheduled route, usually with preplanning and for a longer period than that for a detour.

Research Information Service – see *Highway Research Information Service, Railroad Research Information Service, Transportation Research Information Services, and Urban Mass Transportation Research Information Service*.

Research Program – see *National Cooperative Highway Research Program, National*

Cooperative Transit Research and Development Program and Transit Cooperative Research Program.

reserved transit lane – see *lane, exclusive transit*.

response time – see *time, response*.

retardation – see *deceleration*.

revenue, farebox – the passenger payments for rides, including cash, farecards, tickets, tokens, pass receipts, and transfer and zone charges but excluding charter revenue.

revenue, non transportation (other) – revenue earned by activities not associated with the provision of the system's transit service, for example, sales of maintenance services, rental of vehicles and buildings, non transit parking lots, sale of advertising space, and investment income.

revenue, total operating – the sum of regular passenger revenue, charter revenue, and other miscellaneous revenues, such as those from advertising or concessions.

revenue miles (revenue kilometers) – miles (kilometers) operated by vehicles available for passenger service.

revenue passenger – see *passenger, revenue*.

revenue passenger trips – the number of fare-paying transit passengers with each person counted once per trip; excludes transfer and non-revenue trips.

revenue seat mile (revenue seat kilometer) – the movement of one transit passenger seat over 1 miles (km). In other words, the total number of revenue seat miles (kilometers) for a vehicle is obtained by multiplying the number of revenue seats in the vehicle by the number of revenue miles (kilometers) traveled.

revenue service – see *service, revenue*.

revenue track miles or kilometers – see *track miles, revenue*.

revenue vehicle – see *vehicle, revenue*.

revenue vehicle miles (revenue vehicle kilometers, paid miles or kilometers) – the distance in miles (kilometers) that a revenue vehicle is operated while it is available for passenger service.

reverse commute – see *commute, reverse*.

reverse move – the forward movement of a train going against the normal direction of traffic.

reversible bus lane – see *lane, reversible bus*.

reversible lane – see *lane, reversible*.

ride, check – see *check ride*.

ride, one-zone – see *one-zone ride*.

ride, shared – see *shared ride*.

ride quality – a measure of the comfort level experienced by a passenger in a moving vehicle, including the vibration intensity and frequency, accelerations (longitudinal, transverse, and vertical), jerk, pitch, yaw, and roll.

rider – **1.** A passenger on any revenue service vehicle; also known as a *patron*. **2.** In government reporting, someone making an unlinked trip.

rider, captive – a person limited by circumstances to use one mode of transportation; see also *transit dependent* and *transportation disadvantaged*.

rider, captive transit – a person who does not have a private vehicle available or cannot drive (for any reason) and who must use transit to make

the desired trip; see also *transit dependent* and *transportation disadvantaged*.

rider, choice – a person who has at least two modes of travel available and selects one to use.

riders, group – riders who have a common origin and destination or some demographic variable in common and travel together in the same vehicle.

ridership (patronage) – the number of people making one way trips on a public transportation system in a given time period.

ridesharing – a form of transportation, other than public transit, in which more than one person shares in the use of the vehicle, such as a bus, van, or automobile, to make a trip.

riding check or count, passenger – see *check*.

riding frequency coefficient (riding habit coefficient) – the number of passenger trips during a designated time period divided by the resident population of the area served, such as transit trips per capita per year.

right-of-way (ROW) – **1.** A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to transportation purposes. For transit, rights-of-way may be categorized by degree of their separation: fully controlled without grade crossings, also known as *grade separated*, *exclusive*, or *private ROW*; longitudinally physically separated from other traffic (by curbs, barriers, grade separation, etc.) but with grade crossings; or surface streets with mixed traffic, although transit may have preferential treatment. **2.** The precedence accorded to one vehicle or person over another.

right-of-way, controlled access – lanes restricted for at least a portion of the day for use by transit vehicles and/or other high occupancy vehicles. Use of controlled access lanes may also be permitted for vehicles preparing to turn. The restriction must be sufficiently enforced so that 95 percent of vehicles using the lanes during the restricted period are authorized to use them.

right-of-way, exclusive – roadway or other right-of-way reserved at all times for transit use and/or other high occupancy vehicles.

right-of-way, exclusive transit – a right-of-way that is fully grade separated or access controlled and is used exclusively by transit.

right-of-way, segregated – roadway or right-of-way reserved for transit use, but which permits other modes to cross the right-of-way at defined locations such as grade crossings.

right-of-way, shared – roadway or right-of-way which permits other traffic to mix with transit vehicles, as is the case with most streetcar and bus lines.

right-of-way miles (right-of-way kilometers, first-track miles or kilometers) – the length of right-of-way occupied by one or more lanes or tracks; see also *route miles*.

road – see *highway, street, or road*.

road, collector – see *street, collector-distributor*.

roadbed – **1.** In railroad construction, the foundation on which the ballast and track rest. **2.** In highway construction, the graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulder.

road call – a mechanical failure of a bus in revenue service that necessitates removing the bus from service until repairs are made.

road miles (road kilometers) – linear miles (kilometers) of highway as measured along the centerline of the right-of-way.

road supervisor – see *inspector*.

roadway – that portion of a highway built, designed, or ordinarily used for vehicular travel, except the berm or shoulder. If a highway includes two or more separate roadways, the term means any such roadway separately but not all such roadways collectively.

rolling stock – see *fleet*.

rolling stock capacity – see *capacity, fleet*.

round trip – see *trip, round*.

route – **1.** The geographical path followed by a vehicle or traveler from start to finish of a given trip. **2.** A designated, specified path to which a transit unit (vehicle or train) is assigned. Several routes may traverse a single portion of road or line. **3.** In traffic assignments, a continuous group of links that connects two centroids, normally the path that requires the minimum time to traverse. **4.** In rail operations, a determined succession of contiguous blocks between two controlled interlocked signals.

route deviation service – see *service, route deviation*.

route miles (route kilometers) – various definitions exist for this statistic: **1.** One-way duplicating is total mileage (kilometers) of routes, where the roadway or guideway segments of each individual route are summed up in one direction. For example, a 1-mile (km) segment over which buses operate in both directions would be reported as 2 miles (km); also known as *directional route miles (kilometers)* or *miles (kilometers) of roadway or route*. **2.** One-way non-duplicating is total mileage (kilometers) of routes, where a particular roadway or guideway segment is only counted once regardless of number of routes or direction of travel on that segment; also known as *line miles (kilometers)* or *miles (kilometers) of directional roadway*. **3.** Two-way mileage (kilometers) is total mileage (kilometers) of each route covered from start to finish. No attention is given to direction of routes or number of routes using any particular segment of roadway or guideway.

route structure – **1.** A network of transit routes. **2.** The pattern of transit routes, for example, grid, radial. See *network*.

route supervisor – see *inspector*.

routing, dynamic – see *dynamic routing*.

routing, through – see *through routing*.

rule – in rail operations, a law or order authoritatively governing conduct or action.

run – **1.** The movement of a transit unit (vehicle or train) in one direction from the beginning of a route to the end of it; also known as a *trip*. **2.** An operator's assignment of trips for a day of operation; also known as a *work run*.

run, bus – the daily assignment of a bus, numbered and listed in a master schedule. Each vehicle displays its bus run number.

run, owl – a run that operates during the late night through early morning hours; most commonly, midnight to 0400h or the start of the next day's service. Some systems designate hours after midnight, when operated by vehicles starting the previous day, as 2500h, 2600h and so on.

run cutting – the process of organizing all scheduled trips operated by the transit system into

runs for the assignment of operating personnel and vehicles.

run number – a two or three digit number displayed on a hand set or flip-dot display in the lower windscreen displaying the run or schedule slot the vehicle is in—primarily as information to inspectors, street supervisors or checkers.

running gear – the vehicle parts whose functions are related to the movement of the vehicle, including the wheels, axles, bearings, and suspension system.

running hot (running sharp) – running ahead of schedule. Unacceptable practice on most systems.

running rail – see *rail, running*.

running speed – see *speed, running*.

running time – see *time, running*.

rush hour(s) – see *peak*.

S **SE** – Single Ended, rail or streetcar with driving position only at one end, requires loop to turn around at end-of-line.

SLT – shuttle-loop transit; see *transit system, shuttle-loop*.

SOV – single-occupant vehicle; see *vehicle, single-occupant*.

SU – single unit; see *car, single-unit*.

saddle monorail – see *transit system, monorail*.

safety distance – **1.** minimum separation of trains with various control systems **2.** in a moving-block signaling system, the specific distance between the target point and the train or obstruction ahead. See *control system*.

safety island – see *loading island*.

scatter service – see *service, one-to-many*.

schedule – **1.** A listing or diagrammatic presentation in time sequence of every trip and every time point of each trip, from start to finish of service, on a transit line or route. **2.** In transit or railroad operations, a published table of departure or arrival times (or both) for arranged service over a transit line or route or a specific section of railroad; see also *timetable*.

schedule check – see *check*.

schedule checker – see *checker*.

schedule speed – see *speed, schedule*.

scheduling – in transit operations, the process of preparing the operating plan (schedule) for a transit line or network on the basis of passenger demand, policy or level of service, and operating elements (travel times, etc.)

school bus – see *bus, school*.

school bus service – see *service, school bus*.

scratch ticket – a ticket on which the user can scratch overprinting off to indicate, zone, and/or month, day (and time) of validity. Common on daypasses; used on one and two-zone passes in Vancouver B.C.

seating or seated capacity – see *capacity, seating*.

seating, 2+1 – transverse seating arrangement providing three seats per row, two on one side of the aisle and one on the other side of the aisle.

seating, 2+2 – transverse seating arrangement providing four seats per row, two on each side of the aisle.

seating, 2+3 – transverse seating arrangement providing five seats per row, two on one side of the aisle and three on the other side of the aisle;

not popular with passengers. This seating arrangement constrains aisle width, which may make the provision of wheelchair access difficult.

seating, longitudinal – seats that are placed parallel to the sides of a transit vehicle, so that passengers sit sideways relative to the direction of travel. This seating arrangement increases the aisle width, so allowing more standing room, but may be less comfortable for seated passengers.

seating, transverse – seats that are placed perpendicular to the sides of a transit vehicle, so that passengers face forward or backward relative to the direction of travel. This seating arrangement is often used when it is desired for most passengers to have a seat, although it is also possible to have single transverse seats on either side of the vehicle, with a wide aisle in between.

seat mile, revenue – see *revenue seat mile*.

section – for sections of legislation, see definition of *legislation*.

section, block – see *block*.

section, extra – see *extra section*.

section, maximum load – see *maximum load section*.

self-propelled locomotive – see *locomotive, self-propelled*.

self-propelled or self-powered car – see *car, rail motor*.

self-service, barrier-free fare collection system – see *fare collection system, open, barrier-free, proof of payment, self-service*.

semi-metro system – see *transit system, semi-metro*.

sensor, induction loop – see *induction loop sensor*.

separation, grade – see *grade separation*.

series, time – see *time series*.

series-wound motor – see *motor, series-wound*.

service, arterial – generally major (long or heavily patronized) transit routes that operate on principal or major surface arterial streets.

service, base-period – the level of transit operations during the base period.

service, circulator – bus service confined to a specific locale, such as a downtown area or a suburban neighborhood, with connections to major traffic corridors.

service, city transit – transit serving an urban area, as distinguished from short-haul and regional transit service.

service, community – short feeder or loop route serving a local community, often operated with smaller buses.

service, commuter – transportation provided on a regularly scheduled basis during peak travel periods for users commuting to work, school, and similar destinations.

service, crosstown – non-radial transit service that does not enter the central business district.

service, demand jitney – see *service, jitney*.

service, door-to-door – a service that picks up passengers at the door of their place of origin and delivers them to the door of their place of destination. This service may necessitate passenger assistance between the vehicle and the doors. See also *service, curb-to-curb*.

service, express – service that has fewer stops and a higher operating speed than regular service.

service, express bus – bus service with a limited number of stops, either from a collector area directly to a specific destination or in a particular corridor with stops en route at major transfer points or activity centers. Express bus service usually uses freeways or busways where they are available.

service, feeder – **1.** Local transportation service that provides passengers with connections with a major transportation service. **2.** Local transit service that provides passengers with connections to main-line arterial service; an express transit service station; a rail rapid transit, commuter rail, or intercity rail station; or an express bus stop or terminal, see also *service, community*.

service, few-to-few – a service that picks up passengers at a limited number of origins and delivers them to a limited number of destinations.

service, few-to-many – a service that picks up passengers at a few preselected origins, typically activity centers or transfer points, and delivers them to many destinations.

service, flag stop – **1.** In paratransit operations, a service accessed by hail. **2.** In rail operations, a nonscheduled stop that may be served if proper notice is given by a passenger or prospective passenger.

service, gather – see *service, many-to-one*.

service, jitney – a route deviation service in which small or medium-sized vehicles, such as large automobiles, vans, or minibuses, are used. The vehicles are usually owned by the drivers and the service is often independently operated. However it is authorized or regulated and distinct from unofficial, and usually illegal, “jitney service” where often-uninsured private cars or vans solicit passengers — often running ahead of transit buses. See also *transportation system, jitney*.

service, level of – see *level of service*.

service, limited – **1.** A transit service that operates only during a certain period of the day, or that serves only specific stops (also known as *limited stop service*) or in a specified area, or that serves only certain segments of the population. **2.** Line service with some restrictions on boarding and alighting.

service, line haul – **1.** Transportation service along a single corridor, without branches, with stops along the way. Usually service is intensive (high capacity) and may use exclusive right-of-way. **2.** May also be used to describe express service or even main-line service, as opposed to feeder service.

service, local – **1.** Transit service that involves frequent stops and consequent low average speeds, the purpose of which is to deliver and pick up transit passengers close to their destinations or origins. **2.** Transit operation in which all transit units (vehicles or trains) stop at all stations. **3.** Transit service in a city or its immediate vicinity, as distinguished from regional transit service or interurban lines.

service, local bus – a bus service that picks up and discharges passengers at frequent, designated places (stops) on city streets.

service, many-to-few – a service that picks up passengers at many different origins and delivers them to a few destinations.

service, many-to-many – a service that picks up passengers at many different origins and delivers

them to many different destinations within the service area.

service, many-to-one (gather service) – a service that collects passengers from many origins and delivers them to a specific point, for example, an office building, train station, or bus stop.

service, one-to-many (scatter service) – a service that picks up passengers at one point of origin and delivers them to many destinations.

service, origin-to-destination – service in which the passenger carrying vehicle will not stop along the way to pick up additional passengers.

service, owl – transit service provided late at night, usually from midnight to between 0300h and start of service the next day.

service, peak – service during peak periods.

service, point deviation – public transportation service in which the transit vehicle is required to arrive at designated transit stops in accordance with a prearranged schedule but is not given a specific route to follow between these stops. It allows the vehicle to provide curbside service for those who request it. See also *point-to-point deviation*.

service, public automobile – see *transportation system, public automobile service*.

service, radial – service that connects the CBD with outlying areas.

service, regional rail – alternate term for commuter rail, specific to East coast; see *transit system, commuter rail*.

service, regional transit – long bus or rail transit lines with few stations and high operating speeds. They primarily serve long trips within metropolitan regions, as distinguished from city transit service and local short-haul transit service.

service, research information – see *Railroad Research Information Service, Transportation Research Information Services, and Urban Mass Transportation Research Information Service*.

service, revenue – **1.** Transit service excluding deadheading or layovers. **2.** Any service scheduled for passenger trips.

service, route deviation – public transportation service on an exclusive basis that operates along a public way on a fixed route (but not a fixed schedule). The vehicle may deviate from the route occasionally in response to demand for service or to take a passenger to a destination, after which it returns to its route. It is a form of paratransit. See also *service, jitney*.

service, scatter – see *service, one-to-many*.

service, school bus – service designed to transport children to or from any regularly conducted public or private school or school-related activities, either on an exclusive or nonexclusive basis.

service, shoppers’ special – service provided during off-peak hours that is designed to carry passengers to or from shopping areas.

service, short-haul transit – low-speed transit service for circulation within small areas that usually have high travel density, such as central business districts, campuses, airports, exhibition grounds, and other major activity centers.

service, shuttle – **1.** Service provided by vehicles that travel back and forth over a particular route, especially a short one, or one that connects two transportation systems or centers, or one that acts as a feeder to a longer route. Shuttle services usually offer frequent service, often without a

published timetable. **2.** For rail and other guideway systems, a service in which a single vehicle or train operates on a short line, reversing direction at each terminal.

service, skip-stop – service in which alternate transit units (vehicles or trains) stop at alternate sets of stations on the same route. Each set consists of some joint and some alternate stations.

service, subscription bus – **1.** A bus service in which routes and schedules are prearranged to meet the travel needs of riders who sign up for the service in advance. The level of service is generally higher than that of regular passenger service (fewer stops, shorter travel time, and greater comfort), and the buses are usually obtained through charter or contractual arrangements. **2.** Commuter bus express service operated for a guaranteed number of patrons from a given area on a prepaid, reserved seat basis. Subscription buses are often arranged for and partly subsidized by an employer to serve a specific work location.

service, subscription van – service similar to that provided by a subscription bus, except that the van may be privately owned, leased from a public or private company, or provided by the employer. The driver is usually a member of the group.

service, subsidized taxi – a taxicab service in which the fares are lower than actual taxi fares and the taxi company is reimbursed the difference. The service may be provided to the general public or to special groups, such as elderly people. Funds for the subsidy can come from a variety of sources, including local taxes or social service agency program funds. Often an economical way to provide better off-peak service in low-density areas that cannot support fixed routes.

service, taxicab (exclusive ride taxi, taxi service) – demand responsive public transportation service on an exclusive basis, in a vehicle licensed to render that service; see also *shared ride* and *service, subsidized taxi*.

service application – see *braking, service*.

service area – see *area, service*.

service attributes – those aspects of a transportation system that affect travel decisions about its use, such as travel time, reliability, comfort (e.g., crowding, standees), cost, ease of use, and safety.

service brake – see *brake, service*.

service braking – see *braking, service*; and *braking, maximum service*.

service coverage – see *area, coverage*

service frequency – the number of transit units (vehicles or trains) on a given route or line, moving in the same direction, that pass a given point within a specified interval of time, usually 1 hr; see also *headway*.

service information – see *user information*.

service measure, transit – **1.** A quantitative performance measure that best describes a particular aspect of transit service and represents the passenger's point of view. **2.** A transit performance measure for which transit levels of service are defined, referred to in the *Highway Capacity Manual* as a *measure of effectiveness*.

service performance or quality – see definition of *level of service*.

service span – see *hours of service*.

service track miles (kilometers) – see *track miles, service*.

service volume – the maximum number of vehicles that can pass a given point during a specified period while a specified level of service is maintained.

share, market – see *market share*.

shared ride – a trip, other than by conventional public transit, on which the passengers enter at one or more points of origin and disembark at one or more destinations and for which each passenger is charged an individual fare. Shared ride taxi service is a way of using taxicabs for paratransit.

sharp, running – see *running hot*.

shedding, load – see *load shedding*.

shelter – see *transit shelter*.

shoe, brake – see *brake shoe*.

shoe, overhead contact – see *overhead contact shoe*.

shoe, third-rail – see *third-rail shoe*.

shoe, trolley – see *overhead contact shoe*.

shoofly – a temporary track to allow rail operations to bypass construction activities.

shop – see *workshop*.

shoppers' special service – see *service, shoppers' special*.

short-haul transit service – see *service, short-haul transit*.

short turn – see *turn back*.

shunt – in rail operations, to shift or switch, as a train car; also the railroad switch itself.

shunt motor – see *motor, shunt*.

shuttle-loop transit – see *transit system, shuttle-loop*.

shuttle service – see *service, shuttle*.

shuttle system – see *transit system, shuttle*.

side platform – see *platform, side*.

side track – see *siding*.

sidewalk, moving – see *moving walkway*.

siding (passing track, side track) – a track adjacent to a main or a secondary track, for meeting, passing, or storing cars or trains, see also *pocket track*.

sign, dash – see *dash sign*.

sign, destination – see *destination sign*.

sign, dot matrix – a type of destination, dash, side or rear sign consisting of electrically actuated dots that present either a matte black or bright (usually fluorescent yellow) face that make up individual letters or numbers. Early designs had very poor visibility and reliability but improvements, and the ability to display upper and lower case and double lines, have made the signs acceptable. Versions with back-lit liquid crystal displays or high intensity light emitting diodes introduced in late 1990s. Favored for the ease with which signs can be reprogrammed and buses transferred from garage to garage, but this flexibility is often abused by alternating cute messages, such as HAVE A GOOD DAY, that can confuse intending passengers.

sign, head – see *head sign*.

signal, automatic – a signal that is controlled automatically by certain conditions of the track section that it protects.

signal, automatic block – a system in which signals are actuated automatically by the presence

of a train on the track section, usually with an electric track circuit to detect the presence of any vehicle, and any broken rails.

signal, block – a fixed signal installed at the entrance of a block to govern trains entering and using that section of track.

signal, cab – see *control system, cab signal*.

signal, fixed – in rail operations, a signal at a fixed location that indicates a condition that affects the movement of a train.

signal, grade crossing protection – a railroad crossing flashing light signal or automatic gate actuated by the approach of a train at a grade crossing.

signal, wayside – in rail operations, a fixed signal that is located along the track right-of-way.

signal-actuating device – see *pedestrian signal-actuating device* and *vehicle signal-actuating device*.

signal aspect – **1.** The appearance of a fixed signal conveying an indication, as viewed from the direction of an approaching rail unit. **2.** The appearance of a cab signal conveying an indication, as viewed by an observer in the cab of a rail unit.

signal block – see *block*.

signal indication – the information conveyed by a signal.

signal preemption – in highway operations, an automatic or manual device for altering the normal signal phasing or the sequence of a traffic signal to provide preferential treatment for specific types of vehicles, such as buses or trains.

simple catenary – see *catenary system*.

single-unit car – see *car, single-unit*.

single-occupant vehicle (SOV) – see *vehicle, single-occupant*.

skip-stop service – see *service, skip-stop*.

sleeper – **1.** an inert passenger who remains on a transit vehicle at end of run, often inebriated. **2.** *British* for railroad tie, see *cross-tie*.

slow order – a location where trains must temporarily travel more slowly than maximum authorized track speed for that location.

slug – **1.** a commuter, who, lacking membership in a car pool, regularly waits at designated pick-up points, hoping to catch a ride in a car-pool vehicle with an unfilled seat. (particular to US East Coast). See also *carpool, casual*. **2.** persons who, for a fee, will ride in a car so as to increase the occupancy to allow the car to use an HOV lane.

small bus – see *bus, small*.

smart card – stored value ticket with built-in semi-conductor chip. The chip is loaded with monetary value which is decremented for each ride—in flat amounts or, with exit checks, for distance based fares. Early variants required insertion or contact with farebox or faregate and were time consuming. Most version in transit are proximity cards and require only to be held close to the farebox or faregate inductive detector plate.

soft suspension – see *pendulum suspension*.

space – in the context of transportation vehicle capacity, a space is a seat or the standing area for one passenger, typically a seat consumes 0.5 m² (5 ft²) of floor space and a standing passenger 0.25 m² (2.5 ft²).

space, defensible – see *defensible space*.

spacing – the distance between consecutive vehicles, measured front to front.

special trackwork – see *trackwork, special*.

special work – term for both special trackwork and junctions on overhead electric collection systems.

speed – see *velocity*.

speed, average – see *velocity, effective*.

speed, cruise – see *velocity, cruise*.

speed, cycle – see *speed, overall trip*.

speed, effective operating – see *speed, overall trip*.

speed, operating – vague term with different interpretations, see *speed, running*; and *speed, schedule*.

speed, overall trip (effective operating speed, cycle speed) – in transit operations, the average speed achieved per round trip, including layover and recovery time but excluding deadheading time. It is calculated by individual trips, by running time periods, or for the entire schedule.

speed, running – the highest safe speed at which a vehicle is normally operated on a given roadway or guideway under prevailing traffic and environmental conditions; in some areas, also known as *operating speed*, sometimes *civil speed*.

speed, schedule – the one-way distance between terminals divided by the scheduled travel time between the terminals; exclusive of layover or recovery time, in some areas, also known as *operating speed*.

speed-flow relationship – the relationship between the flow (volume) of units on a transportation facility and the speed of those units. As flow increases, speed tends to decrease.

speed limit, civil – see *civil speed limit*.

spill-back – a situation that may occur in on-street light rail transit operations when trains or motor vehicles fail to clear a signalized intersection and so prevent the following train from entering that block. Particularly acute in downtown streets where the light rail train can be the full length of the block.

split, directional – see *directional split*.

split, modal or mode – see *modal split*.

spot time – see *time, layover*.

standard gauge – see *gauge, standard*.

standard rail – see *rail, standard*.

standard urban bus – see *bus, standard urban*.

standees – the number of standing passengers on a transit vehicle.

standing capacity – see *capacity, standing*.

station – **1.** An off-street facility where passengers wait for, board, alight, or transfer between transit units (vehicles or trains). A station usually provides information and a waiting area and may have boarding and alighting platforms, ticket or farecard sales, fare collection, and other related facilities, also known as a *passenger station*. **2.** The location to which operating employees report and from which their work originates. **3.** In transportation planning, the location along a cordon line at which interviews are made. **4.** In railroad operations, a place designated in the timetable by name, at which a train may stop for traffic or to enter or leave the main track, or from which fixed signals are operated.

station, accessible – a public transportation passenger facility which provides ready access, is

usable, and does not have physical barriers that prohibit and/or restrict access by individuals with disabilities, including individuals who use wheelchairs.

station, all-stop – in transit systems with skip-stop schedule or express service, a station that is served by all scheduled transit units (vehicles or trains).

station, cornfield – a transit station provided in a relatively undeveloped area, to allow for low cost parking, or to allow the planned development of transit-oriented uses around the station.

station, off-line – a station at which a transit unit (vehicle or train) stops outside the main track or travel lane so that other units can pass while passengers board and alight, rare but found on a few automated guideway transit systems and busways.

station, on-line – a station in which transit units (vehicles or trains) stop on the main track or travel lane. This is the common design, and the term is used only to distinguish this station from off-line stations.

station, passenger – see *station*.

station accessibility – see *accessibility, station*.

station platform – see *platform, passenger*.

stinger – a portable cable to connect electric rail vehicles to traction power while in the workshop.

stock, rolling – see *fleet*.

stop, far-side – a transit stop located beyond an intersection. It requires that transit units (vehicles or trains) cross the intersection before stopping to serve passengers.

stop, midblock – a transit stop located at a point away from intersections.

stop, near-side – a transit stop located on the approach side of an intersection. The transit units (vehicles or trains) stop to serve passengers before crossing the intersection.

stop, off-line – see *station, off-line*.

stop, on-line – see *station, on-line*.

stop, terminal – a transit stop located at either end of a transit route or line.

stop, transit – an area where passengers wait for, board, alight, and transfer between transit units (vehicles or trains). It is usually indicated by distinctive signs and by curb or pavement markings and may provide service information, shelter, seating, or any combination of these. Stops are often designated by the mode offering service, for example, bus stop, car stop.

stopped time – see *time, stopped*.

stored value card – a magnetic striped or smart (electronic) farecard, purchased with a set monetary value, from which the cost of each trip is decremented, see also *fare collection system, automatic and smart card*.

street – see *highway, street, or road*.

street, bus-only – a street devoted to bus traffic only.

street, mixed mode – a street carrying mixed traffic, that is, having no exclusive transit lanes or priority lanes for transit.

street, transit – a street reserved for transit vehicles only.

streetcar – an electrically powered rail car that is operated singly or in short trains in mixed traffic on track in city streets. In some areas it is also

known as a *trolley car* and, primarily in Europe, as a *tram*.

streetcar, heritage – an old streetcar or streetcar built to resemble an older vehicle, electrically operated on rail tracks, generally in downtown areas, for local distribution and tourists. Not to be confused with rubber tired replica streetcars (see *bus, trolley replica*).

streetcar, low-floor – a streetcar with low floor for level boarding and exiting. Floor is typically 300 to 350 mm (12-14 in) high requiring a platform or raised curb at this height. Wheelchair access is provided directly or by a hinged or removable bridge plate.

streetcar, partial low-floor – a low floor streetcar with steps or ramps to access high-floor area(s) over trucks and/or any articulations. In this way conventional trucks and propulsion equipment can be used, sometimes termed *hybrid low-floor*.

streetcar operator – see *operator, train*.

streetcar, replica – see *bus, trolley replica*.

streetcar system – see *transit system, streetcar*.

street furniture – equipment placed on the street (off the vehicle lanes), such as lights, benches, signs, bus shelters, kiosks, and plants in containers.

street railway – early term for streetcar system. see *transit system, streetcar*.

street supervisor – see *inspector*.

strip, median – see *median*.

structure, aerial – see *aerial structure*.

structure, fare – see *fare structure*.

structure, route – see *route structure*.

stub terminal – see *terminal, stub*.

study, origin-destination – see *origin-destination study*.

subscription bus service – see *service, subscription bus*.

subscription van service – see *service, subscription van*.

subsidized taxi service – see *service, subsidized taxi*.

sub-station – see *electric sub-station*.

suburb – see definition of *area, urbanized*.

suburban coach or suburban transit bus – see *bus, suburban transit*.

subway – **1.** That portion of a transportation system that is constructed beneath the ground surface, regardless of its method of construction. **2.** An underground rail rapid transit system or the tunnel through which it runs. **3.** In local usage, sometimes used for the entire heavy rail or rapid transit system, even if it is not all beneath the ground surface.

subway car – see *car, rail rapid transit*.

superelevation, cant (British) – **1.** In track construction, the vertical distance that the outer rail is set above the inner rail on a curve, expressed as the vertical distance of the outer rail over the inner rail or as the transverse grade percent. Permits increased operating speed on curves, cannot exceed a maximum, typically 10%, to allow for trains that may stop or operate at below design speed on the curve. **2.** In highway construction, the banking of the roadway on a curve.

supervision, train – see *automatic train supervision*.

supervisor, road, route, or street – see *inspector*.

supported monorail – see *transit system, monorail*.

survey, travel – the collection of data that describe the social, economic, and travel characteristics of people who make trips by various modes of transportation.

suspended monorail – see *transit system, monorail*.

switch – **1.** The movable rails of a turnout that divert the wheels of passing rolling stock from one track to either one of two branching from it. **2.** To move rail cars from one place to another within a defined territory, such as an industry, a yard, or a terminal.

switch, track – see *turnout*.

switch throw and lock time – see *time, switch throw and lock*.

symmetrical monorail – see *transit system, monorail*.

synchronous motor – see *motor, synchronous*.

synfuel or synthetic fuel – see *fuel, synthetic*.

system – see *operator and property*.

system, automated highway – see *automated highway system*.

system, automatic train control – see *automatic train control system*.

system, automatic train stop – see *automatic train stop system*.

system, automatic vehicle location – see *automatic vehicle location system*.

system, bus priority – see *bus priority system*.

system, catenary – see *catenary system*.

system, command and control – see *command and control system*.

system, control – see *control system*.

system, fare collection – see *fare collection system*.

system, honor – see *fare collection system, self-service, barrier free*.

system, propulsion – see *propulsion system*.

system, transit – see *transit system*.

system, transportation – see *transportation system*.

system, trolley – see *transit system, streetcar*.

system effectiveness – system effectiveness is the probability that the system can successfully meet a proper operational demand within a prescribed acceptable time when operated under specified conditions.

system management, transportation – see *transportation system management*.

system performance – see definition of *level of service*.

system planning – in transportation, a procedure for developing an integrated means of providing adequate facilities for the movement of people and goods, involving regional analysis of transportation needs and the identification of transportation corridors involved.

system safety – the application of Operating, Technical and Management techniques and principles to the safety aspects of a system throughout its life to reduce hazards to the lowest level possible through the most effective use of available resources.

system safety engineering – the application of scientific and engineering principles during the design, development, manufacture and operation of a system to meet or exceed established safety goals.

T **TCRP** – Transit Cooperative Research Program.

TDM – Transportation Demand Management.

TEA-21 – Transportation Efficiency Act for the 21st Century. See *legislation, TEA-21*.

TRB – Transportation Research Board; see *organizations, Transportation Research Board*.

TRIS – Transportation Research Information Services.

TSM – transportation system management.

TTS – timed transfer system.

TVM – ticket vending machine.

TWU – Transport Workers Union; see *union, transit*.

target point – a continually advancing or fixed stopping point in a moving-block signaling system at which a train must always be able to stop under the most adverse conditions— including partial braking failure, see *control system, moving-block*.

taxicab – a passenger automobile or a specially designed vehicle driven by a professional driver in a for-hire taxi.

taxicab service – see *service, taxicab*.

taxi service, subsidized – see *service, subsidized taxi*.

terminal – **1.** The end station or stop on a transit line or route, regardless of whether special facilities exist for reversing the vehicle or handling passengers; also known as a *terminus*. **2.** An assemblage of facilities provided by a railroad or intercity bus service at a terminus or at an intermediate location for the handling of passengers and the receiving, classifying, assembling, and dispatching of trains or dispatching of buses; also known as a *depot*.

terminal, off-street – a transit terminal or turnaround point for transit vehicles that is located away from other vehicular traffic.

terminal, stub – a dead-end terminal in which the entering rail (or other guided) transit unit must depart by the same guideway on which it entered. Because no loop is provided, a bidirectional transit unit (vehicle or train) is necessary.

terminal layout sheet – see *sheet, terminal layout*.

terminal stop – see *stop, terminal*.

terminal time – see *time, terminal*.

terminus – see *terminal*.

territory, train control – see *train control territory*.

theoretical line capacity – see *capacity, theoretical line*.

third rail – see *rail, third*.

third-rail shoe – a graphite sliding contact attached to the trucks of electric rail vehicles for the purpose of collecting current from the third-rail distribution system, uses gravity or spring pressure.

throughput – **1.** The volume of vehicles passing or people transported past a point or series of points during a given period of time. **2.** Traffic.

through routing – the efficient practice of joining the ends of radial transit routes, with similar demand, to travel through downtown instead of having each route turn back in the downtown and return to its origin.

ticket – **1.** A printed card or piece of paper that gives a person a specific right to ride on a train or transit vehicle. **2.** To provide a ticket or tickets.

ticket, commutation – see *commutation ticket*.

tie – see *cross-tie*.

time, access – the time elapsed on a trip from the moment of leaving the point of origin (i.e. home or work) to the moment of boarding a vehicle.

time, clearance – all time losses at a stop other than passenger dwell times. It can be viewed as the minimum time between one transit vehicle leaving a stop and the following vehicle entering, including any delay associated with waiting for a sufficient gap in traffic to allow a transit vehicle to re-enter the travel lane.

time, deadhead (not-in-service time) – time spent moving a revenue vehicle in non-revenue service.

time, delay – the amount of time by which a transit unit (vehicle or train) in service is delayed from its scheduled time.

time, dwell – the time a transit unit (vehicle or train) spends at a station or stop, measured as the interval between its stopping and starting.

time, egress – the time elapsed on a trip from the moment of alighting from a vehicle to the moment of arriving at the point of destination.

time, excess – time delay associated with travel to or between major transit routes, for example, time spent walking, waiting, or transferring.

time, layover (recovery time, relay time, spot time, turnaround time) – time built into a schedule between arrivals and departures, used for the recovery of delays and preparation for the return trip. The term may refer to transit units (also known as *vehicle layover*) or operators. Note that layover time may include recovery time and operator rest time as two specific components.

time, linked trip (overall travel time, total travel time) – in transportation planning, the time duration of a linked trip, that is, from the point of origin to the final destination, including waiting and walking time at transfer points and trip ends.

time, not-in-service – see *time, deadhead*.

time, operating – the actual time required for a transit unit (vehicle or train) to move from one point to another, including making stops.

time, overall travel – see *time, linked trip*.

time, passenger flow, passenger service – the average time a single passenger takes to pass through a transit vehicle doorway when boarding or alighting, includes any fare collection time.

time, platform – **1.** The time a transit unit is in revenue service **2.** The period during which an operator is charged with the operation or care of a transit unit (vehicle or train), including operating time in revenue service and deadhead, layover, and other time that the unit may be in operation but not in passenger service. **3.** The time the operator is actually on the assigned transit unit; also known as *work time*.

time, recovery – see *time, layover*.

time, response – in demand-responsive operations, the time between a passenger's request for service and the passenger pickup.

time, running – the actual time required for a transit unit (vehicle or train) to move from one point to another, excluding time for stops.

time, stopped – time on a trip spent stationary because of the stoppage of other traffic.

time, switch throw and lock – the time required for the *points* of a rail switch to move from being lined for one direction of travel to being lined for the alternative direction of travel, including any time needed for the points to be safely locked into the new position.

time, terminal – **1.** For passengers, the time required at the ends of trips to park and pick up their private vehicles, including any necessary walking time. **2.** For rail vehicles, the time allowed at a terminal between arrival and departure for turning vehicles, recovering delays, and preparing for the return trip. **3.** The time required for a passenger to pass through a terminal when there is a change of mode.

time, total travel – see *time, linked trip*.

time, transfer – the time required to effect a change of mode or to transfer between routes or lines of the same mode. In transportation modeling this time is weighted—typically by a factor of 1.5.

time, trip – see *time, linked trip*; and *time, unlinked trip*.

time, turnaround – see *time, layover*.

time, unlinked trip – in planning, the time duration of an unlinked trip, that is, one made on a single vehicle.

time, wait – the time spent waiting for a transit vehicle.

time, weighted – a measure of travel time where certain components (e.g., wait time) are factored upward, see also *time, transfer*.

time, work – see *time, platform*.

timed connection or transfer – see *transfer, timed*.

timed transfer focal point – see *hub*.

timed transfer system – a transit network consisting of one or more nodes (transit centers) and routes or lines radiating from them. The system is designed so that transit vehicles on all or most of the routes or lines are scheduled to arrive at a transit center simultaneously and depart a few minutes later; thus transfers among all the routes and lines involve virtually no waiting. Typically used in suburban areas and for night service where headways are long. Transit centers (also known as *timed transfer focal points* or *hubs*) are ideally located at major activity centers, see also *hub*.

time-of-day fare – see *fare, time-of-day*.

time-of-day pricing – see *pricing, time-of-day*.

time point – a point on a line or route for which the time that transit units (vehicles or trains) are scheduled to pass is specified; usually, the leaving time is used.

timetable – **1.** Usually refers to a printed schedule for the public. **2.** A listing of the times at which transit units (vehicles or trains) are due at specified time points; also known as a *schedule*.

3. In railroad operations, the authority for the movement of regular trains subject to the rules. It

contains classified schedules with special instructions for the movement of trains and locomotives.

token – **1.** a prepaid, non-monetary stamped piece used in payment for transit service, usually one trip, usually metal, sometimes plastic, sometimes with punched-out center or bi-metal to deter forgery. **2.** an object allowing a train operator possession of a single track section of line, handed-off to a signalman or the operator of the opposing train.

total bus mile equivalents – the number of vehicle miles that would have been operated by a transit mode if the service had been provided by motor buses. Based on average seating plus standing capacity of the vehicle as compared to the capacity including standees (typically 70 people) of a standard-size motorbus.

total operating revenue – see *revenue, total operating*.

total travel distance – see *distance, linked trip*.

total travel time – see *time, linked trip*.

total vehicle capacity – see *capacity, vehicle*.

track – **1.** An assembly of rails, supporting ties, and fastenings over which rail vehicles travel. **2.** A linear cam or way that physically guides (and usually supports) any matching vehicle used for transportation. **3.** The width of a wheeled vehicle from wheel to wheel, usually measured between the outsides of the rims. **4.** The distance between the centers of the tread of parallel wheels, as of an automobile.

track, double – a section of rail-right-of way where two parallel tracks are provided (i.e., four running rails).

track, passing – see *siding*.

track, pocket – see *pocket track*.

track, side – see *siding*.

track brake – see *brake, track*.

track car – see *car, track*.

track circuit – an electrical circuit that makes use of both rails to detect train occupancy of the track and, in response, to actuate signals, train control devices, and grade crossing protective equipment.

track crossing – see *crossing, track*.

track gauge – see *gauge, track*.

trackless trolley– trolleybus, mainly East Coast usage, see *trolleybus*.

track miles (track kilometers) – the sum of the one-way linear miles (kilometers) of all trackage in a system, including all main track and trackage in yards, car barns, switches, and turnouts.

track miles, revenue (revenue track kilometers) – the number of miles (kilometers) of track used in passenger-carrying service.

track miles, service (service track kilometers) – the number of miles (kilometers) of track used exclusively in non-revenue service.

track special work – see *trackwork, special*.

track switch – see *turnout*.

track trip – a device that is located near the track and interconnected with the signal system so that it triggers the emergency brakes of any train that passes when the signal is red.

trackless trolley– trolleybus, mainly East Coast usage, see *trolleybus*.

trackwork – the rails, switches, frogs, crossings, fastenings, pads, ties, and ballast or track-support slab over which rail cars are operated.

trackwork, special (track special work) – all rails, track structures, and fittings, other than plain unguarded track, that is neither curved nor fabricated before laying.

traction – **1.** Colloquial term for all electric transit. **2.** Grip of wheel on rail or tire on road.

traction motor – see *motor, traction*.

traction interlock, traction safety interlock – in rail transit, a series circuit of electrical switches at each door that prohibit a train from starting unless all passenger doors are closed and locked.

traction pole – pole, mast or standard supporting electric overhead for streetcars and trolleybuses, sometimes other electric traction modes.

traction sub-station – see *electric sub-station*.

tractive effort (tractive force) – the force exerted by a locomotive or other powered vehicle on its driving wheels. It is equal to the weight on the driving wheels times the coefficient of adhesion.

trade union – see *union*.

traffic, annual average daily (AADT) – daily traffic that is averaged over a calendar or fiscal year.

traffic, annual average weekday (AAWDT) – daily traffic that is averaged over a calendar or fiscal year and that includes only weekdays (Mondays through Fridays). It may also exclude holidays.

traffic, average daily (ADT) – the average number of vehicles that pass a specified point during a 24-hr period.

traffic, mixed (mixed flow traffic) – traffic that contains different vehicle categories or different modes.

traffic, passenger – see *passenger flow*.

traffic assignment – see *trip assignment*.

traffic checker – see *checker*.

traffic control device, grade crossing – see *grade crossing traffic control device*.

traffic control system, centralized – see *control system, centralized traffic*.

traffic count – a record of the number of vehicles, people aboard vehicles, or both, that pass a given checkpoint during a given time period. It may be classified by type of vehicle. See also *count*.

traffic operations, mixed – see *mixed traffic operations*.

trailer car – see *car, trailer*.

train – **1.** Two or more transit vehicles physically connected and operated as a unit; see also *transit unit*. **2.** One or more locomotives or self-propelled rail cars, with or without other cars but with marker lights.

train, bad order – a train that is in need of repair.

train, local – a train that stops at every station on the line; see also *service, local*.

train, push-pull – a locomotive and a set of cars equipped with one or more cab cars from which the locomotive can be controlled. The train is either pulled and controlled from the locomotive in the conventional manner or pushed by the locomotive and controlled from the leading car.

train berth – in rail operations, the space designated for a train of given length to occupy when it is stopped at a station platform, in a terminal, on a transfer track, or at some other designated place.

train control – see *automatic train control system*.

train control system, manual – see *control system, manual train*.

train control territory – the portion of a railroad division or district that is equipped with an automatic train control system.

train density – **1.** The number of trains that can be operated safely over a segment of railroad in each direction during a 24-hr period. **2.** The average number of trains that pass over a specified section of railroad in a specified period. In rail transit usually in trains per hour.

trainlined brake – see *brake, continuous*.

train operation – the way in which a train is operated, for example, automatic with automatic overspeed control, or manual with either automatic or manual speed control, or skip-stop.

train operation, automatic – see *automatic train operation*.

train operator – see *operator, train*.

train protection, automatic – see *automatic train protection*.

train stop system, automatic – see *automatic train stop system*.

train supervision, automatic – see *automatic train supervision*.

tram – see *streetcar*.

tramway – see *transit system, streetcar*.

tramway, aerial – see *aerial tramway*.

transfer – **1.** A passenger's change from one transit unit (vehicle or train) or mode to another transit unit or mode. **2.** A slip of paper, card, or other instrument issued to passengers (either free or with a transfer fee) that gives the right to change from one transit unit or mode to another according to certain rules that may limit the direction of travel or the time in which the change may be made.

transfer, free – a transfer that requires no additional payment.

transfer, paid – a transfer that requires an additional payment (*transfer fee*), either at the time of purchase or at the time of boarding another transit unit (vehicle or train).

transfer, paid area – a transfer in a controlled area, within which all patrons will have paid a fare, that allows boarding of transit units (vehicles or trains) through all doors, without fare inspection—most notably in Toronto.

transfer, timed – **1.** A transfer that is valid only for a specified time. **2.** The scheduling of intersecting transit routes so that they are due to arrive at a transfer point simultaneously, eliminating waiting time for transfer passengers; also known as a *timed connection*. See also *timed transfer system*.

transfer center – see *transit center*.

transfer facility, intermodal – see *transit center*.

transfer fee – see definition of *transfer, paid*.

transfer passenger – see *passenger, transfer*.

transfer surcharge – see *transfer, paid*.

transfer time – see *time, transfer*.

transit, mass or public – see *public transit*.

transit accessibility – see *accessibility, transit*.

transit agency or authority – see *transit district*.

transit bus – see *bus, standard urban*; and *bus, suburban transit*.

transit car – see *car, rail rapid transit*.

transit center – a transit stop or station at the meeting point of several routes or lines or of different modes of transportation. It is located on or off the street and is designed to handle the movement of transit units (vehicles or trains) and the boarding, alighting, and transferring of passengers between routes or lines (in which case it is also known as a *transfer center*) or different modes (also known as a *modal interchange center, intermodal transfer facility* or an *hub*).

Transit Cooperative Research Program – a major transit research program provided for in the Intermodal Surface Transportation Efficiency Act of 1991 and established by the Federal Transit Administration in 1992. The program is administered by the Transportation Research Board on behalf of the Federal Transit Administration and the American Public Transit Association. The program emphasizes the distribution of research information for practical use.

transit dependent – having to rely on transit services instead of the private automobile to meet one's travel needs; see also *rider, captive; rider, captive transit*; and *transportation disadvantaged*.

transit district – a geographical or political division created specifically for the single purpose of providing transportation services. It is a separate legal entity and usually possesses the authority to impose a property tax. Transit agencies can directly operate transit service or contract out for all or part of the total transit service provided. Such political divisions may also be known as a *transit agency* or *transit authority*; see also *property*.

transit facilities, exclusive – see *exclusive transit facilities*.

transit lane, exclusive or reserved – see *lane, exclusive transit*.

transit mall – see *street, transit*.

transit mode – see *mode, transit*.

transit performance measure – a quantitative or qualitative factor used to evaluate a particular aspect of transit service.

transit priority measures – a blanket term for measures such as *busways, queue jumpers, signal preemption*, etc. that give transit vehicles priority over other road users.

transit service measure – a quantitative performance measure that best describes a particular aspect of transit service and represents the passenger's point of view.

transit shelter – a building or other structure constructed at a transit stop. It may be designated by the mode offering service, for example, *bus shelter*. A transit shelter provides protection from the weather and may provide seating or schedule information or both for the convenience of waiting passengers.

transit stop – see *stop, transit*.

transit street – see *street, transit*.

transit-supportive area – see *area, transit-supportive*.

transit system – the facilities, equipment, personnel, and procedures needed to provide and maintain public transit service.

transit system, accessible – a transit system that can transport any mobile person, including those who are physically disabled, and in which the vehicles and stops or stations are designed to accommodate patrons who are confined to wheelchairs.

transit system, automated guideway (automated guided transit, AGT) – A transportation system in which automated, driverless vehicles operate on fixed guideways with exclusive right-of-way.

transit system, bus rapid – an inexact term describing a bus operation that is generally characterized by operation on an exclusive or reserved right-of-way that permits higher speeds. It may include reverse lane operations on limited access roads.

transit system, commuter rail – The portion of passenger railroad operations that carries passengers within urban areas, or between urban areas and their suburbs, but differs from rail rapid transit in that the passenger cars generally are heavier, the average trip lengths are usually longer, and the operations are carried out over tracks that are part of the railroad system in the area. In some areas it is called *regional rail*.

transit system, dual-mode – a broad category of systems wherein vehicles may be operated in both of two different types of operation or propulsion, for example, manually steered and guided, on highways and on guideways, or with diesel and electric traction.

transit system, fixed guideway – 1. A transportation system composed of vehicles that can operate only on their own guideways, which were constructed for that purpose. Examples are heavy rail, light rail, and monorail. 2. Federal usage of the term in funding legislation also includes bus priority lanes, exclusive right-of-way bus operations, trolley coaches, and ferryboats as fixed guideway transit.

transit system, group rapid (GRT) – an automated guideway transit system that uses medium-sized vehicles operating automatically as single units or coupled trains on exclusive rights-of-way with special guideways. The vehicles are usually rubber tired and electrically propelled. The systems are sometimes referred to as *people mover systems* but preferred term is *automated guideway transit*.

transit system, heavy rail – see *transit system, rail rapid*.

transit system, interurban – electric rail transit service between cities and towns. Once common in North America, now rare with the Chicago, South Shore & South Bend the only remaining system.

transit system, light rail (LRT) – as defined by the TRB Subcommittee on Light Rail Transit, “a metropolitan electric railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways, or occasionally, in streets, and to board and discharge passengers at track or car floor level.”

transit system, light rail, dual-mode – light rail transit with operation extended over railroad trackage that is shared with other trains. First examples in Karlsruhe and Saarbrücken, Germany

with cars equipped to operate at 750 volts DC and 15,000 volts AC.

transit system, light rail rapid – A Buffalo-only designation referring to a subway system with light rail type equipment and operation on a downtown mall.

transit system, major activity center (MAC system) – a transit system that provides service for short trips within small, densely populated major activity centers, such as shopping centers and downtown areas.

transit system, monorail – a transit system consisting of vehicles supported and guided by a single guideway (rail or beam), usually elevated. The basic types are *supported or straddle*, in which vehicles straddle the guideway or are laterally supported by it; and *suspended*, in which vehicles hang directly below the guideway (*symmetrical monorail*) or to one side of it (*asymmetrical monorail*).

transit system, personal rapid (PRT) – a theoretical concept for an automated guideway transit system that would operate small units (two to six passengers) under computer control over an elaborate system of guideways. Off-line stations would provide demand-responsive service (except, perhaps, during peak periods) with very short headways with travel between origin and destination stations without stopping. Only system with some of these features is in Morgantown, West Virginia.

transit system, pre-metro – a light rail transit system designed with provisions for easy conversion to heavy rail, (rail rapid transit).

transit system, publicly owned – a transit system owned by any municipality, county, regional authority, state, or other governmental agency, including a system operated or managed by a private company under contract to the government agency owner.

transit system, rail – any of the family of transit modes with rail technology, see adjacent listings.

transit system, heavy rail, rail rapid transit, rapid rail transit, – a transit system using trains of high-performance, electrically powered rail cars operating in exclusive rights-of-way, usually without grade crossings, with high platform stations. The tracks may be in underground tunnels, on elevated structures, in open cuts, at surface level, or any combination thereof. Some local terms used are *elevated, the el, the “L”, the rapid, the subway, metro, (for metropolitan railway), underground (British) U-Bahn, (Untergrundbahn) and Stadtbahn (German)*. (Note that Stadtbahn is distinct from S-bahn which is generally a commuter rail type operation.)

transit system, rapid – transit service which is operated completely separate from all other modes of transportation. The term “rail rapid transit” frequently refers both to operation of light rail transit vehicles over exclusive right-of-way and heavy rail transit vehicles; the term “bus rapid transit” refers to operation of motor buses over exclusive bus roads or busways.

transit system, semi-metro – a light rail transit system that uses exclusive right-of-way for much of its length, usually at surface grade but occasionally in tunnels or on aerial structures. Also similar to *transit system, pre-metro*—built for later conversion to heavy rail. Particular to several European countries and now little used.

transit system, shuttle – a transit system that is characterized by a back-and-forth operation, usually over a short distance.

transit system, streetcar (street railway, tramway, trolley) – a street transit system consisting of electrically powered rail vehicles operating in single or multiple-unit, mostly on surface streets with mixed traffic.

transit system availability – a measure of the capability of a transit system to be used by potential passengers, including such factors as the hours the system is in operation, route spacing, and accessibility to the physically handicapped.

transit union – see *union, transit*.

transit unit – one or more transit vehicles coupled and operated together. The term includes single vehicles (bus, rail, or other guideway) and multicar trains (rail or other guideway).

transit unit, bidirectional or double-ended – see *double-ended transit unit*.

transitway – a dedicated right-of-way, most commonly in a mall, that is used by transit units (vehicles or trains), usually mixed with pedestrian traffic. Locally used (Ottawa) term for *busway*.

transmission based control system – see *control system, moving block*.

transport, conventional rail – see *conventional rail transport*.

Transport Workers Union – see *union, transit*.

transportation, department of – see *organizations, department of transportation*; and *U.S. Government, Department of Transportation*.

transportation, elderly and handicapped – see definition of *elderly and handicapped*.

transportation, intercity – see *intercity transportation*.

transportation, mass – see *mass transportation*.

transportation, private – see *private transportation*.

transportation, public – see *public transportation*.

transportation, purchased – see *purchased transportation*.

transportation, urban public – see *urban public transportation*.

transportation demand management (TDM) – the concept of managing or reducing travel demand rather than increasing the supply of transportation facilities. It may include programs to shift demand from single-occupant vehicles to other modes such as transit and ridesharing, to shift demand to off-peak periods, or to eliminate demand for some trips.

transportation disadvantaged (low-mobility group) – people whose range of transportation alternatives is limited, especially in the availability of relatively easy-to-use and inexpensive alternatives for trip making. Examples include the young, the elderly, the poor, the handicapped, and those who do not have automobiles. See also *transit dependent*; *rider, captive*; and *rider, captive transit*.

transportation facilities – see *accessible transportation facilities*.

transportation handicapped – see *handicapped*.

transportation improvements, low-capital – see *low-capital transportation improvements*.

transportation interface – the point or facility at which two or more modes of transportation meet

or at which two or more transit system routes or lines meet.

transportation modeling system, urban – see *urban transportation modeling system*.

transportation planning process, urban – see *urban transportation planning process*.

Transportation Research Board – see *organizations, Transportation Research Board*.

Transportation Research Information Services (TRIS) – a national network of transportation research information services developed by the Transportation Research Board. TRIS consists of the Air Transport Information Service, Highway Research Information Service, Maritime Research Information Service, Railroad Research Information Service, and Urban Mass Transportation Research Information Service.

Transportation Study, Nationwide Personal – see *Nationwide Personal Transportation Study*.

transportation system – 1. A system that provides for the movement of people, goods, or both. 2. A coordinated system made up of one or several modes serving a common purpose, the movement of people, goods, or both.

transportation system, demand-actuated – see *transportation system, demand responsive*.

transportation system, demand-responsive (demand-actuated transportation system, demand response transportation system) – passenger cars, vans or buses with fewer than 25 seats operating in response to calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick up the passengers and transport them to their destinations. A demand response operation is characterized by the following: (a) The vehicles do not operate over a fixed route or on a fixed schedule except, perhaps, on a temporary basis to satisfy a special need; and (b) typically, the vehicle may be dispatched to pick up several passengers at different pick-up points before taking them to their respective destinations and may even be interrupted en route to these destinations to pick up other passengers. The following types of operations fall under the above definitions provided they are not on a scheduled fixed route basis: Many origins-many destinations, many origins-one destination, one origin-many destinations, and one origin-one destination.

transportation system, dial-a-ride – a demand-responsive system in which curb-to-curb transportation is provided to patrons who request service by telephone, either on an ad hoc or subscription basis. It is also known as dial-a-bus when buses are the vehicles used.

transportation system, fixed route – service provided on a repetitive, fixed-schedule basis along a specific route with vehicles stopping to pick up and deliver passengers to specific locations; each fixed-route trip serves the same origins and destinations, unlike demand response. Includes route deviation service, where revenue vehicles deviate from fixed routes on a discretionary basis.

transportation system, jitney – public transportation rendered in small or medium-sized vehicles that are licensed to render that service at a fixed rate or fare for each passenger. The vehicles operate on fixed routes along public ways, from which they may deviate from time to time in response to a demand for service or to

take passengers to their destinations, thereafter returning to the fixed route. The scheduling and organization of this type of system vary among jurisdictions. It is used extensively in cities of developing countries that have inadequate transit service. See also *service, jitney*.

transportation system, non-fixed route – service not provided on a repetitive, fixed-schedule basis along a specific route to specific locations. Demand response is the only non-fixed-route mode.

transportation system, urban – the system of transportation elements (both private and public) that provides for the movement of people and goods in an urban area. The components include transit systems, paratransit services, and highway or road systems, including private vehicles and pedestrians.

transportation system management (TSM) – that part of the urban transportation planning process undertaken to improve the efficiency of the existing transportation system. The intent is to make better use of the existing transportation system by using short-term, low-capital transportation improvements that generally cost less and can be implemented more quickly than system development actions.

trap – in railway cars, a manually raised and lowered floor section that covers the steps at the ends of the car. When raised, the trap allows passengers to use the car steps at stations without high platforms. When lowered, the trap provides nearly level boarding at high platform stations, and keeps passengers out of the step area when the train is in motion.

travel distance – see *trip distance, linked*.

travel survey – see *survey, travel*.

travel time, overall or total – see *time, linked trip*.

travel time factor – an empirically determined set of factors in which each factor expresses the effect of one particular travel time increment of trip interchanges between zones.

travel time ratio – the ratio that compares travel times between a pair of points via two different modes or facility types.

treatment, preferential – see *preferential treatment*.

trip – **1.** A one-way movement of a person or vehicle between two points for a specific purpose; sometimes called a *one-way trip* to distinguish it from a round trip. **2.** In rail operations, a mechanical lever or block signal that, when in the upright position, activates a train's emergency braking system. **3.** The movement of a transit unit (vehicle or train) in one direction from the beginning of a route to the end of it; also known as a *run*.

trip, inbound – a trip toward the central urban area, into the central business district, or to a timed transfer point or major activity center.

trip, linked (linked journey, linked passenger trip) – a trip from the point of origin to the final destination, regardless of the number of modes or vehicles used.

trip, non-home-based – a trip that has neither its origin nor its destination at a residence.

trip, one-way – see *trip*.

trip, outbound – a trip away from the central urban area, out of the central business district, or

away from a timed transfer point or major activity center.

trip, passenger – one passenger making a one-way trip from origin to destination.

trip, person – a trip made by a person by any mode or combination of modes for any purpose.

trip, round – the movement of a person or a vehicle from a point of origin to a destination and then back to the same point of origin.

trip, track – see *track trip*.

trip, unlinked – **1.** A trip made in a single vehicle. **2.** The boarding of one transit vehicle in revenue service; also known as an *unlinked passenger trip*. **3.** Any segment of a linked trip.

trip, vehicle – the one-way movement of a vehicle between two points.

trip arm – see *track trip*.

trip assignment (flow distribution, traffic assignment) – in planning, a process by which trips, described by mode, purpose, origin, destination, and time of day, are allocated among the paths or routes in a network by one of a number of models; see also *urban transportation modeling system*.

trip distance, linked (total travel distance) – the distance traveled on a linked trip, that is, the distance from the point of origin to the final destination, including the walking distance at trip ends and at transfer points.

trip distance, unlinked – the distance traveled on an unlinked trip, for example, a trip on a single vehicle.

trip distribution – in planning, the process of estimating movement of trips between zones by using surveys or models; see also *urban transportation modeling system* and *model, sequential*.

trip end – a trip origin or a trip destination.

trip generation – in planning, the determination or prediction of the number of trips produced by and attracted to each zone; see also *urban transportation modeling system* and *model, sequential*.

trip generator – a land use from which trips are produced, such as a dwelling unit, a store, a factory, or an office.

tripper – **1.** In transit operations, a short piece of work that cannot be incorporated into a full day's run, usually scheduled during peak hours. **2.** In transit operations, a short work schedule for operators, usually 1-3 hr long; for example, during peak periods. **3.** On some transit properties, a short run that is less than 8 hr long. **4.** On some transit properties, a transit service that operates on only a portion of a route, usually at peak hours.

trip productions – in planning, the number of trips, daily or for a specified time interval, that are produced from and return to a given zone, generally the zone of residence. Trip productions can also be defined as the home end of home-based trips or the origin of non-home-based trips.

trip purpose – the primary reason for making a trip, for example, work, shopping, medical appointment, recreation.

trip time – see *time, linked trip*; and *time, unlinked trip*.

trolley – **1.** An apparatus, such as a grooved wheel or shoe, at the end of a pole, used for collecting electric current from an overhead wire

and transmitting it to a motor of a streetcar, trolleybus, or similar vehicle, where it is used for traction and other purposes. **2.** colloquial term for streetcar, and in some cities, trolleybus and/or replica streetcar (see *bus, trolley replica*).

trolley bus – alternate spelling for *trolleybus*, the single word is recommended.

trolleybus (electric trolleybus, trolley coach, trackless trolley) – an electrically propelled bus that obtains power via two trolley poles from a dual (positive and negative) overhead wire system along routes. It may be able to travel a limited distance using battery power or an auxiliary internal combustion engine. The power-collecting apparatus is designed to allow the bus to maneuver in mixed traffic over several lanes.

trolleybus, articulated – see *articulated bus or articulated trolleybus*.

trolley car – see *car, trolley*.

trolley coach – see *trolleybus*.

trolley pole – **1.** A swiveling spring-loaded pole attached on the roof of a trolleybus or streetcar that holds a wheel or sliding shoe in contact with the overhead conductor (which usually takes the form of a thick wire), collects current from it, and transmits the current to the motor on the vehicle, for example, a streetcar or trolleybus. **2.** Inexact reference to traction pole or mast support trolleybus or streetcar overhead contact wiring.

trolley replica bus – see *bus, trolley replica*.

trolley shoe – see *overhead contact shoe*.

trolley system – see *transit system, streetcar*.

trolley wire – see *contact wire*.

truck (bogie, British usage) – in rail transportation, a rail vehicle component that consists of a frame, normally two axles, brakes, suspension, and other parts, which supports the vehicle body and can swivel under it on curves. A truck usually also contains traction motors.

turbine engine – see *engine, turbine*.

turn, short – see *turn back*.

turnaround time – see *time, layover*.

turn back – **1.** In transit operations, to cut short a transit trip (to turn back before reaching the end of the route or line), usually to get back on schedule or to meet peak passenger demands; also known as a *short turn*. **2.** In rail operations, a point along a track at which a train may reverse direction.

turnout – **1.** In rail transportation, the assembly of a switch and a frog with closure rails by which rolling stock or trains can travel from a track onto either one of two diverging tracks; also known as a *track switch*. **2.** A short side track or passage that enables trains, automobiles, and similar vehicles to pass one another. **3.** A short passing lane on a highway.

turnout, bus – see *bus bay*.

turnover, parking – see *parking turnover*.

turnover point – a point along a transit route at which a large proportion of passengers leave and board a transit unit.

turnstile – a mechanical device used to control and/or measure pedestrian entry or exit from an area. It uses a bar that rotates out of the way when a pedestrian presses against it. When used as a faregate, the bars unlock only after the correct fare has been paid.

turnstile, fare-registering – see *fare-registering faregate*.

turntable – a circular, rotating mechanical device that allows a rail car to be turned in place to change its direction of travel. It may be motorized, or as in the case of San Francisco's cable cars, require operators to physically push the car to turn it around.

U

UA – urbanized area; see *area, urbanized*.

UITP – see *organizations, International Union of Public Transport*.

UMTA – Urban Mass Transportation Administration; previous name for FTA, see *U.S. Government, Federal Transit Administration*.

UMTRIS – Urban Mass Transportation Research Information Service.

U.S. DOT – U.S. Department of Transportation; see *U.S. Government, Department of Transportation*.

UTU – United Transportation Union; see *union, transit*.

UZA – used by some to indicate an urbanized area, although the Bureau of the Census uses UA; see *area, urbanized*.

underground – see *transit system, rail rapid*.

unidirectional car – see *car, unidirectional*.

uninterrupted flow – transit vehicles moving along a roadway or track without stopping. This term is most applicable to transit service on freeways or on its own right-of-way.

union, transit – one of the many unions representing various segments of the transit industry's work force. Three major ones in the United States and Canada are the *Amalgamated Transit Union (ATU)*, the *Transport Workers Union (TWU)*, and the *United Transportation Union (UTU)*. Their membership is limited to operators, mechanics, and other non-supervisory employees. A non-affiliated *Independent Canadian Transit Union* has raided older unions and represents some transit systems in Canada, the largest being BC Transit.

unit, basic operating – see *basic operating unit*.

unit, transit – see *transit unit*.

United States Government – see *U.S. Government*.

United Transportation Union – see *union, transit*.

unlimited access – see *access, unlimited*.

unlinked passenger trip – see *trip, unlinked*.

unlinked trip – see *trip, unlinked*.

unlinked trip distance – see *trip distance, unlinked*.

unlinked trip time – see *time, unlinked trip*.

urban ferryboat – see *ferryboat, urban*.

urban fringe – that part of an urbanized area outside the central city or cities.

Urban Mass Transportation Act – see *legislation, Urban Mass Transportation Act of 1964*.

Urban Mass Transportation Administration – see *U.S. Government, Federal Transit Administration*.

Urban Mass Transportation Research Information Service (UMTRIS) – a computer-based information storage and retrieval system developed by the Transportation Research Board

under contract to the Federal Transit Administration. It consists of summaries of research projects in progress and abstracts of published works.

urban place – A U.S. Bureau of the Census-designated area (less than 50,000 population) consisting of closely settled territory not populous enough to form an urbanized area.

urban public transportation – transportation systems for intraurban or intraregional travel, available for use by any person who pays the established fare. It consists of transit and paratransit.

urban rail car – see *car, urban rail*.

urban transit bus – see *bus, standard urban*.

urban transportation system – see *transportation system, urban*.

urbanized area – see *area, urbanized*.

U.S. Department of Transportation – see *U.S. Government, Department of Transportation*.

user information (service information) – information on fares, stopping places, schedules, and other aspects of service essential to the efficient use of public transit. The term also refers to devices employed to convey such information, including bus stop signs, timetable brochures or books, telephone inquiries, and computerized user-interactive systems.

U.S. Government, Amtrak – see *U.S. Government, National Railroad Passenger Corporation*.

U.S. Government, Department of Energy (DOE) – a cabinet-level federal agency whose responsibilities include improving the energy efficiency of transportation.

U.S. Government, Department of Health, Education, and Welfare (HEW) – a cabinet-level federal agency that provides funds for many specialized transportation services in urbanized and rural areas as part of its social service programs.

U.S. Government, Department of Transportation (DOT) – a cabinet-level federal agency responsible for the planning, safety, and system and technology development of national transportation, including highways, mass transit, aircraft, and ports.

U.S. Government, Federal Highway Administration (FHWA) – a component of the U.S. Department of Transportation, established to ensure development of an effective national road and highway transportation system. It assists states in constructing highways and roads and provides financial aid at the local level, including joint administration with the Federal Transit Administration of the 49 USC Section 5311 (formerly Section 18 of the Federal Transit Act) program.

U.S. Government, Federal Railroad Administration (FRA) – an agency of the United States government, established in 1966 as part of the U.S. Department of Transportation. It coordinates government activities that are related to the railroad industry.

U.S. Government, Federal Transit Administration (FTA) – a component of the U.S. Department of Transportation, delegated by the Secretary of Transportation to administer the federal transit program under Chapter 53 of Title 49, United States Code and various other statutes.

Formerly known as the Urban Mass Transportation Administration.

U.S. Government, National Railroad Passenger Corporation (Amtrak) – an agency created by Congress in 1970 to operate the national railroad passenger system. It also operates commuter rail service under contract, usually to metropolitan transit agencies.

U.S. Government, National Transportation Safety Board (NTSB) – an independent agency of the federal government whose responsibilities include investigating transportation accidents and conducting studies, and making recommendations on transportation safety measures and practices to government agencies, the transportation industry, and others.

U.S. Government, Urban Mass Transportation Administration (UMTA) – former name of the Federal Transit Administration; see *U.S. Government, Federal Transit Administration*.

utilization coefficient – see *load factor*.

V

VKT – vehicle kilometers of travel; see *vehicle miles of travel*.

VMT – vehicle miles of travel.

validation – the marking of a ticket, pass, or transfer for the purpose of verifying its legitimate use for paid travel, usually giving time and place of marking.

validator (cancellor) – component of ticket vending machine or separate machine that stamps date, time and sometimes location on pre-purchased ticket or pass to validate or cancel same.

value, default – see *default value*.

van – vehicles having a typical seating capacity of 5 to 15 passengers and classified as a van by vehicle manufacturers. A modified van is a standard van which has undergone some structural changes, usually made to increase its size and particularly its height. The seating capacity of modified vans is approximately 9 to 18 passengers.

van, subscription – see *service, subscription van*.

vanpool – vans and/or buses seating less than 25 persons operating as a voluntary commuter ride sharing arrangement, which provides transportation to a group of individuals traveling directly between their homes and their regular places of work within the same geographical area. The vans should have a seating capacity greater than seven persons, including the driver. It is a mass transit service operated by a public entity, or in which a public entity owns, purchases, or leases the vehicles. Other forms of public participation to encourage ridesharing arrangements such as the provision of parking spaces, utilization of high occupancy vehicle (HOV) lanes, coordination or clearing house service, do not necessarily qualify as public vanpools.

vehicle, accessible – public transportation revenue vehicles which do not restrict access, are usable, and provide allocated space and/or priority seating for individuals who use wheelchairs.

vehicle, active – the vehicles that are available to operate in revenue service, including vehicles

temporarily out of service for routine maintenance and minor repairs.

vehicle, articulated rail – see *articulated rail vehicle*.

vehicle, dual-mode – a vehicle that operates both manually on public streets and automatically on an automated guideway. May also be used to describe vehicles with more than one source of power; for example, a bus that can be propelled by a diesel engine or an electric motor.

vehicle, high-occupancy (HOV) – any passenger vehicle that meets or exceeds a certain predetermined minimum number of passengers, for example, more than two or three people per automobile. Buses, carpools, and vanpools are HOV vehicles.

vehicle, light rail – see *car, light rail*.

vehicle, public service – a vehicle used for public passenger transport.

vehicle, revenue – a vehicle used to provide passenger transit service for which remuneration is normally required. It is distinct from non-revenue equipment, which is used to build or maintain facilities, provide supervision, and so on.

vehicle, single-occupant (SOV) – a vehicle occupied by the driver only.

vehicle capacity – see *capacity, vehicle*.

vehicle hours – The hours a vehicle travels while in revenue service (vehicle revenue hours) plus deadhead hours. For rail vehicles, vehicle hours refer to passenger car hours. Vehicle hours exclude hours for charter services, school bus service, operator training and maintenance testing.

vehicle layover – see *time, layover*.

vehicle location system – see *automatic vehicle location system*.

vehicle miles (or kilometers) – the miles a vehicle travels while in revenue service (vehicle revenue miles plus deadhead miles). For rail vehicles, vehicle miles refer to passenger car miles. Vehicle miles exclude miles for charter services, school bus service, operator training and maintenance testing.

vehicle miles, revenue – see *revenue vehicle miles*.

vehicle miles of travel (VMT; vehicle kilometers of travel, VKT) – **1.** On highways, a measurement of the total miles (kilometers) traveled by all vehicles in the area for a specified time period. It is calculated by the number of vehicles times the miles (kilometers) traveled in a given area or on a given highway during the time period. **2.** In transit, the number of vehicle miles (kilometers) operated on a given route or line or network during a specified time period.

vehicle occupancy – the number of people aboard a vehicle at a given time; also known as *auto or automobile occupancy* when the reference is to automobile travel only.

vehicle signal-actuating device – a device to control traffic signals that is activated by vehicles.

vehicle trip – see *trip, vehicle*.

velocity (speed) – the distance passed per unit of time, or the rate of change in location relative to time. For transportation vehicles, it is usually measured in miles (kilometers) per hour.

velocity, cruise (cruise speed) – the forward velocity that a vehicle maintains when it is neither

accelerating nor decelerating. It is usually less than maximum design speed but can be equal to it.

velocity, effective (average speed) – **1.** The average velocity at which a vehicle travels. For transit vehicles, it includes dwell times at stops or stations, acceleration, and deceleration. **2.** Vehicle miles divided by vehicle hours.

velocity, maximum theoretical – the highest theoretical velocity that a vehicle is physically capable of achieving, usually specified on level, tangent road or track with full service load.

viaduct – mainly British and European, see *aerial structure*.

voltage, high – in rail transportation, the prime propulsion power voltage supplied by an overhead wire or third rail, usually 550-650, 750, 1,000, 1,500 and 3,000 volts DC; and 11,000, 15,000, and 25,000 volts AC.

voltage, low – in rail transportation, the voltage used for most auxiliary systems (e.g., illumination, fans, public address systems), usually 24 or 72 V direct current or 110-240 V alternating current.

volume – in transportation, the number of units (passengers or vehicles) that pass a point on a transportation facility during a specified interval of time, usually 1 hr; see also *flow rate*.

volume, design hourly – see *design hourly volume*.

volume, line – see *passenger volume*.

volume, link – see *link volume*.

volume, passenger – see *passenger volume*.

volume, service – see *service volume*.

W

wait time – see *time, wait*.

walkway, moving – see *moving walkway*.

way, bicycle – see *bicycle route*.

way, public – see *public way*.

wayside – along the right-of-way, usually of rail system.

wayside control system – see *control system, wayside*.

wayside lift – see *wheelchair lift*.

wayside signal – see *signal, wayside*.

weighted time – see *time, weighted*.

welded rail – see *rail, welded*.

wheelchair lift – a device used to raise and lower a platform that facilitates transit vehicle accessibility for wheelchair users and other handicapped individuals. Wheelchair lifts may be attached to or built into a transit vehicle or may be located on the station platform (*wayside lifts*).

wheel flange – in rail systems, a projecting edge or rim on the circumference of a steel wheel that is designed to keep the wheel on a rail.

wheels, driving – see *driving wheels*.

wide gauge – see *gauge, broad*.

windscreen card – a printed or hand written card usually placed in the bottom of the curb-side windscreen to denote a destination or service information such as “via...”, express, limited stop, short turn, et. al. Often used when the destination blind does not contain the desired

destination or to display a secondary destination or route deviation.

wire, contact or trolley – see *contact wire*.

workshop (shop) – section of yard, depot, maintenance and storage facility or garage where maintenance is carried out on vehicles.

wye – a triangular rail junction to turn trains or streetcars around without the need for a loop.

Y **yard** – **1.** In rail systems, a facility within defined limits that has a system of tracks used for making up trains, storing rail cars, and other purposes. **2.** In transit systems, an open storage lot for light rail vehicles, streetcars, electric trolley buses, and motor buses.

yard limits – a slow-speed area on main railroad tracks that often extends 8-16 km (5-10 mi) from either end of a yard. For transit operations, this distance is much shorter: it is usually confined to the yard itself or to a short lead, usually less than 1.6 km (1 mile) in length.

Z **zone, auto-free** – see *auto-free zone*.

zone, auto-restricted – see *auto-restricted zone*.

zone, layover – see *layover zone*.

zone accessibility – see *accessibility, zone*.

zone or zoned fare – see *fare, zone*.