Standards

Capital District Transportation Authority
Transit Development Plan

January 2025

Figures

Tables

Service Standards

Performance standards provide objective and consistent thresholds to track service performance and a guide to help make decisions about service. The sections below develop guidance for coverage, frequency, span, passenger loads, and other foundational elements of service planning. The subsequent sections outline standards for infrastructure and service. For each section, best practices and peer agency practices are described to provide context for CDTA's standards.

Fixed Route

When more routes follow a common standard, service is easier for customers to understand; however, this may lead to inefficiencies on certain routes, such as mismatched frequency and demand, inflexible scheduling during high demand time periods, or increased need for operational resources (drivers, vehicles, etc.). CDTA will weigh simplicity against efficiency when considering adherence to the standards.

COVERAGE

Coverage standards are widely used by transit agencies to provide a baseline understanding of where to provide fixed-route local service. These standards typically incorporate a combination of demographic indicators, similar to those found in the market analysis conducted as part of this plan.

The Transit Cooperative Research Program's (TCRP) *Transit Capacity and Quality of Service Manual*[1] serves as a best practice guide for transit agencies. The guide highlights that a minimum of 4.5 housing units per net acre is typical for hourly daytime fixed-route service to be feasible (or four jobs per gross acre).[2] Coverage standards should also account for unique local factors, such as funding availability, ridership patterns, and varying transit needs across areas with similar population densities, to ensure they align with the specific operational and community goals of the transit agency.

Many peer agencies, such as Niagara Frontier Transportation Authority (NFTA)[3], use transit propensity mapping to define coverage needs. NFTA prepares a combined value inclusive of each of five index factors (median income, minority, economically disadvantaged households' density, zero car households' density, low-income jobs density), and then divides the combined

[1] 3rd Edition, 2013
[2] The transit need and transit potential mapping conducted as part of the market analysis of this TDP use population density rather than housing density. For reference, the CDTA region averages about 2.15 people per housing unit. Therefore, the regional equivalent of this guideline is about 10 people per acre.
[3] NFTA. *Service Design Guidelines & Delivery Standards* (2021).

values into quartiles, such that the lowest-scoring 25 percent of block groups are considered low transit need. Other peers, such as Pioneer Valley Regional Transit (PVRT)[4] and the Rhode Island Public Transit Authority (RIPTA)[5], identify specific housing and employment density minimum thresholds for service type. CDTA does not have density threshold standards broken down by mode, but **Table 1** references standards used by PVTA and RIPTA. Note that CDTA uses population per acre rather than housing per acre, so an equivalent population estimate is included to make comparison simpler.

Table 1: Transit Supportive Density Minimum Thresholds – Housing and Employment per Acre

		Agency	
Transit Mode		**PVTA**	**RIPTA**
Bus Rapid Transit	Housing	10	12
	Population (estimate)	22	26
	Employment	20	13
Frequent Bus	Housing	5	12
	Population (estimate)	11	26
	Employment	15	13
Fixed-Route	Housing	3	3-6 (60 min. headways) 6-12 (30 min. headways)
	Population (estimate)	6	6-13 (60 min. headways) 13-26 (30 min. headways)
	Employment	6	4 (60 min. headways) 8 (30 min. headways)

Since the 2007 TDP, CDTA has used a regional coverage standard informed by the Transit Propensity Index (TPI), which includes demographics, population, and employment statistics.[6] At least 75 percent of block groups with a TPI score of two and higher were expected to have transit service available. Within this analysis, population and employment densities are key indicators of potential transit demand and are used to inform service frequencies and route type.

This TDP replaces the TPI with Transit Need and Transit Potential statistics. Transit Potential includes both population density and employment density, while Transit Need includes population density, people without access to an automobile, people with disabilities, low-income individuals, young people, and older adults. The current maps for these data can be found in the Market Analysis memo.

[4] PVTA. *Comprehensive Regional Transit Plan Update* (2020).
[5] RIPTA. *Service Guidelines* (2015).
[6] CDTA. *Transit Development Plan Update* (2013).

These maps should be used to support service planning and service monitoring by identifying locations that can generally support transit service. For a route to warrant hourly service with minimal span (baseline level service), a route should connect areas of at least medium (yellow) Transit Potential or Need. One exception might be a short feeder route to connect people to nearby service. Higher levels of need or potential would indicate potential for more service. Besides data such as Transit Need and Transit Potential, CDTA should consider unique transit trip generators that might not be reflected in Transit Need or Potential, like a university, mall, airport, or rail station.

HEADWAYS AND SERVICE SPAN

Clockface Headways

In keeping with the strategic principle of simplicity, CDTA uses "clockface" headways where possible. This means that headways always divide into 60 minutes (i.e., a bus every 10, 12, 15, 20, 30, or 60 minutes). Because vehicles arrive at the same time each hour, passengers can easily predict the departure times at given a stop all day long. Consistent intervals also enable smoother transfers with more predictable wait times. CDTA may violate clockface frequencies when necessary to make transfer connections, meet shift time requirements for riders, or when scheduling constraints prevent the implementation of clockface frequencies (e.g., complex route alignment, traffic congestion, or limited vehicle availability).

Headways

The *Transit Capacity and Quality of Service Manual* outlines the passenger and operator perspectives related to different headways:

- **5- to 10-minute headways** are considered frequent and do not require passengers to reference schedules. These are suited for high-density corridors or locations where multiple routes converge.
- **11- to 15-minute headways** are considered relatively frequent, but passengers reference schedules to minimize wait times; these frequencies are suited for higher density corridors.
- **16- to 30-minute headways** require riders to adjust their travel to the transit schedule, which calls for them to arrive earlier than necessary at their destinations; these frequencies are appropriate in moderate-density corridors.
- **31- to 59-minute headways** typically result in passengers checking schedules to avoid long waits where riders need to adjust their schedule to accommodate bus departures; these frequencies are appropriate in low- to moderate-densities.
- **60-minute headways** provide minimal service that will meet basic travel needs. Any headways higher than 60 minutes are considered undesirable for local service but may be appropriate for express services and special or seasonal service.

To provide context on CDTA's existing operations, **Table 2** compares CDTA's existing Trunk Routes headway ranges with its peers during peak periods. CDTA's Trunk Routes operate with similar frequencies as peer agencies.

Table 2: CDTA Existing Trunk Route Headway Range Comparison to Peer Agencies

Transit Agency	Headway Range for Trunk Routes and Peer Equivalent Route Types
CDTA	10-20
Madison Metro (Madison, WI)[7]	15-30
Niagara Frontier Transportation Authority (Buffalo, NY)	10-15
Pioneer Valley Transit Authority (Springfield, MA)	15-20

Headway standards for CDTA service can be viewed in **Table 3** below. CDTA uses expected frequency of service by time of day for each service type. Note that BusPlus, Trunk, and Neighborhood service types are expected to have headways of no more than 60 minutes.

Table 3: Standards for Headway Ranges by Time Period and Service Type

Service Type	Headway Ranges						
	Weekday				Weekend		
	Peak	Mid-Day	Evening	Late Night/ Early AM	Day	Early AM/Evening	Late Night/Early AM
BusPlus[8]	12-15	12-15	12-15	20-30	15-20	20-30	20-30
Trunk	12-30	12-30	20-30	20-60	15-60	15-60	30-60
Neighborhood	20-60	30-60	30-60	30-60	20-60	20-60	30-60
Express	2+ trips	0-4 trips	-	-	-	-	-

[7] Madison Metro. *Transit Development Plan for the Madison Urban Area* (2013).
[8] BusPlus service standards will match latest Federal Transit Administration (FTA) requirements for Small Starts project criteria. For fixed guideway or corridor-based bus rapid transit (BRT), the weekday service will operate a 14-hour service span with either 15-minute all-day headways or 10-minute max peak headways with 20-minute max off-peak headways.

Service Span

Agencies set service span standards either in terms of the hours of operations (e.g., 6 AM to 8 PM) or service hours (16 hours daily). The *Transit Capacity and Quality of Service Manual* uses service hours:

- **18+ hours of service** provide a full or nearly full range of trips. Note that some agencies may provide extended hours on only certain days of the week to accommodate late night shift work (e.g., entertainment districts on weekends). CDTA's BusPlus and Trunk routes generally fall in this service span.
- **15- to 18-hours of service** captures working hours for most people as well as evening classes or shifts ending in the late evening, such as retail.
- **12- to 14 hours of service** provide for riders who work traditional working hours and still allow for some flexibility with departure times. Students and many workers (e.g., restaurant or hospital workers) might be excluded. CDTA's Neighborhood routes generally fall in this service span.
- **Less than 12 hours of service** provides basic services, such as express, shopper, or lifeline services. CDTA's Express routes fall in this service span.

Table 4 shows how CDTA's weekday service span compares with its peers by service type. Generally, CDTA's existing service span matches or exceeds its peers. Note that service span guidelines are seen as aspirational rather than an indication of existing service offerings.

Table 4: CDTA Existing Service Span Comparison to Peer Agencies

	Weekday Service by Route Type		
Transit Agency	**BusPlus and Peer BRT Routes**	**Trunk Routes and Peer Equivalent Route Types**	**Neighborhood and Peer Equivalent Route Types**
CDTA	4:00 AM to 2:00 AM	5:00 AM to 12:30 AM	6:00 AM to 9:00 PM
Madison Metro (Madison, WI)	-	5:30 AM to 1:00 AM	5:30 AM to 1:00 AM
Niagara Frontier Transportation Authority (Buffalo, NY)	5:30 AM to 1:00 AM	5:30 AM to 1:00 AM	5:30 AM to 12:00 AM
Pioneer Valley Transit Authority (Springfield, MA)	6:00 AM to 10:00 PM	6:00 AM to 9:00 PM	6:00 AM to 7:00 PM

CDTA defines service span by hours of operation. From the rider perspective, span indicates what times of day and days of the week riders can expect a route to operate. Service span varies depending on route type and different needs of riders on a particular route. **Table 5** provides CDTA's desired service spans by route type. Many CDTA routes exceed these hours if it caters to a destination with additional service needs. For instance, Route 452 is a Neighborhood Route that serves Skidmore College past midnight on Thursday, Friday, and Saturday nights. In some cases where ridership might be low during the early morning or late-night hours, service span may be reduced below the standard.

Table 5: Standards for Service Span by Time Period and Service Type

Service Type	Service Span (Service Hours)		
	Weekday	**Saturday**	**Sunday/Holiday**
BusPlus[9]	4:00 AM – 2:00 AM (22 hrs)	5:00 AM – 2:00 AM (21hrs)	5:00 AM – 1:00 AM (20 hrs)
Trunk	5:00 AM – 1:00 AM (20 hrs)	5:30 AM – 1:00 AM (19.5 hrs)	6:30 AM – 12:00 AM (17.5 hrs)
Neighborhood	5:30 AM – 11:30 PM (18 hrs)	6:30 AM – 11:30 PM (17 hrs)	7:30 AM – 9:30 PM (14 hrs)
Express	Primarily Peak Periods	-	-

PASSENGER LOADS

Passenger loads are calculated using the average load at the busiest point on the route divided by the maximum seating capacity of the bus. The load factor is presented as a percentage where 100 percent means that all the seats are occupied, and no one is standing. Load factors exceeding 100 percent can indicate excessive loads where passengers are standing, crowding occurs, and conditions may be uncomfortable. If the load factor at the busiest point on a route is below 60 percent, it may indicate an underperforming route or route segment.

The *Transit Capacity and Quality of Service Manual* provides the following guidance regarding load factors:

- **Up to 80 percent.** Passengers have some freedom to where they sit, and their perception of travel time matches the actual travel time.
- **81 to 100 percent.** All passengers can sit, but passengers start to perceive travel time as longer than actual travel time.
- **101 to 125 percent.** Some passengers are required to stand. Standees will need to adjust position as passengers board and alight. Perceived travel time is doubled relative to actual travel time for standees.
- **126 to 150 percent.** Up to a third of the passengers are standing, and boarding passengers must ask standing passengers to move to find an available spot on the bus. Perceived travel time continues to exceed actual travel time.
- **Above 150 percent.** Perceived travel time rises further and many passengers at stops opt to wait for the following bus rather than board.

NFTA's service standards indicate a peak hour maximum average load factor of 140 percent for its Bus Rapid Transit, frequent, and limited stop services. They allow 120 percent for their standard services and 100 percent for their express services. PVTA has a peak hour maximum

[9] BusPlus service standards will match latest Federal Transit Administration (FTA) requirements for Small Starts project criteria. For fixed guideway or corridor-based bus rapid transit (BRT), the service will operate at least a 14-hour service span.

average load factor of 120 percent for its fixed-route services, except for their express service (100 percent).

CDTA has a similar maximum average load factor to its peers, and sometimes permits less crowding during peak periods, as it caps the load factor during peak hour at 125 percent for all routes except Express routes, on which all passengers should have seats. This is because Express routes use coach buses and travel on interstates at higher speeds relative to other service types.

Note that if alternative fuel vehicles are acquired, these standards will need to be revisited because some alternative fuel vehicles do not permit standees due to weight.

Table 6 displays the vehicle capacities at different load factors, and **Table 7** displays load factor thresholds by service type. Total seating can vary slightly from bus to bus.

Table 6: Standards for Vehicle Capacities (Riders) and Load Factors (Occupied Seats)

Load Factor at Busiest Point (Peak Hour)	24' Mini-bus	30' Bus	35' Bus	40' Bus	60' Articulated Bus
60 %	10	13	19	24	33
100 %	18	23	32	40	55
125 %	22	28	40	50	68

Table 7: Load Factor Caps by Service Type

Service Type	Peak Hour Maximum Load Factor	Off-Peak Hour Maximum Load Factor
BusPlus	125 %	100 %
Trunk	125 %	100 %
Neighborhood	125 %	100 %
Express	100 %	-

RIDERSHIP PRODUCTIVITY

Ridership productivity measures the efficiency of a route and is calculated by dividing ridership by revenue hours. Revenue hours include in-service time and layover/recovery time while excluding deadheads, pulls, operator training, and vehicle maintenance tests.[10]

Transit agencies vary in how they measure productivity (shown in **Table 8**), but ridership by revenue hour is the most common measure.

[10] Definition provided by the National Transit Database Glossary (Federal Transit Administration) https://www.transit.dot.gov/ntd/national-transit-database-ntd-glossary

Table 8: Peer Review of Productivity Guidelines

Peer Agency	Notes on Productivity
Madison Metro (Madison, WI)	At least 10 boardings per revenue hour and an average of 15 mid-day (weekday) boardings per hour
Niagara Frontier Transportation Authority (Buffalo, NY)	Uses productivity but has no set threshold or minimum
Pioneer Valley Transit Authority (Springfield, MA)	Uses minimum productivity levels of 10-20 passengers per revenue hour for fixed route services; exact amount is determined by route type and time of day.

CDTA evaluates productivity by looking at thresholds by time period and service type. For BusPlus, Trunk, and Neighborhood service types, CDTA evaluates the routes in the bottom quartile of productivity. The bottom quartile are the first routes to be considered for potential reduction in service or size of vehicle. Reductions, however, are not automatic, and must be evaluated based on other factors (e.g., equity, Universal Access, lifeline services). The top quartile of productivity is also evaluated to consider how revenue hours might be distributed to maximize efficiency within the service type. Extending service hours, increasing frequency, or assigning higher capacity vehicles are options for top performing routes.

The Express service type is evaluated separately given its unique service characteristics.

Table 9 summarizes the productivity thresholds as of August 2024.

Table 9: Productivity (Riders per Revenue Hour) Thresholds by Service Type

		BusPlus		Trunk		Neighborhood	
		25th percentile	75th percentile	25th percentile	75th percentile	25th percentile	75th percentile
Weekday	AM Peak	19	27	20	25	12	21
	Late Night / Early AM	13	17	11	19	8	15
	Mid-Day	19	25	17	27	12	21
	PM Peak	23	27	23	29	12	25
Weekend	AM Peak	12	19	11	18	6	18
	Late Night / Early AM	14	18	9	21	7	15
	Mid-Day	19	24	12	24	9	20
	PM Peak	21	27	16	28	9	23

Productivity is measured by riders per revenue hour. This table reflects what the thresholds would be based on August 2024 data. The table below indicates target thresholds.

Productivity threshold targets should be aspirational but achievable. **Table 10** summarizes the recommended targets for fixed-route service. While express service is not depicted in the table, it is recommended that the minimum productivity threshold for Express routes is fifteen passengers per trip, which is in line with some of CDTA's peer agencies such as Pioneer Valley Transit Authority.

Table 10: Standards for Productivity (Riders per Revenue Hour) Thresholds Targets by Service Type

		BusPlus		Trunk		Neighborhood	
		25th percentile	75th percentile	25th percentile	75th percentile	25th percentile	75th percentile
Weekday	AM Peak	20	30	20	30	10	20
	Late Night / Early AM	10	20	10	20	10	15
	Mid-Day	20	30	20	30	10	20
	PM Peak	20	30	20	30	10	20
Weekend	AM Peak	10	20	10	20	10	20
	Late Night/Early AM	10	15	10	20	10	15
	Mid-Day	15	25	10	25	10	20
	PM Peak	20	25	15	25	10	20

Productivity is measured by riders per revenue hour. Routes in the bottom quartile should be evaluated for potential reduction in service or size of vehicles after other factors (e.g., equity, lifeline service, Universal Access) are considered.

ON-TIME PERFORMANCE (OTP)

The *Transit Capacity and Quality of Service Manual* names on-time performance (OTP) as the most prevalent performance metric for North American transit systems. OTP measures the reliability of buses by calculating how often and how well vehicles adhere to schedules. Despite its wide use, OTP is not standardized due to the variability of defining locations for measurement (e.g., terminals or mid-route points) or timeframes for what is considered "on-time." Peer agencies have also introduced other factors for considering OTP, such as holding separate standards for low-frequency, standard, or BRT (bus rapid transit) routes, or using separate temporal parameters for routes with timed transfers (dependent on pulses) and routes without timed transfers (dependent on static timeframes).

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Table 11 compares CDTA's definition for on-time performance with peer agencies.

Table 11: CDTA On-Time Performance Guidelines Compared to Peer Agencies

Agency	Temporal Parameters		System-Wide Goals	Notes on Measurement Method
CDTA (Albany, NY)	One minute early to five minutes late		80%	Monitoring will occur at non-termini timepoints
Madison Metro (Madison, WI)	Routes without timed transfers	Less than five minutes late	90+ %	Monitoring will be during March and October due to school schedules and weather fluctuations
	Routes with timed transfers	Trips that arrive after the transfer time instead of a static timeframe		
PVTA (Springfield, MA)	One minute early to five minutes late		85%	Measured at both termini to account for variability in traffic and driver breaks
NFTA (Buffalo, NY)	Two minutes early to five minutes late		84% or higher than the prior year's average OTP	
RGRTA (Rochester, NY)[11]	Two minutes early to five minutes late		88%	OTP is measured as part of a quarterly performance scorecard
RIPTA (Rhode Island)	One minute early to five minutes late		79%	OTP is measured at every time point for every trip every day

CDTA determines OTP for fixed routes based on whether they arrive at a time point (a stop with arrival times included in public schedules) at the scheduled arrival time. CDTA gives an on-time performance window of -1 to 5, meaning a bus is on time if it arrives any time between one minute early and five minutes late. CDTA has a systemwide OTP goal of 80 percent.

There are also some special circumstances where CDTA does not follow standard on-time performance rules. BRT routes, which use headway management during peak periods, aim to keep headways consistent instead of adhering to specific arrival times, due to the frequency of service on these corridors and the compounding effects of customer buildup due to a late bus making later buses even later. CDTA also runs a pulse system in Glens Falls, meaning connections at Ridge Street Terminal are prioritized over strict schedule adherence.

[11] Rochester Genesee Regional Transportation Authority. *Comprehensive Strategic Plan & Financial Plan* (2023).

Additional Services

This section outlines the service standards for on-demand (FLEX and FLEX+) and car-sharing (DRIVE).

FLEX AND FLEX+ MICROTRANSIT

On-demand services provide flexible mobility options for customers in select areas. Often, public transit agencies use these services to bridge the first-and-last-mile between transit stations and destinations not served by fixed-routes. These operate by request of riders in eligible areas and can be measured by wait times, zone coverage, operation costs, and more. The *Transit Capacity and Quality of Service Manual* considers six metrics for on-demand transit: response time, service span, service coverage, reliability, travel time, and no-shows.

Table 12 outlines service standards used by agencies with similar public on-demand services.

Table 12: Example Service Standards and Guidance from On-Demand Transit Services

Agency	Indicator	Measurement Method and Details
Seattle Metro Flexible On-Demand Service (Seattle, WA)[12]	Productivity	Riders per vehicle hour
	Efficiency	Cost per boarding
	Equity	Percent of riders that are picked up/dropped off in a designated equity priority area
RIPTA Flex (Rhode Island)	Passengers per Revenue Hour	Count of passengers per revenue hour by day and time
	Minimum Farebox Recovery	Goal of 5%
	Passenger Load	Maximum of 100% (no standing allowed)
Dart Regional On-Call (Des Moines, Iowa)[13]	Passengers per Hour	Passengers served per service hour with a standard of at least five passengers
	Cost per Customer	$25 or less per passenger
	On Time Performance	Percent of trips that are on-time (before or at most five minutes after scheduled time) with a standard of 85%
	Trips Completed	Percent of trips that are completed at a standard of 98%
	Passenger Load	Number of passengers on vehicle relative to passenger load of vehicle with a maximum of 125%

CDTA provides on-demand services through its FLEX microtransit program. Microtransit is provided by larger agencies but remains uncommon among peer agencies. It can be a more efficient solution than fixed-route service in the proper context, such as covering an area with high transit need but low demand. However, microtransit is not expected to be efficient or cost-effective on its own. Accordingly, microtransit should be strategically and in situations where a small amount of microtransit service creates a significant benefit to fixed route service.

[12] King County Metro. *Service Guidelines* (2021).
[13] Des Moines Area Regional Transit Authority. *Service Standards and Performance Monitoring Guidelines* (2019).

Microtransit can also offer a one-seat ride, a short wait for pickup and a relatively direct ride, meaning it can be a customer experience improvement where the fixed route option is slow, indirect, or has long headways.

Service Span and Coverage

FLEX can be used to extend CDTA service span by operating in areas served by fixed route at times when fixed route does not operate. This ensures that fixed route riders are not stranded late at night and covers late night connections for populations such as third shift workers. FLEX may at times be overwhelmed by sudden surges of demand, which may indicate the need for late night fixed route service.

FLEX can also extend the geographic coverage of fixed route service, by connecting otherwise uncovered areas to the fixed route network. The best example in the CDTA service area is Crossgates Mall, which has excellent service headed east towards Albany but very little headed west into Guilderland. A short ride on FLEX gets customers into the entire CDTA network.

On-Time Performance and Reliability

CDTA mantains a goal of 75 percent on-time performance for FLEX. For on-demand services, on-time includes all arrivals of five minutes early to five minutes late. Average wait times for FLEX should ideally be kept under 30 minutes. To improve FLEX wait times, CDTA will rely on methods other than adding vehicles and drivers, such as improving the booking and scheduling process and changing route geography and/or pickup locations. Past experience has shown that merely adding drivers and vehicles does not directly alleviate wait time issues, as it often leads to increased ridership. If wait times cannot reach a satisfactory level, CDTA will evaluate FLEX service for a possible transition to fixed route or other service.

DRIVE CAR-SHARE

Few municipal or transit agency carshare programs exist. Traditional round-trip carsharing is usually modeled on profitability within a given market, while transit agencies generally consider many other factors besides profitability. Carsharing operators often struggle to break even, and operators cannot offer carsharing services at prices inexpensive enough to attract low-income drivers. Therefore, operational guidance from peer agencies rather than service standards is offered below to provide best practices on operational efficiency. While subsidized car-sharing in the model offered by CDTA is a mission-driven service, operational efficiency must still be considered.

The San Francisco Municipal Transportation Agency (SFMTA)’s requirements for on-street carsharing parking include (but are not limited to) the following:

- Carsharing operator maintains a citywide network of at least 10 vehicles.
- Vehicles are available 24 hours a day, seven days a week using a virtual storefront (no staff required), or available during the hours a vehicle is parked in a garage.
- Automobile insurance is provided for each member for the duration of the rental.
- Vehicles are only made available for rental in hourly increments or less.
- Vehicles are made available for at least 75 percent of any given month.
- Operator provides quarterly reports on the number of members in the city by ZIP code, vehicle locations, trip data, and operational metrics to SFMTA.[14]

Subsidized car-sharing in the model offered by CDTA is a mission-driven service and intends to offer an option for car trips for those without a household vehicle or customers with short-term vehicle needs. However, the service must balance operational efficiency against equity goals and may not require conformance with typical standards used by peers for market viability.

Building from the SFMTA requirements above, guidelines for DRIVE include:

- Vehicles are available 24 hours a day, seven days a week.
- Insurance, maintenance, roadside assistance, and charging are included in the rental fee cost.
- Vehicles should be available for at least 75 percent of a given month.
- Siting of carshare locations should factor in equity considerations (e.g., prevalence of zero vehicle and low-income households).
- Planning for Mobility Hubs should consider potential for DRIVE parking locations.
- To track DRIVE's success internally, CDTA can conduct annual reporting on the following characteristics: membership data (age, household income, household size, education level, and ZIP code); vehicle locations, utilization, and operational characteristics; and trip data (origins, destinations, mileage, and times). This will help inform CDTA of demonstrated need, use potential, and potential need for expansion.

CDPHP CYCLE! BIKE SHARE PROGRAM

The CDPHP Cycle! Program is a bike share program, offering both pedal bikes and pedal-assist electric bikes. The program launched in 2017 with 160 bikes and 41 bike stations in Albany, Schenectady, Troy, and Saratoga Springs. In 2024, more than 600 bikes and more than 100 stations are available. Amsterdam, Glen Falls, and Cohoes have been added to the coverage area.

[14] San Francisco Municipal Transportation Agency. *Vehicle Sharing Parking Permit Policy* (2017).

Based on findings from the National Association of City Transportation Officials (NACTO), CDTA will use the following guidelines when locating and designing new CDPHP Cycle! stations:

- Stations within a continuous network should be placed within a five-minute walk of other stations. This allows customers to be close to a Cycle! rack without any planning, like high frequency transit lets customers get up and go without having to plan around a schedule.
- All stations should be easily accessible and visible; well-lit locations are strongly encouraged, and locations blocked by walls, buildings or trees are discouraged.
- An ideal location will:
  - Be adjacent to a connected sidewalk network.
  - Avoid conflicts with other streetscape elements like loading bays, fire hydrants, and bus stops.
  - Be well-served by a connected network of bike lanes.
  - Overlap with the fixed route network to provide first/last mile connections and cover short trips not well served by fixed route.

Station Site Selection Considerations

Equity - Bikeshare can offer affordable transportation options and may yield even greater ridership in locations with the greatest need for affordable transportation. Communities with a relatively high concentration of zero-car households, college-aged adults, or populations below the poverty line may be well suited for new stations.

Safety –CDTA cannot guarantee the safety of its riders, but CDTA will prefer locations with safer options for riding. Riders must use their own judgment about safety and their ability as a rider.

Last Mile Connections with Fixed Route - Locations with last-mile access needs, such as major employment centers with limited bus frequencies or incomplete fixed route coverage, may offer other opportunities for popular stations.

Tourism and Recreation – Bike share is often popular with tourists and CDPHP *Cycle!* riders often ride for recreation. Even without a direct connection to fixed route, *Cycle!* stations can see good utilization.

Customer Feedback - Lastly, soliciting suggestions from existing riders and community members for new station locations may be a beneficial and efficient way to grow the system organically. While still acknowledging the equity goals and technical siting considerations, CDTA could seek feedback on the best new locations.

Infrastructure Standards

Stop Spacing

Bus stop spacing aims to balance walkability with minimizing travel time for riders. Closer stops serve passengers more directly but slow down service due to frequent stopping. The balancing of these two considerations requires complex consideration. For example, buses can generally run faster in suburban or rural areas than in cities. Closely spaced stops on suburban or rural streets may cause the bus to never get up to top speed, slowing down service.

However, suburban and rural areas often lack pedestrian infrastructure, making walking a longer distance to a bus stop less safe, less convenient, and less comfortable. A stop with low ridership may look like a strong candidate for elimination, but eliminating a stop the bus never stops at won't speed up service. CDTA must also weigh the customers riding through a neighborhood against the needs of riders who board in that neighborhood. If one group greatly outnumbers the other, this may affect CDTA's decision-making process as well.

For BusPlus Bus Rapid Transit (BRT) stations, stop spacing is determined through dedicated planning studies for each project. Unlike local fixed route bus stops, limited stops are a feature of Bus Rapid Transit to increase a route's speed and efficiency. Since BusPlus generally overlaps with local fixed route, customers have a choice between routes using closely spaced stops and BRT with wider stops for a faster ride.

FLEX is a service that uses a semi-on-demand model with key pickup locations. FLEX is moving away from picking up anywhere within a zone to using pickup locations similar to fixed route.

Peer transit agencies differ in how they approach stop spacing standards (**Table 13**), but they generally set distinct guidance for specific types of routes or density levels.

Table 13: Peer Agency Stop Spacing Standards

Agency	Environment	Stop Spacing
RIPTA	Rapid Bus	1,100 ft – 1,300 ft
	Key Corridor	900 ft – 1,300 ft
	Urban Radial	900 ft – 1,300 ft
	Non-Urban/Suburban/ Crosstown	660 ft – 1,100 ft
	Regional	900 ft – 1,100 ft
	Express/Commuter	900 ft – 1,100 ft
NFTA	Downtown Buffalo	1,200 ft
	Higher-Density Municipality	950 ft
	Lower-Density Municipality	700 ft
	Bus Rapid Transit	¾ mile

Given the relative balance between speed and convenience, stop spacing on CDTA routes will generally be closer together in dense, urban areas, and further apart in lower density areas. Stop spacing may vary in specific circumstances, but it will generally follow the standards shown in **Table 14**.

Table 14: Proposed Stop Spacing Standards

Environment	Stop Spacing	
	Typical	Maximum
Local Bus: Central Core	750 ft	1,000 ft
Local Bus: Urban Areas	1,000 ft	1,500 ft
Local Bus: Suburban & Rural Areas	1,250 ft	2,000 ft
BusPlus[15]	1,000 ft	2,500 ft

Stop Amenities

Bus stop amenities are largely based on the number of daily boardings. Specific stops may require additional amenities due to particular conditions (e.g., exposure to weather at an isolated stop location may warrant a shelter even where boardings are low). Other factors such as sidewalk width, ADA compliance, or walkability can also influence the ability to install amenities. The walkability of stops varies by location; while all stops are accessible to some extent, access may also depend on other modes of transport, such as park-and-ride options. These considerations are evaluated on a case-by-case basis. **Table 15** offers guidance on amenity placement. More details on specific amenities can be found in the sections below.

Table 15: Stop Amenity Placement Guidelines based on Passenger Boarding Activity.

Daily Boardings	Shelter[16]	Bench and Seating	Trash Receptacles	Real-Time Information	Walkability and Stop Access	ADA Accessibility
< 15	No	No	No	Stop ID Only	Yes	Yes
15-35	No	Yes	Case-by-case	Stop ID Only	Yes	Yes
35+	Yes[17]	Yes	Yes	Consider Real-Time Sign	Yes	Yes
BusPlus & Key Corridors	Yes[18]	Yes	Yes	Consider Real-Time Sign	Yes	Yes

[15] BusPlus stop spacing may be closer in the Central Core and other activity centers to balance BRT speed and accessibility to key destinations.
[16] Consider supplying a shelter at isolated stops on a case-by-case basis where passenger exposure to wind, precipitation, traffic, or other adverse conditions.
[17] Subject to suitable site conditions (e.g., sufficient right-of-way, grades, and ADA accessibility).
[18] Subject to suitable site conditions (e.g., sufficient right-of-way, grades, and ADA accessibility).

While the above are CDTA's standards for stop amenities, the backlog to get everything done is extremely long. Priority for improvement starts with the highest ridership locations and moves down from there.

SHELTERS

Shelter placement considers several factors, including ridership levels, transit need and potential, existing sidewalk amenities, and the characteristics of the surrounding area. CDTA will place shelters at all bus stops at transit centers, BRT stations, and park and rides.[19] Shelters will also be placed at high ridership stops along frequent transit corridors and at all significant transfer points. Transfers to low frequency routes should also be considered since customers may be forced to wait for a long time.

For stops that are not at transit centers, BRT stations, park and rides, or along the frequent transit corridor, CDTA will evaluate shelter placement on a case-by-case basis. This evaluation includes factors such as average boardings, the number of routes and trips served by each stop, and the overall transit potential and need in the surrounding area. Bus stops that serve several routes or are located in areas with high ridership or dense populations that are more likely to use transit may be prioritized for shelter installation. [20]

All shelters must comply with ADA accessibility standards, ensuring that waiting areas within the shelter accommodate individuals with mobility devices or limitations. This commitment ensures that public transit remains accessibly and inclusive to all riders of all abilities.

Because of technical difficulties, radiant heating will not be standard for CDTA shelters going forward. CDTA will revisit this standard once a plan to address known issues has been developed. Roof designs are also evaluated to help maintain customer comfort, with innovative approaches like a green roof piloted in Troy, New York. This pilot demonstrated improved heat retention and better stormwater runoff control, showcasing environmental benefits. All BRT shelters should also include heated sidewalks to clear snow.

Over 35 daily boardings is the standard requirement for a shelter, but some other factors may be considered, such as if customers often spend a long time waiting at the stop.

Specifications for stops and related equipment are subject to site-specific studies and CDTA's stop amenity guidelines in **Table 15**.

[19] SORTA Bus Stop Master Plan (2025).
[20] SORTA Bus Stop Master Plan (2025).

BENCHES AND SEATING

Benches and seating enhance passenger comfort, improve accessibility, and increase bus stop visibility. While seating is typically associated with bus stop shelters, it can also be a stand-alone amenity in locations where shelters are either not warranted or are constrained by site limitations. In cases where space is constrained and a bench is not possible given the available space, leaning rails could be considered, as they offer a more compact alternative to a shelter or bench, providing comfort at higher-volume stops, including those on the BusPlus network.

Typically, 15-35 daily boardings is required to justify the installation of a bench; however, not all stops that meet this threshold may be suitable for seating. The decision to install benches or other seating amenities also consider the stop's strategic importance, such as whether it is part of a key transit corridor or served by multiple bus routes. Demographic and geographic factors (e.g., high concentration of people with disabilities or the elderly, or hilly terrain) may also influence bench placement.

Seating design will discourage non-passenger loitering, such as by using individualized seating elements or partitioned benches.

TRASH RECEPTACLES

Trash receptacles at bus stops are determined by ridership levels and the surrounding environment. A stop that serves only an infrequent express route may not require a trash receptacle, but a major hub may warrant multiple. The proximity of landmarks and high-traffic areas, such as streets lined with takeout restaurants, is also considered, as these areas tend to generate more waste compared to residential neighborhoods. The ease of receptacle maintenance is also a key factor in placement decisions. Lastly, regardless of any of the previously described predictive factors, trash receptables can be placed in response to any actual trash problem.

Maintenance responsibility for trash receptacles varies by location. In some jurisdictions, the local government or neighborhood business improvement district may be responsible for placing and therefore maintaining trash receptables. CDTA will create sensible partnerships with local property owners and municipalities to use their maintenance staff where possible. CDTA will maintain the receptables where it is not possible. Clearly defining maintenance responsibilities is essential before implementing trash receptacles at CDTA stops.

In high-volume areas or where trash collection is labor-intensive or infrequent, solar-powered, self-compacting trash receptacles may be considered. These compacting devices have already been deployed at BusPlus stops to manage higher waste volumes efficiently.

LIGHTING

To promote safety and make waiting customers more visible to the driver at night, CDTA will explore lighting solutions inside and around bus shelters, such as smart LED lighting or solar-powered lighting. Where possible, stops will be prioritized for placement in well-lit areas. Where sufficient lighting does not already exist, CDTA will work to have appropriate lighting installed, either in the shelter, or as needed to make sure customers feel safe and are highly visible to drivers. Pedestrian-scale lighting will include streetlamps that are less than 25 feet high.[21] To avoid glare for pedestrians, lights that are placed lower will be adjusted in brightness. In locations where external lighting is limited, some shelters will be equipped with internal lighting options. Photovoltaic panels or glazing on the shelter may also be used to generate electricity, providing power for LED lighting. They have been successfully piloted at BusPlus Blue Line shelters in Troy.

Besides its safety and comfort purposes, lighting will also be deployed to increase visibility of customers for drivers where it is needed.

WALKABILITY AND STOP ACCESS

Bus stop location plays a pivotal role in determining accessibility. When possible, stops will be placed at locations that maximize access to surrounding destinations through direct and safe paths for all users, at all times of day, and in all seasons. Barriers such as excessive roadway crossings, steep grades, or other obstacles will be minimized. Ideally, stops are located near intersections with clear visibility and easy access to return stops in the opposite direction of travel.

Because CDTA does not own the right of way it operates in, CDTA's ability to directly invest in improvements beyond the bus stop may be limited. Collaboration with the right of way owner (generally a municipality or New York State) is essential.

Potential access improvements beyond the stop may include sidewalk upgrades or repairs, installation of curb ramps and pedestrian signals, crosswalk enhancements, improved lighting, ADA improvement such as tactile warning surfaces or railings, safety enhancements like removing dense vegetation (aligned with Crime Prevention Through Environmental Design (CPTED) principles, or connections to multi-modal transit. CDTA will work with local and regional stakeholders to prioritize these improvements, but funding will come from a variety sources.

CDTA will also keep a record of which stops are ADA accessible. CDTA will incorporate this information into its trip planner tool and use this information to plan improvements.

[21] NACTO Transit Street Design Guide.

COMMUNITY IDENTITY AND PUBLIC ART

Community identity and public art can enrich the public experience and reflect the local history, cultural heritage, and spirit of nearby neighborhoods or cultural institutions.

Public art is typically installed adjacent to a bus stop, or incorporated into stop components, such as shelter panels, bike racks, or cabinet/trash receptacle vinyl wraps. CDTA ensures consistency in the application of community art by identifying specific elements of the stop environment that can be customized.

The placement of public art considers the surrounding environment, aiming to enhance areas that might benefit from additional color or artwork that signifies the neighborhood or nearby landmarks (e.g., the New York State Seal at a bus stop near the State Capitol). Public art installations must not interfere with the functionality of the bus system or the visibility or safety of users. Public art can also make bus stops more visible.

The selection of public art can involve various stakeholders, including CDTA employees, local arts organizations, neighborhood associations, or a consortium of local artists.

Infrastructure

When locating and designing infrastructure improvements, CDTA evaluates multiple factors to ensure they are appropriate, cohesive, and aligned with the street network:

- Elements of the physical environment, such as sidewalk width, are assessed to ensure infrastructure improvements are designed appropriately and cohesively with the current street network.
- Safety solutions like lighting and emergency call buttons will be incorporated to address potential safety concerns.
- Lighting also can increase visibility of customers and reduce missed pickups.
- Customer feedback will play an essential role in highlighting areas of need.
- Characteristics of the surrounding area are analyzed before determining where infrastructure improvements should be implemented.
- Factors such as ridership trends, current operational performance, demographic factors, and proximity to major landmarks serve as a guide for where new infrastructure will be most impactful.

To ensure effective and efficient implementation of infrastructure improvements, CDTA will evaluate the associated costs and identify funding opportunities through local or state grants, community partnerships, or sponsorships. Successful design and implementation of infrastructure improvements will also require close coordination with the respective local municipality to ensure community support and maintaining compliance with local standards.

Further details on specific types of infrastructure improvements and additional considerations are outlined below.

AMERICANS WITH DISABILITIES ACT COMPLIANCE

As much as possible, future stop improvements and amenities will adhere to ADA accessibility standards as outlined in FTA's ADA Circular.[22] This includes ensuring a level surface (within ADA slope guidelines) for deploying wheelchair ramps, providing hard landing surfaces, and maintaining adequate clearances for pedestrian pathways and maneuvering within the station area. CDTA will work with partner jurisdictions to address adjacent infrastructure, such as sidewalks, curb ramps, and pedestrian crossings, wherever feasible.

BUS STOP PAD

The installation of reinforced concrete bus pads at high-frequency bus and BRT stops is considered best practice. Concrete pads eliminate the wear and tear that would occur on asphalt pavements caused by braking and accelerating buses, particularly on sloped travel lanes. They also provide better control over cross slopes that affect passenger boarding and ramp deployment. In locations where bus pads are implemented, they will be at least 8.5 feet wide in order to accommodate both wheels of a bus and will be constructed in concrete.[23] Bus pads may be wider or extend across the full width of a lane in some cases to ensure the surface is consistent. Regardless of whether a reinforced bus pad is used, CDTA and partner agencies will consider the potential impacts of cumulative pavement overlays on curb height and bus stop geometry.

BUS STOP LENGTH

Bus stop lengths should have adequate space to allow buses to safely pull in and out, minimizing conflicts with other vehicles. Bus stops vary in length depending on various features such as number of lanes on a road, the presence of on street parking, proximity to intersections, and types of buses that serve it.

High frequency stops served by multiple routes benefit from a multiple berth arrangement to reduce vehicle queuing delays. This determination will be made on a site-specific basis based on stop volumes and prevailing roadway geometric conditions. Boarding location identifications are helpful at stops with multiple bus berths to speed up boarding and improve ADA accessibility. Determination of near-side, far-side, or mid-block stops will consider the number of buses serving a stop at a given time, traffic conditions, and road and sidewalk layout. **Table 16** provides the desired minimum bus stop length for each stop position as well as type of bus and number of buses.

[22] FTA Circular: ADA Guidance (2015). https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/Final_FTA_ADA_Circular_C_4710.1.pdf
[23] NACTO Transit Street Design Guide (2016).

It is preferable to maintain clearance at bus stops for rear-door passenger alighting. Ideally, stops allow for exiting the bus onto a smooth paved ADA compliant surface. At certain stops, there may be practical limitations to meeting this objective without relocating the stop (e.g., mature street trees, utility poles, streetscaping, or planter strips).

Bus stops will include regulatory signage to prohibit parking or standing by private automobiles or delivery vehicles in locations reserved for transit. Problematic locations may warrant a closer examination of curb regulation and utilization in the area to reduce conflicts.

Table 16: Standards for Minimum Bus Stop Length by Stop Position and Vehicle Type (feet)[24]

Stop Position		40' Bus	60' Bus	2 x 40' Bus	2 x 60' Bus
In-Lane	Near-Side	35	55	80	115
	Far-Side	45	65	90	130
	Mid-Block	35	55	80	115
Pull-Out	Near-Side	100	120	145	185
	Far-Side	90	100	125	165
	Far-Side (right turn)	140	160	140	230
	Mid-Block	120	145	185	210

BUS STOP SIGNAGE

Current bus stop signage depicts a color-coded scheme by route classification, as well as a unique sign ID number on the lower left of the sign (see **Figure 1**). This is the minimum standard for all stops in the system.

At bus stops with less than 35 daily passenger boardings, bus schedules, the Navigator app, the Transit app, the CDTA stop webpage, and location pins for Google Maps and Apple Maps will be available through QR codes displayed on bus stop signage or near it. This will ensure riders have access to bus schedules and real-time passenger information while waiting at the stop. QR codes will also be available for passengers to report issues at bus stops. As detailed in **Table 15**, more advanced technology for displaying real-time information will be explored at BusPlus stations and other high-ridership stops with greater than 35 daily passenger boardings. Additionally, where street parking coexists with bus stops, markings are used to denote the stop area and no parking area.

[24] NACTO Transit Street Design Guide (2016).

Figure 1: Example of Current CDTA Bus Stop Signage

CDTA will consider adding more detailed information to bus stop signage or shelters to enhance customer experience and improve accessibility. This could include clearer instructions on how to use real-time services, additional wayfinding information, or maps showing key landmarks and nearby transfer points. To ensure that signage meets the diverse needs of its riders, CDTA should also conduct a comprehensive study to evaluate the effectiveness of current signage, identify potential areas for improvement, and explore the use of more advanced technologies or design features at high-traffic locations, such as dynamic electronic ink schedules[25]. Static schedules and maps are not used due to the rate at which CDTA services change. See the Bus Stop Technology section for more information on this topic.

TRANSIT SIGNAL PRIORITY

CDTA is an early adopter of Transit Signal Priority (TSP) with widespread deployment within the service area for over 20 years. TSP is installed in the three BusPlus rapid transit corridors. TSP improves transit performance by reducing average travel time, facilitating recovery from delays, and reducing travel time variability.

[25] https://www.mbta.com/projects/solar-powered-e-ink-signs

Any consideration of TSP will begin with a quantitative assessment of service deficiencies in the corridor, and the root cause of delay: intersections, congestion, bus stop boarding activities, and other operational phenomena.

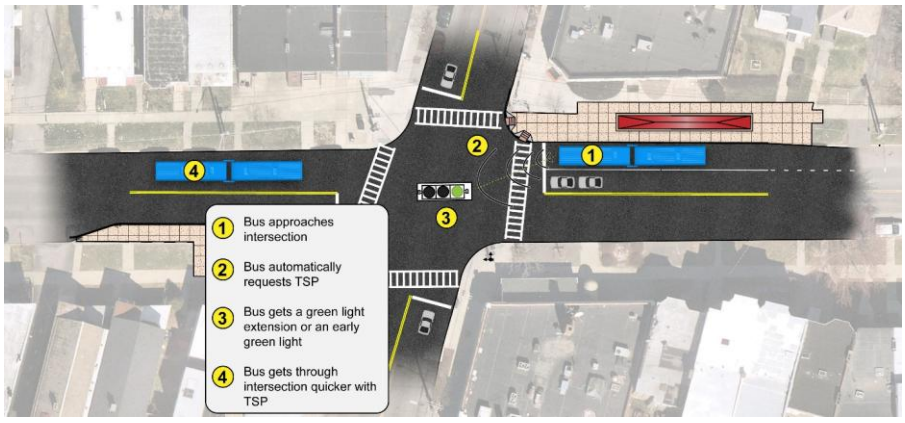
TSP is considered to have a significant improvement on bus operations in high density transit and traffic corridors. TSP can reduce travel time by up to ten percent and can help reduce delays by as much as 50 percent.[26] The feasibility and effectiveness of TSP depends on site-specific factors including the location of TSP, traffic and transit volumes, intersection geometry, and stop location.

CDTA will investigate new locations for transit signal priority, starting with the Infrastructure Priority Network. Any additional locations will be identified based on the potential benefits for reducing passenger and bus delay. Corridors with more than four buses per hour, relatively low speeds, and relatively high throughput will be prioritized as potential candidates for future TSP treatments.[27]

Besides CDTA's own operational needs, TSP should be planned based on the willingness of the owner of street (generally a municipality or NYSDOT) and emergency responders, who are also important stakeholders when controlling signal phases.

Oversight responsibilities will be shared jointly between CDTA and the owning agency. **Figure 2** depicts the application of TSP at an intersection.

Figure 2: Visual of Transit Signal Priority



[26]NACTO Transit Street Design Guide https://nacto.org/publication/transit-street-design-guide/intersections/signals-operations/active-transit-signal-priority/

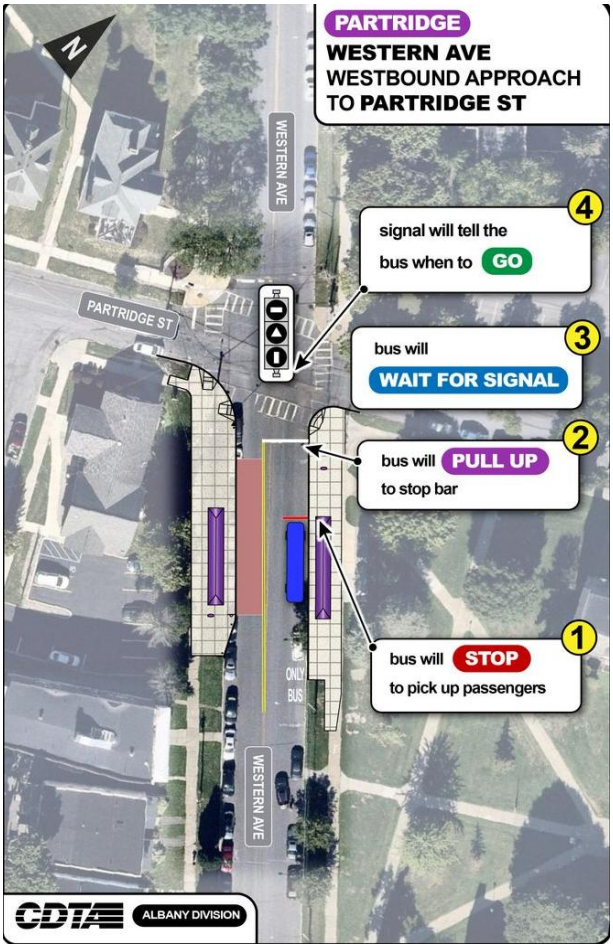
[27] Capital Region Bus Lane Feasibility Study (2023).

QUEUE JUMP BYPASS LANES[28]

CDTA is an early adopter of queue jump bypass lanes with widespread deployment within the operating region. Locations with queue jump bypass lanes include intersections along Route #905, such as Central Avenue and Wolf Road and Central Avenue and New Karner Road in Colonie. Queue jump bypass lanes are an effective tool in corridors that experience significant delays at one or more intersections.

Queue jump bypass lanes are a bus-only lane with their own signal phase, allowing buses to get ahead of traffic at a busy intersection. When activated, a queue jump signal allows the bus to proceed through the intersection-going straight or making a right turn. Queue jump bypass lanes will be evaluated on site-specific studies, which include, an assessment of road layout and capacity, potential for realignment, street geography, and roadway congestion. **Figure 3** depicts the use of a queue jump at an intersection.

Figure 3: Visual of Queue Jump on BusPlus Purple Line



[28] https://nacto.org/publication/transit-street-design-guide/intersections/intersection-design/queue-jump-lanes/

The Capital Region Transportation Council Bus Lane Feasibility Study found queue jump bypass lanes would be most useful at Central Avenue and Washington/State/Broadway in Albany, State Street in Schenectady, and 3rd/4th Street in Troy (see **Figure 4**Error! Reference source not found. – **Figure 7**). These corridors have high transit ridership, but also experience high levels of passenger delay, slow bus speeds, and unreliable service. Future locations for queue jump bypass lanes will be identified and prioritized based on high bus density or congestion, lower transit speeds, transfer opportunities to other routes, and potential for growth and redevelopment.[29]

Figure 4: Central Avenue, Albany

Figure 5: Washington/State/Broadway, Albany

Figure 6: State Street, Schenectady

Figure 7: 3rd/4th Street, Troy

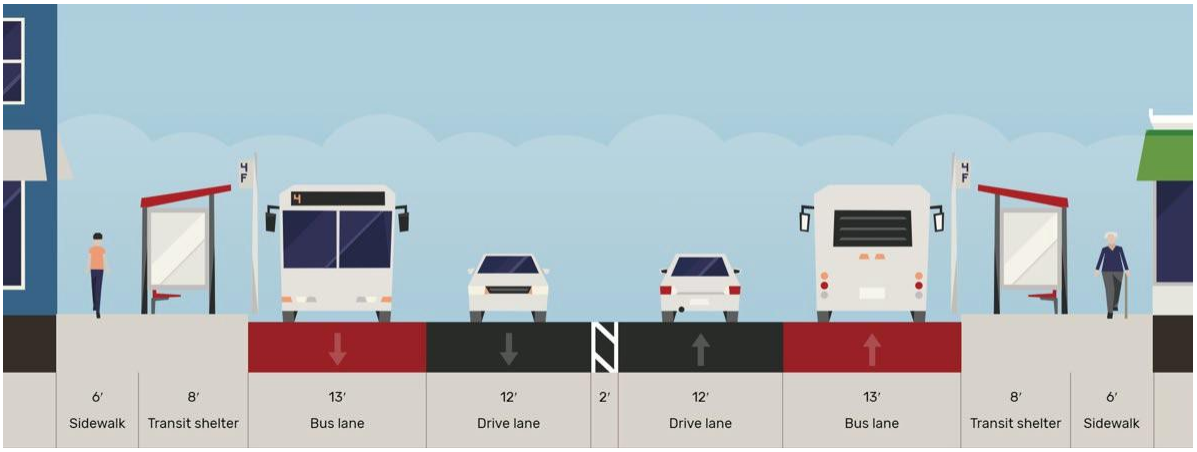
As with TSP, CDTA does not own the roads and depends on the cooperation and willingness of the roadway owner.

[29] Capital Region Bus Lane Feasibility Study (2023).

BUS LANES

Planning for bus lanes must consider road layout and capacity, congestion, and high-volume traffic, as well as opportunity costs, such as road space taken away from other purposes such as a regular travel lane, parking lane, or a bike lane. Bus lanes do not necessarily translate into exclusive lanes for bus movement only, as they can also be turn lanes (often referred to as Business Access and Transit, or BAT lanes) or shared bike lanes. Bus lanes can work in conjunction with TSP and queue jump bypass lanes for improved efficiency. CDTA and local jurisdictions will collaborate with local authorities to ensure proper enforcement of bus lane usage. **Figure 8** shows an example of a bus lane at a mid-block stop.

Figure 8: Bus Lane Concept



Bus lanes may be beneficial in similar areas as TSP and queue jump bypass lanes. Given their ability to increase bus speeds and improve reliability, bus lanes will be considered in areas with high transit volumes as well as high passenger and bus delay. Current corridors that fit this description and may benefit from bus lanes include Central Avenue and Washington/State/Broadway in Albany, State Street in Schenectady, and 3rd/4th Street in Troy (see **Figure 4** – **Figure 7**).[30] Future studies may identify additional locations based on high bus density or congestion, lower transit speeds, transfer opportunities to other routes, and potential for growth and redevelopment.[31]

Bus Stop Technology

REAL-TIME INFORMATION

Real-time customer information provides estimated next bus arrival times. CDTA will distribute real-time information updates through a variety of channels, including digital signage, websites, mobile apps, and third-party services.

[30] Capital Region Bus Lane Feasibility Study (2023).
[31] Capital Region Bus Lane Feasibility Study (2023).

Higher volume stops may incorporate fixed real-time information signs for passenger convenience. Fuller-featured signage may be provided at locations with power and communications feeds. Emerging technology options to consider, such as e-ink signage, use cost-effective solar and cellular communications approaches that significantly reduce infrastructure costs. Such signage is available in sign pole-mounted, shelter-mounted, and overhead configurations, allowing adaptations to varied site conditions and activity levels.

Audio Announcements

CDTA aims to ensure onboard audio announcements are clear, timely, and compliant with ADA regulations while minimizing unnecessary noise on the bus. On fixed-route transit systems, stop announcements will be made for every stops. Stop announcements will be made regardless of whether a passenger with a disability is onboard, and they will be completed with enough time to allow riders to pull the stop cord. Stop announcements will be short enough that they keep up with the pace at which stops are being passed. Stop announcement volume will also be set to a high enough volume that they can be heard by all customers but not so loud as to be irritating. Stop names will strike a balance between brevity for timeliness of announcements while providing enough detail to orient the listener.

Video Surveillance

Video and audio surveillance is universal on the interior and exterior of CDTA fixed-route buses, which will continue to be CDTA's standard. Video cameras have also been implemented at certain CDTA stop locations to enhance safety and security (e.g., BusPlus stops in Schenectady). Video surveillance will be provided at bus stops as needed, but will generally be limited to major transfer centers, mobility hubs, or BusPlus stops. CDTA will prioritize video surveillance in locations that are served during late night or early morning hours.[32]

Cameras and video infrastructure located at bus stops enhance passenger safety, provide timely and more accurate incident response, facilitate law enforcement investigations, provide asset protection, deter fraudulent claims, and provide real-time operational insight. The operational intentions drive the design approach and requirements of the surveillance system, as well as the CDTA and external users who require access to historical or real-time video feeds.

The installation and use of camera and video infrastructure is subject to site- and asset-specific studies and assessments. Camera installations also consider partnerships with local authorities and neighboring communities, for emergency response, privacy concerns, and prevailing video surveillance laws.

[32] MDOT MTA Bus Stop Design Guide (2019).

Service Monitoring, Data Collection, and Reporting Standards

A program of ongoing data collection, service monitoring, and reporting is critical to the effectiveness of CDTA's service standards. Standards are designed to ensure delivery of service appropriate to CDTA's mission statement and customer-focused priorities, and to continually assess the performance of the suite of services against benchmarks with clear thresholds for action.

The emphasis for monitoring is on the performance side rather than policy. This is to ensure that individual services perform at or above expectations within their categories, though adjustments are to be considered within the parameters of policy standards. For example, if a bus route exhibits below-average ridership productivity, reducing frequency is a possible corrective action, so long as the revised frequencies adhere to minimum standards for that type of service.

Performance thresholds will highlight services that do not meet standards (e.g., lower than target ridership productivity), as well as those that exceed standards. Low-performing services will be flagged for a range of potential corrective actions. High-performing services will be flagged for potential service increases, additional vehicles, and other measures to capitalize on their effectiveness.

Application of CDTA's service standards will be incorporated into quarterly service planning cycles associated with schedule changes, as well as regular reporting mechanisms such as route profiles. This way, any review of performance and service characteristics is linked to the established standards. Any new routes, however, will have a grace period in the first two years. **Table 17** outlines the trajectory of expected ridership for a new route.

Table 17: Expected Ridership of New Routes

Time from Implementation	Expected Ridership (Percent of Classification Standard)
6 months	70 percent
12 months	80 percent
18 months	90 percent
24 months	100 percent

A monitoring program will fall under the purview of a specific CDTA staff member who is responsible for:

- Ensuring collection and accuracy of data.
- Input of data into an ongoing tracking mechanism.
- Application of standards against the data to assess performance and compliance.
- Internal staff collaboration and coordination to identify and advance actions when specific. services are flagged against standards (low- and high-performers).

Finally, linking monitoring to standards, corrective actions, and reporting allows CDTA to demonstrate its commitment to continuous improvement of service quality to its internal and external stakeholders.

A recommended framework for monitoring incorporates the relevant standards and identifies data sources, frequency of review, responsible parties, and reporting. Internal reporting should highlight performance for a given timeframe (e.g., monthly in the case of typical route performance metrics) and note degree of change relative to prior report and prior year.

SERVICE STANDARDS

Table 18 provides the monitoring framework for CDTA's service standards. Data for service standards will generally be reviewed monthly or quarterly by IT and Service Planning. The exception is fixed-route coverage, which will be reviewed annually by Strategic Planning. The resulting performance reports will be assessed by CDTA to determine whether any service adjustments are needed. As noted above, services that do not meet standards may call for corrective action.

Table 18: Service Standards Monitoring

Standard or Guideline	Data to Review	Frequency of Review	Responsibility	Reporting
Fixed Route				
Coverage	US Census	Annual	Strategic Planning	Follow TDP cycles
Headways and Service Span	Route timetables, classification	Quarterly (regular service change cycle)	IT, Service Planning	Quarterly service changes
Passenger loads	APC	Monthly for all routes; more frequently as needed when known crowding occurs	IT, Service Planning	Monthly route performance report
Productivity	Farebox, operating trip reports	Quarterly (regular service change cycle)	IT, Service Planning	Quarterly service changes
On-time performance	AVL (scheduled vs. actual OTP)	Monthly	IT, Service Planning	Monthly route performance report
Additional Services				
On-Demand (FLEX)	Farebox, operating trip reports (trips completed), operating cost	Monthly	IT, Service Planning	Monthly service performance report

Standard or Guideline	Data to Review	Frequency of Review	Responsibility	Reporting
Car share (DRIVE)	Vendor reporting (usage, frequency, duration, operating cost)	Monthly	IT, Service Planning	Monthly service performance report
Bike share (CDHP Cycle!)	Vendor reporting (usage, frequency, duration, operating cost)	Monthly	IT, Service Planning	Monthly service performance report

INFRASTRUCTURE STANDARDS

Table 19 provides the monitoring framework for CDTA's infrastructure standards. These standards will be reviewed every three to five years. The responsible party will vary depending on the type of infrastructure, but Facilities will be consistently involved. These reviews will largely be reported through audits, which CDTA will examine to direct any necessary infrastructure improvements.

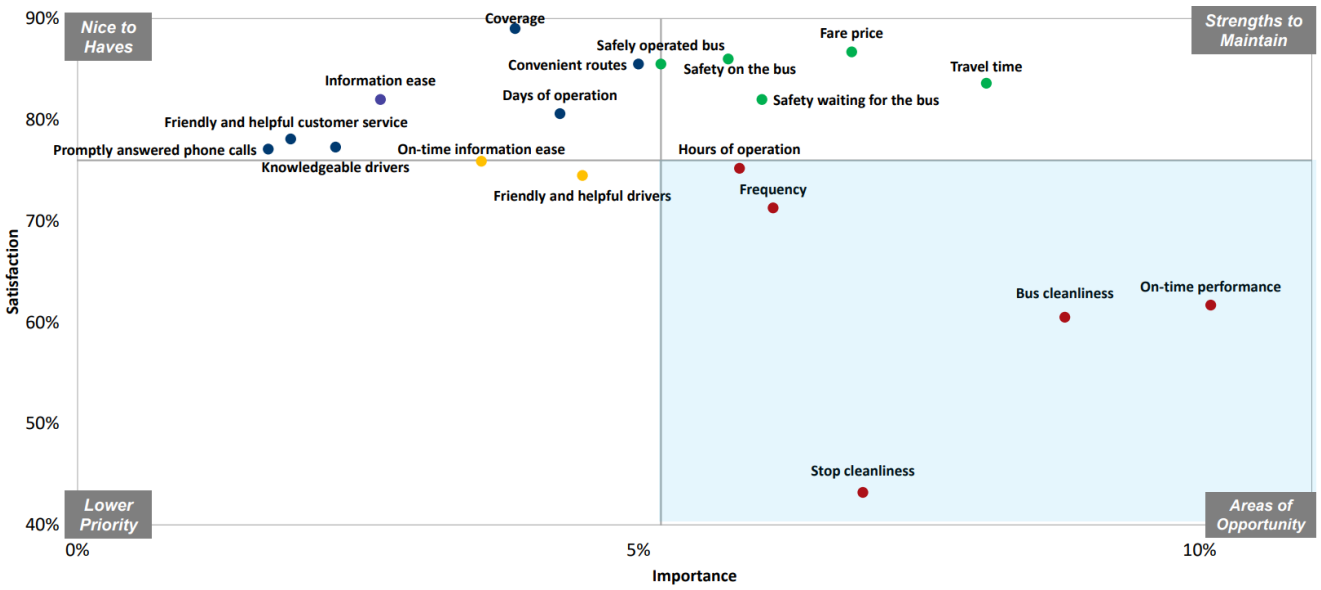
Table 19: Infrastructure Standards Monitoring

Standard or Guideline	Data to Review	Frequency of Review	Responsibility	Reporting
Stop spacing	Ridership data, geographic constraints	3-5 years	Service Planning, Strategic Planning, Facilities	TDP Update
Stop amenities	Inventory of shelters, benches, trash receptacles, customer feedback	3-5 years	Facilities	Amenities Audit
Stop infrastructure	ADA compliance, pavement condition, shelter structural integrity	3-5 years	Facilities	Stop Infrastructure Audit
Stop technology	Real-time information systems, electronic signage functionality	3-5 years	Facilities, IT	Technology Audit

PERFORMANCE BASED MANAGEMENT

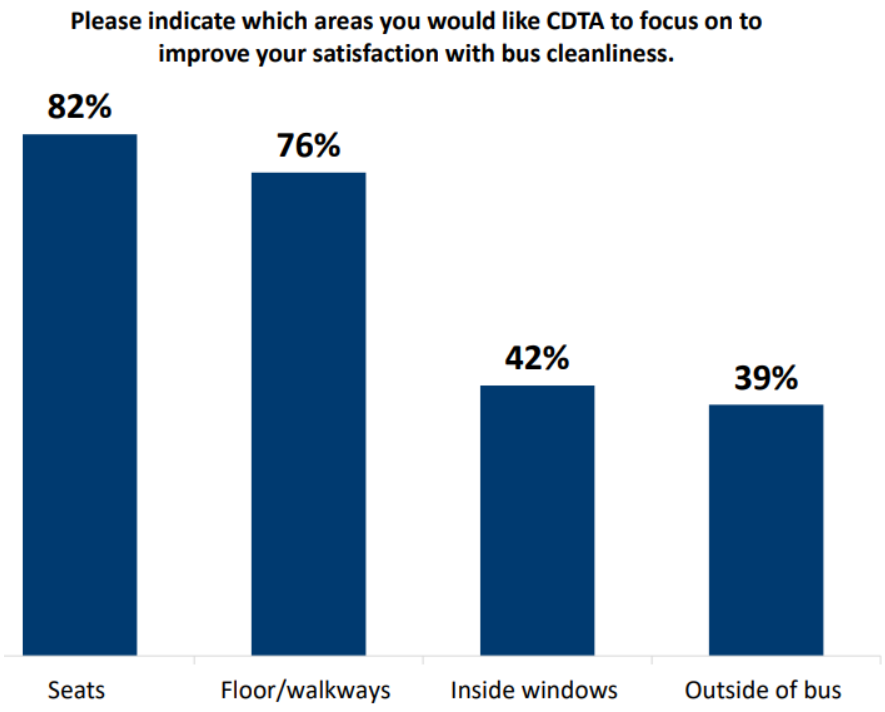
CDTA collects customer satisfaction data through customer satisfaction surveys. This data is compiled into reporting, like the "Key Driver Analysis" shown in **Figure 9**. This example reveals that CDTA performs well in areas of lower importance to customers but faces challenges in areas that customers consider important. Targeted improvements are needed in the areas that matter most to riders. CDTA regularly monitors this information to plan improvement efforts and track progress.

Figure 9: Key Driver Analysis



Further dives on each metric help plan improvements. A closer look at stop cleanliness reveals further insights, including concerns about bus cleanliness, shown in **Figure 10**.

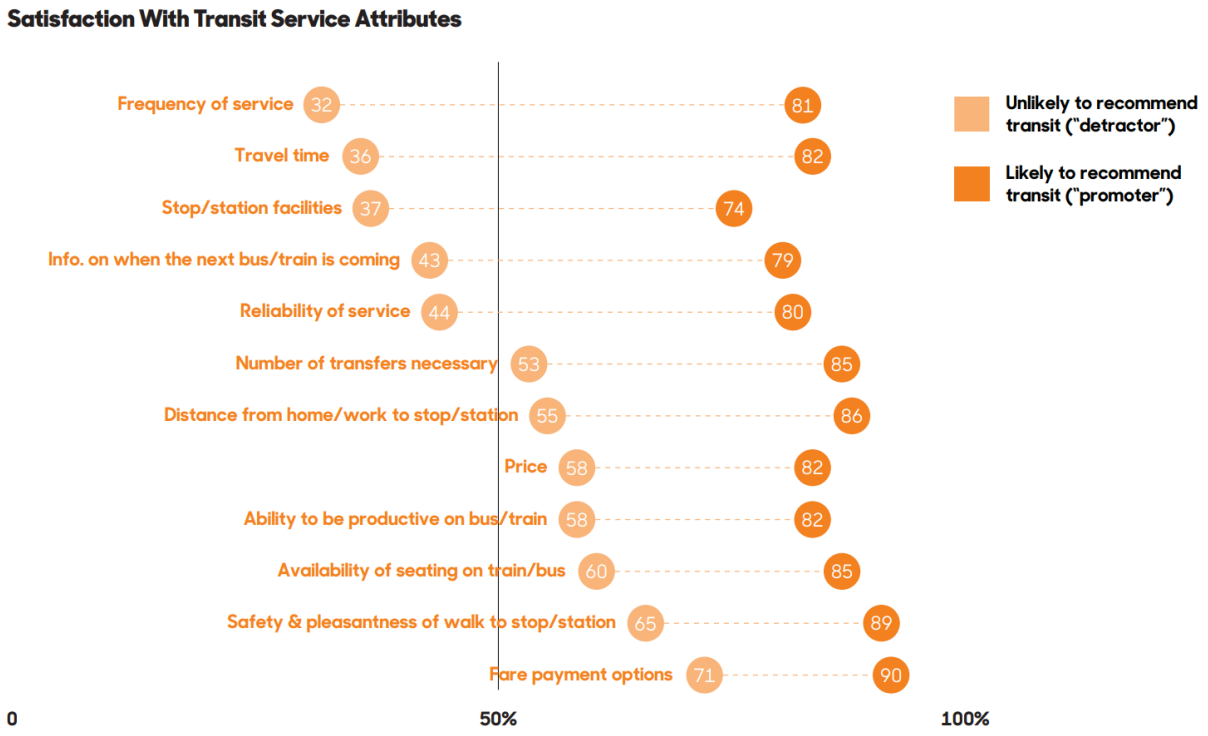
Figure 10: Customer Concerns on Bus Cleanliness



CDTA uses these surveys to set objectives at CDTA, both short-term and long-term. Going forward, CDTA will also share these findings and objectives with all CDTA employees, and, when appropriate, the public.

CDTA will also continue to test out ways of tracking customer satisfaction. For example, other studies have tracked the connection between Net Promoter Score and satisfaction with specific aspects of transit service. Tracking both points of information side by side reveals the actual importance of each factor rather than relying solely on customer estimates. See **Figure 11** below.

Figure 11: Satisfaction with Transit Service Attributes[33]



Having robust customer satisfaction data also speeds up other projects, as CDTA may already have all the public input data we need.

This information can be collected through manually collected surveys, or it can be collected passively, through surveys published online or on the Navigator app. Other third-party transit apps also collect rider survey data and offer it for a fee.

[33] Transit Center. (2019, August 13). Who's On Board. TransitCenter.org. https://transitcenter.org/publication/whos-on-board-2016/

CDTA should be careful to ensure such surveys are representative of CDTA ridership. Manually collected surveys avoid self-selection bias but are expensive to collect. They should be collected less frequently and used to establish demographics off of which passively collected surveys can be statistically corrected. It is important than CDTA also collects enough customer feedback to ensure a statistically representative sample size.

Land Use and Development Standards

This section describes the zoning code and land use standards for properties which receive transit service. Land use and transit have a positive relationship, so both CDTA and developers should aim to collocate transit and development as much as possible and design both to work together.

RESIDENTIAL DENSITY

Residential density of at least 12 people per acre is necessary to support 30-minute transit service.[34] When residential density reaches about 30 people per acre, transit service every 10 to 15 minutes is possible.[11] As detailed in the Zoning Code and Land Use Regulations, Appendix F, CDTA can work with municipalities to expand transit-supportive land use practices. This may include creating incentives for increasing building height maximums, which can allow for denser residential zones.

EMPLOYMENT DENSITY

Employment density of 10 to 20 employees per acre is necessary for 30–60-minute service.[34] Employment density of at least 20 employees per acre is necessary to support 10–15-minute local transit service.[11] Remote work may be prevalent post-COVID in areas that traditionally had high employment densities in the past. CDTA will evaluate how this impacts demand before determining level of service.

LAND USE PATTERNS

Mixed use and density put more destinations in walking distance of any one point, whether that point is a bus stop, where someone lives, where they work, or anywhere else. Transit needs such environments to succeed. Low-density, single-use zoning (especially residential only zoning) make walking for anything but recreation very unlikely. Serving a smaller area means CDTA can provide high quality, frequent service instead of low-frequency coverage service over a larger geography.

Individual lots can also be planned to support transit. Building should be placed in a lot to minimize walking distance from the bus stop to the building entrance. Parking lots should be placed in the side or rear of the building rather than in front.

Municipalities looking to support transit must also consider parking. Excessive amounts of parking reduce density, increase walking distances, and create safety hazards and unpleasant environments for walking. Since transit riders do not use parking, properties near transit need less parking, allowing more land to be devoted to profitable uses. Parking management

[34] TCRP Report 16: Transit and Urban Form, https://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_16-1.pdf

strategies include eliminating parking minimums, reducing curb cuts through access management and shared parking agreements. Properties should also include bicycle parking as transit customers also often bike.

Unbundling parking from apartment rents means a tenant rents housing through a lease and may choose to also rent parking. Doing so allows tenants who do not own a car to save money by opting out of paying for parking. This type of lease is common in Boston, Seattle, San Francisco, Bellevue, Washington, Arlington, Virginia, and many more places, but has not yet been implemented in the Capital Region to our knowledge.

Municipalities can also consider transit-oriented development overlay zones near major transit stops to encourage more development with lower or no parking requirements near transit.

CDTA will work with the Capital Region Transportation Council, New York State Department of Transportation, and local municipalities to create best practices around these types of policies and strategies. For more detail relating to zoning, refer to the Zoning Code and Land Use Regulations memo.

PUBLIC STREET DESIGNS

Public street design should focus on eliminating, minimizing, and mitigating safety hazards for vulnerable road users, especially around busy CDTA transit stops, as well as making travel convenient for transit, bicyclists, and pedestrians.

Eliminating a safety hazard means making it physically impossible or at least unlikely for a crash to occur. Sidewalks are an example of a design feature that minimizes safety hazards by providing a space for pedestrians and a curb that separates them from vehicular traffic.

Minimizing hazards means reducing their number and keeping risks low. An example of this is access management, which reduces the number of curb cuts and turning motions on a busy street, reducing conflict points.

Lastly, mitigating means making the consequences of a hazard less severe. An example of this is a speed limit reduction or lane narrowing, both of which slow cars down, so when a crash does occur, it isn't as severe. Municipalities should refer to the Capital Region Transportation Council's Vision Zero Action Plan and Complete Street Design Guide for more complete guidance.

Complete Street designs should consider efficient movement of transit vehicles through signal optimization or transit signal priority and reducing driveways to minimize turning conflicts. In areas with higher speeds (those over 40 MPH) bus pull-outs and a balanced approach to the turning radii at intersections will be considered. The turning radius should be wide enough to

allow buses to navigate corners smoothly and safely to avoid blocking traffic or endangering pedestrians on the sidewalk.

Transit, biking, and walking all reinforce one another. With the growth of e-bikes, cycling is poised to grow as a part of the transportation landscape. Good bicycle infrastructure—mainly bicycle parking, bike lanes, multi-use paths and trails—create more options for CDPHP Cycle! riders and makes better first/last mile connections to transit by bike. All transit trips include the first/last mile connection, which refers to the travel between a location and the bus stop at the start and end of a trip. If that connection is too far, dangerous, inaccessible, or unpleasant, it can hinder the viability of transit.

Pedestrian infrastructure should get customers from the bus stop to the front door of their destination conveniently and with minimal safety hazards. This means looking both at pedestrian infrastructure on the street and on individual lots.

Lastly, municipalities should build streets to create less circuitous walking and biking routes and less dead ends. This can be done without opening neighborhoods to car through traffic, which is a common goal for a typical suburban cul de sac. Examples of pedestrian and bicycle friendly connections can be found on Justin Street, Bonnie Court, and History Hills Court in Colonie, and on Myrtle Avenue in Albany between Manning Boulevard and Marion Avenue. More pedestrian permeability means more access to transit stops and more walkability. Not every street needs to be designed to facilitate a 40-foot bus. But those that aren't should be in walking distance of streets that are.

LARGE DEVELOPMENT PRIVATE STREET DESIGN

Streets that are built on private property and owned by a private entity but provide public access will be regulated at site plan review by the municipality. If a private development is to receive transit service, the following will be considered: a balanced approach to driveway and intersection turn radius, appropriate lane widths, low roadway grades (or slopes), pavement to handle vehicle loads of 20,000 pounds per axle, and proper bus passenger loading pads. Bus boarding zones and sidewalks throughout the property will meet ADA requirements to ensure the service is accessible to all riders.