

BLUE

GREEN

GREY

Conceptual Bus Stop Designs

Farmers Branch



March 5, 2020

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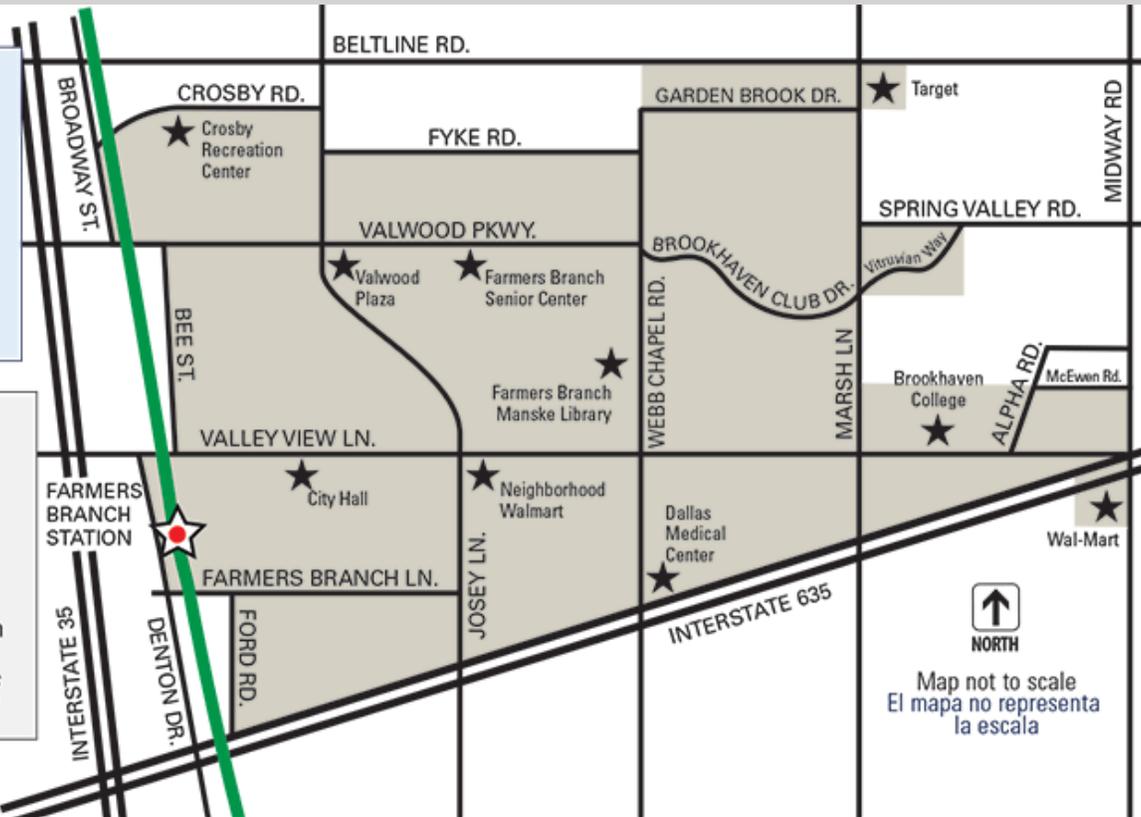
Farmers Branch Zone

Effective October 1, 2019

GoLink serves Farmers Branch Station, for connections to DART Rail and buses.

GoLink sirve la Farmers Branch Station, para conexiones a los trenes y autobuses de DART.

-  Service Area Zone
Zona del área de servicio
-  Farmers Branch Station
-  DART Green Line
-  Popular Destination (Inside Zone)
Destinos populares (Dentro de la zona)



PURPOSE

The City of Farmers Branch received a grant from NCTCOG to explore the benefits of green infrastructure at bus stops.

Many successful communities rely on their transportation systems to support the public's travel needs. In order to create connected and wide-coverage transit systems, bus stops are essential. They are placed so anyone can access transit systems from anywhere, allowing for balanced mobility across transportation systems.

If transportation systems can be balanced, why can't environmental systems? Why not take advantage of the consistency of bus stops to do both? Integrating transportation and the environment in a comprehensive bus stop design can bring many benefits to communities. Considering returns on investment, more advanced designs will bring more economic, social, and environmental benefits. The first and most obvious advantage of adding environmental components to bus stops is the effect on the environment. In order to slow down, spread out, and soak in stormwater before it enters waterways green infrastructure can be considered. By conveying water through natural treatment and retention systems rather than straight to stormwater

pipes, filtration and retention provide opportunities to improve the quality and reduce the quantity of stormwater runoff.

The second benefit of integrating green infrastructure with bus stop design is an enhancement in quality of life. Transforming bus stops to "pocket parks" makes traveling not only more comfortable, but also more enjoyable. Clean and aesthetically appealing areas will attract more people and make Farmers Branch a happier place to live.

The third benefit of Blue Green Grey bus stops is the improvement to the area's transportation system. Many suggested strategies, such as crosswalks and other traffic calming methods, are intended to make bus stops safer and easier to use. Another purpose of the bus stop design should be to pinpoint these locations as nodes of activity. Creating active spaces with transit accessibility rather than simple bus stops can enhance connectivity within the community. Advances in connectivity, safety, and quality of life could possibly encourage ridership for the transit system. The fourth advantage of

Design Changes Demand – As streets become more heavily traveled, re-purposing space for transit can dramatically increase ridership, bringing more activity to the street. Investments in transit-supportive infrastructure attract new riders and reveal latent demand for better transit service -

NACTO

enhanced bus stop designs is the generation of economic development within the area. As bus stops grow to become nodes that provide various services to visitors, new economic opportunities can arise, including residential, commercial, or institutional developments. These areas can trigger growth within communities to bring them together and strengthen their economies.

The overall implementation of sustainable infrastructure at bus stops can have many advantages. Blue Green Grey designs will enhance quality of life, increase safety, improve connectivity, support the environment, encourage ridership, and trigger economic development. Investing in smarter bus stops will bring advantages to make communities more efficient and resilient.

Farmers Branch is a perfect fit for this study as it sits close to two (2) major metropolitan cities and is serviced by Dallas Area Rapid Transit “DART”. There are seven (7) bus routes that run

through Farmers Branch and 200 bus stops. The Green Bus Stop Guidelines will directly address how to manage water quality issues at the development sites, the impact on the native and natural environment at each site, and incorporating these management practices in the day-to-day transit infrastructure. These guidelines will engage a set of criteria for these unique sites to show best practices for implementing design strategies at Farmers Branch bus stops. With these guidelines, an additional goal would lead to adaptable protocols for the development or retrofit of other transit stops in the Dallas/Fort Worth area. This guide will inform how to address future conflicts in the tightly allocated right-of-ways spaces and show how green development practices can complement bus stops and pedestrian infrastructure. The collaboration between the Blue, Green, and Grey becomes more vital each day as human impacts on the environment become increasingly evident.

(Transit) Stops are tools to attract riders, improve operational efficiency, build the brand identity of a system, and foster local economic development. Transit stops exist on a continuum, from minimal sign-and-pole stops to fully enclosed stations.

APPROACH

To plan and design systems that accomplish goals ranging from increasing ridership to improving stormwater quality, infrastructure can be divided into three sectors: blue, green, and grey. Blue represents water infrastructure, green represents environmental infrastructure, and grey represents transportation infrastructure. This design approach integrates design aspects of transportation, environment, and water to create comprehensive systems that benefit communities socially, economically, and environmentally. Blue, green, and grey criteria were established to serve as a starting point for considerations when designing bus stops.

These ideas were utilized in order to select design concepts for the three selected bus stops in Farmers Branch. The purpose of this project is to create a standard to which bus stops should be designed, but it should be noted that design concepts are not limited to the ideas suggested in this report. Advances in technology and innovation will bring additional opportunities to enhance systems.

The Blue Green Grey approach also requires participation from multiple departments, creating a collaborative approach to plan connected, efficient systems. Possible departments could include Engineering, Streets/Drainage Design & Maintenance, Landscape Design & Maintenance, Construction, ADA Compliance, Transit Planning, Land Use Planning, and GIS. Because there are so many parties that can be involved, there are numerous project triggers to plan and design efficient bus stops. Some examples include:

- Comprehensive Planning
- Transit Master Planning
- Thoroughfare Planning
- Site Development Application
- Economic Development Planning
- DoT System Planning
- Environmental Planning
- Parks/Trails/Open Space Planning

Once a bus stop project has been established, specific objectives should be identified in order to determine areas of focus and the site's overall purpose. Water

goals could include enhancing water quality and decreasing runoff volumes. Transportation goals might include increasing ridership and improving connectivity. Environmental goals could include using zero net energy or improving air quality. A Blue Green Grey approach will include objectives from all three sectors to create a comprehensive system that accomplishes goals in numerous focus areas.

Based on the identified goals, a team should be formed that covers all departmental needs. Specific roles and lines of communication should be established. An evaluation of the site can be completed to determine existing conditions. Considerations should include potential visitors, accessibility, future development, flood risks, access to utilities, possible constraints, and any other factor that might affect the design. Long term maintenance of the site is also a major factor.

The final planning stage is concept selection. Evaluating all blue, green, and grey criteria, determine which concepts can be applicable to the site. It is important to be open-minded and consider all possibilities during this stage. Once a list of possible design concepts has been formed, each method should be thoroughly examined. The project team should consider feasibility, costs, timeline, operation and maintenance, stakeholders, and possible advocates. Based on these considerations, the list of design concepts can be refined to complete a conceptual plan for the bus stop.

Sustainable Return on Investment for Bus Stop Retrofit Sites

After the concept stage in addition to a concept cost estimate for the improvements, a high level evaluation of the potential sustainable return on investment for each of the case study sites was performed. This was done in order to determine economic, social, and environmental benefits associated with a full implementation of each retrofit. The return on investment metrics evaluated for each site include the following:

1. Property Values
2. Tree Canopy Ecosystem Services
3. Trash Management
4. Stormwater BMP Ecosystem Services

EVALUATION OF SITE

Blue Green Gray Bus Stop Design				
Blue				
Conservation	Public Water	Water Quality	Data	
<ul style="list-style-type: none"> Rainwater Harvesting/Irrigation 	<ul style="list-style-type: none"> Bottle Filling Stations 	<ul style="list-style-type: none"> Hydrodynamic Separator Bioswale/Bioretenion Shared Use with Development Floatables/Debris Management 	<ul style="list-style-type: none"> Meteorological Pounds of Trash and Debris Influent and Effluent Monitoring Plastic Bottles Not Used Greywater Quantity vs. Potable Water Use for Irrigation 	
Green				
Ecology	Air, Climate, and Energy		Public Space	
<ul style="list-style-type: none"> Community Gardens Pollinators Native Species Drought Tolerant Plants Riparian Corridor Restoration Reduced Light Pollution Lighting Reduced Fertilizers/Pesticides Other 	<ul style="list-style-type: none"> Low Albedo Surfaces Air Flow Management Cool Roofs Vegetated Canopy Structural Canopy Solar Panels Emissions Reduction Air Filtration Carbon Sequestration Other 		<ul style="list-style-type: none"> Shared Use Landscaped Areas Living Laboratories Digital Displays User Tracking/Apps/Rewards Linked System Data Tracking System Wide Branding/Messaging Continuous User Feedback/Tracking Other 	
Gray				
Balanced Mobility	Safety	Health	Programming	Economic Vitality
<ul style="list-style-type: none"> Accessibility Other 	<ul style="list-style-type: none"> Crosswalk/Side-walk Enhancements Video/Police/Fire Connectivity Visual Based Traffic Calming Other 	<ul style="list-style-type: none"> First Mile/Last Mile Waste Management Comfort Noise Reduction Other 	<ul style="list-style-type: none"> Bike Storage Vendors Digital Media Systems Site Furniture Lighting Systems Wayfinding, Trails, Commercial, Institutional Charging Stations Corporate Programs for Ridership Other 	<ul style="list-style-type: none"> Site Enhancement/Shared Use Reward Program Tie In Community Branding Vendors, Food Trucks, etc. Revitalization Other

Above: Approach to plan and design systems for Farmer's Branch bus stops.

BLUE

Water



Above: Right-Of-Way-in Brooklyn, NY.

Blue infrastructure focuses on stormwater and public water. Water is a valuable resource and it is important that communities implement strategies to control and manage water. Integrating green stormwater infrastructure at bus stations will ideally create a standard for stormwater management that can be consistently applied across communities at each bus stop. The water sector has been split into four sections: conservation, public water, water quality, and data collection.

CONSERVATION

Conservation of water should focus on collection and reuse. Rainwater harvesting is a valuable conservation strategy that can be carried out on site. Using harvested rainwater to provide irrigation to local vegetation not only reduces the need for potable water, but it also reduces stormwater runoff.

PUBLIC WATER

Providing water to the public can be an attractive design feature. This could include water fountains or bottle filling stations. Special considerations for this category might include connections to public utility lines and monitoring for leaks.

Blue Infrastructure Strategies	
Conservation	
	<i>Method Description</i>
Rainwater Harvesting/Irrigation	Cistern/Vault Collects Runoff from Site and Shelter
Other	
Public Water	
	<i>Method Description</i>
Bottle Filling Stations	Public Bottle Filling Station Integrated into Shelter
Other	
Water Quality	
	<i>Method Description</i>
Hydrodynamic Separator	Water Quality Inlet and Proprietary Device for Pre-Treatment Upstream of Bioswale
Bioswale/Bioretenion	Bioswales Collecting and Treating Runoff from Water Quality Inlet
Shared Use with Development	Bioswales Collect Water Quality Volume from Adjacent Development
Floatables/Debris Management	Onsite Waste and Recycling Collection
Other	
Data	
	<i>Method Description</i>
Meteorological	Temperature/Rainfall Monitoring
Pounds of Trash and Debris	Smart Trash Can / Constant Monitoring / Collection Efficiency
Influent and Effluent Monitoring	Water Quality Data from BMP Discharge
Plastic Bottles Not Used	Counter from Bottle Filling Station
Greywater Quantity vs. Potable Water Use for Irrigation	Metered Cistern/Vault
Other	

WATER QUALITY

There are multiple strategies that can be utilized to treat stormwater on site. Proprietary systems such as hydrodynamic separators can be used to remove trash and floatable debris along with suspended solids from stormwater runoff. Bioswales and bioretention cells can retain, infiltrate, and treat runoff to improve water quality in receiving streams. Floatables and debris management is another strategy that can be employed to reduce trash and any other harmful pollutants.

One significant consideration for water treatment is the concept of shared use with adjacent developments. Sharing these treatment and storage strategies with adjacent developments can help to maximize utilization and efficiency.

DATA COLLECTION

Collecting data is helpful to quantify water quality and conservation benefits from the implemented strategies. Displaying some of this data to the public can illustrate

the importance of green infrastructure and serve as a form of public education and awareness.

Examples of possible data to collect and display include:

- Meteorological data
- Amount of trash and debris treated
- Influent and effluent stormwater flows
- Plastic bottles saved from water filling station
- Potable water conserved from greywater reuse



Above: Solar panels providing shade at a bus stop.

GREEN

Environment

Green infrastructure concentrates on preserving and restoring the environment. Bus stations can be used as a widespread model of how to implement green infrastructure to benefit the environment. Public spaces can support ecosystems by serving as habitats for native vegetation and certain animal species. Some design concepts also allow for the environment to be utilized to improve air quality, reduce the urban heat island effect, and produce energy. The green sector has been split into three sections: ecology, air/climate/energy, and public space.

Green Infrastructure Strategies

Ecology

	<i>Method Description</i>
Community Gardens	Shared Gardens for the Benefit of the Community
Pollinators	Animals that Naturally Fertilize Flowers Through Movement of Pollen
Native Species	Native Vegetation Requiring Minimal Maintenance
Drought Tolerant Plants	Plants Tolerant of Dry Conditions
Riparian Corridor Restoration	Structural and Ecological Restoration of Stream Banks to Prevent Erosion and Damage to Habitats
Reduced Light Pollution Lighting	Low Emittance Lighting to Reduce Light Pollution
Reduced Fertilizers/Pesticides	Effort to Limit Usage of Harmful Chemicals on Site
Other	

Air, Climate, and Energy

	<i>Method Description</i>
Low Albedo Surfaces	Surfaces that Reflect Minimal Solar Radiation
Air Flow Management	Manipulating Air Flow to Control Local Temperature at Bus Stop
Cool Roofs	Roofs with High Solar Reflectance to Mitigate Heat
Vegetated Canopy	Vegetated Cover to Provide Shade and Absorb Rainwater
Structural Canopy	Structural Cover to Provide Shade
Solar Panels	Photovoltaic Panels Utilizing Sunlight as a Source of Energy
Emissions Reduction	Cleaner Sources of Fuel, Electric-Powered Buses
Air Filtration	Increased Tree Coverage On Site
Carbon Sequestration	Capture and Underground Storage of Atmospheric Carbon Dioxide
Other	

Public Space

	<i>Method Description</i>
Shared Use Landscaped Areas	Landscaped Green Space for Public Enjoyment
Living Laboratories	
Digital Displays	Solar/Battery-Powered Screens Exhibiting Local Shops/ Restaurants, Transit Information, Local Weather, And Scientific Data Related to the Bus Stop's BGG Strategies
User Tracking/Apps/Rewards	Application-Based Reward Program for Transit Users at the Bus Stop
Linked System Data Tracking	Smart Technology Sharing Data from Monitor Equipment, Real-Time Bus Routes, and Other Technology On Site
System Wide Branding/Messaging	Consistent Branding through Signage and Advertising
Continuous User Feedback/Tracking	Conducting Surveys and Tracking Data to Monitor Usage and User Satisfaction

ECOLOGY

There are numerous strategies than can be implemented at bus stops to support local ecology. Community gardens can be planted to diminish the impact of food deserts, provide fresh and affordable food to local customers, and encourage community activity. Native plant species, pollinator gardens, drought tolerant plants, and riparian corridor restorations are also smart landscaping choices that will create a strong ecological area. Reduced fertilizers and pesticides can prevent excessive nutrient concentrations in air and soils. Light pollution around the bus stop should be another consideration.

Below: A community garden is an example of a public space supporting an ecosystem.



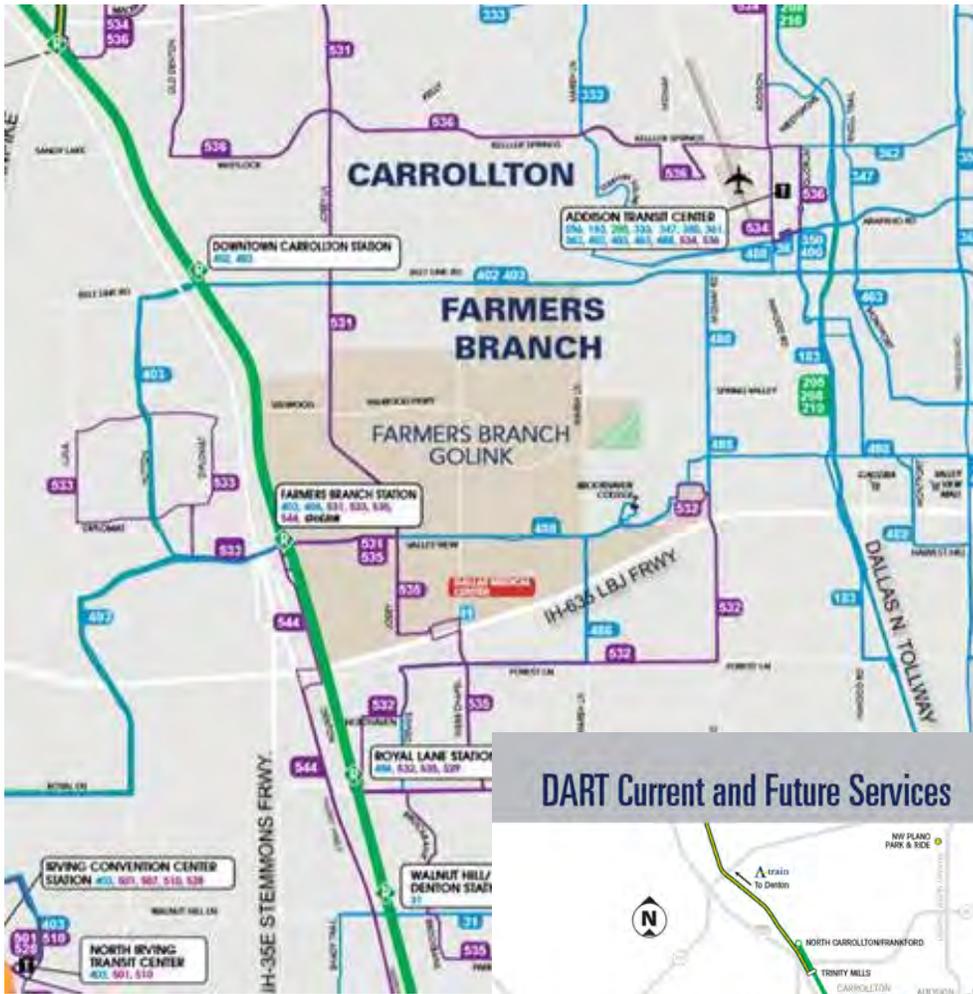
AIR/CLIMATE/ENERGY

Air, climate, and energy can affect local habitats as well as the health and comfort of any visitors at the bus stop. The urban heat island effect can be reduced through techniques such as low albedo pavements, cool roofs, vegetated or structural canopies, and air-flow management. Solar panels can store and generate energy to provide efficient lighting or display systems. Air filtration, emissions reduction, and carbon sequestration technologies are additional ways to improve the air and climate in the vicinity of the bus stop.

PUBLIC SPACE

Public space considerations should include strategies to enhance and complement the area. Rather than designating bus stops to be used solely for transit users, the stations could serve as shared use landscaped areas, plazas, or gathering spaces. Digital displays or information kiosks could show local weather, real-time bus routes, local shops and restaurants, or even information on water or air quality in the area. Linked system data tracking, monitoring systems, and user feedback can provide crucial information and data. User tracking and rewards technology through apps or computer systems could supply an incentive to visit the area. System-wide branding or messaging is another consideration to appeal to the public and attract visitors.

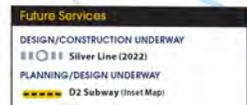
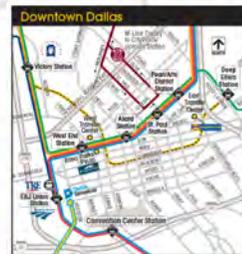
The City of Farmers Branch Community Garden is an example of a community space supporting an ecosystem. The Community Garden is located within the DART Go Link service area and while not located directly on a bus route, the garden is within a half mile walk of routes 535 and 488.



DART Current and Future Services



Current and future system maps for Farmers Branch and the rest of the DFW region can be found at www.DART.org



GREY

Transportation Infrastructure

Grey infrastructure examines all aspects of public transportation. This can include anything that affects the public, such as safety issues or accessibility. As bus stops are an integral part of transportation systems, this sector has many considerations related to improving the overall transit experience. The grey sector has been divided into five sections: balanced mobility, safety, health, programming, and economic vitality.

BALANCED MOBILITY

From a transportation perspective, the bus stops should be easily accessible and well-connected. Accessibility should be a priority to allow for anyone to access transit at anytime. Considerations for this category might include ADA requirements and route frequencies.

SAFETY

Safety measures are essential and can be implemented in numerous different ways. Crosswalks can allow pedestrians to safely cross busy roadways, and other traffic-calming techniques such as medians or bulbouts can be used to slow traffic. Video surveillance as well as connectivity to police and fire stations are other helpful tools to augment safety measures.



Above: A modern bus stop with different programming elements.

HEALTH

Public health is important when considering impacts on the community. The First Mile, Last Mile concept encourages active transportation, such as biking or walking, to and from bus stops. Waste management is a factor to consider in order to reduce pollutants. Noise reduction methods and other similar design concepts can contribute to transit-users' overall comfort levels.

PROGRAMMING

Programming refers to any physical design concept that can make the public's experience at the bus stop more convenient. There are numerous programming features that could be implemented at bus stops;

some examples include bike racks, vendors, digital media systems, site furniture, lighting systems, signage, nearby trails, charging stations, or corporate programs for ridership.

ECONOMIC VITALITY

Economic vitality is a major benefit of innovative bus stop design. Revitalizing sites and designating them as shared-use rather than transit-only brings more activity and growth to these areas. Vendors and food trucks are attractive options for park-like gathering areas. Reward programs and community branding could also be used to support the local economy.

Gray Infrastructure Strategies	
Balanced Mobility	
	<i>Method Description</i>
Accessibility	Barrier-Free, Accessible Connections to Streets, Sidewalks, and Pedestrian Paths
Test	Monitor Route Frequencies and Compliance with ADA Requirements
Other	
Safety	
	<i>Method Description</i>
Crosswalk/Sidewalk Enhancements	Proper Placement of Crosswalks to Ensure Safe Crossing on Busy Roads
Video/Police/Fire Connectivity	Video Surveillance and Emergency Connectivity to Police/Fire Stations
Visual Based Traffic Calming	Slowing Traffic via Medians/Roundabouts
Other	
Health	
	<i>Method Description</i>
First Mile/Last Mile	Active Transportation Modes (Biking/Walking) to Bus Stops
Waste Management	Double/Triple Stream Recycling Bins and Waste Collection
Comfort	Comfortable Benches, Leaning Rails, Weather-Proof and Shaded Shelters
Noise Reduction	Enclosed Shelters, Noise Barriers, Nearby Tree Canopies
Other	
Programming	
	<i>Method Description</i>
Bike Storage	Bike Racks
Vendors	Markets, Stands, Food Trucks
Digital Media Systems	Solar/Battery-Powered Screens Exhibiting Local Shops/Restaurants, Transit Information, Local Weather, And Scientific Data Related to the Bus Stop's BGG Strategies
Site Furniture	Benches and Leaning Rails
Lighting Systems	Solar/Battery-Powered Lighting Fixtures
Wayfinding/Trails/Commercial/Institutional	Signs and Transit Maps Including Distinctive Locations e.g. Trails, Commercial, and Institutional Destinations
Charging Stations	On Site Solar USB Charging Stations
Corporate Programs for Ridership	Employer/School Transit Pass Programs
Other	
Economic Vitality	
	<i>Method Description</i>
Site Enhancement/Shared Use	Economic Growth Opportunities Via Converting A Transit Spot to a Shared Use Site
Reward Program Tie In	Loyalty Points Program for Bus Travelers
Community Branding	Enhance Branding Through Design Emphasis on Community Character
Vendors, Food Trucks, etc.	Retail and Commercial Development
Revitalization	Enhance Area Viability and Existing Businesses
Other	

FARMERS BRANCH BUS STOPS EVALUATED IN BLUE GREEN GRAY STUDY



LUNA AT MERCER CROSSING
(NORTHBOUND LANES)



LUNA AT VALLEY VIEW
(NORTHBOUND LANES)



LUNA AT MERCER CROSSING
(SOUTHBOUND LANES)



JOSEY AT VALLEY VIEW
(SOUTHBOUND LANES)



LUNA AT WHITTINGTON
(SOUTHBOUND LANES)



JOSEY AT VALLEY VIEW
(NORTHBOUND LANES)



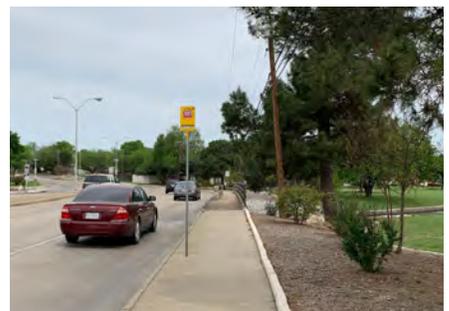
LUNA AT WHITTINGTON
(NORTHBOUND LANES)



JOSEY AT GOLFING GREEN
(SOUTHBOUND LANES)



LUNA AT VALLEY VIEW
(SOUTHBOUND LANES)



JOSEY AT GOLFING GREEN
(NORTHBOUND LANES)

SELECTED SITES

Three conceptual bus stop designs are presented for consideration. Each of the designs was developed with City of Farmers Branch and DART staff input in order to showcase possible benefits when green infrastructure is used to enhance an existing bus stop. The conceptual bus stop designs should not be considered requirements or recommendations by the City of Farmers Branch or by DART.

- The goal of creating conceptual designs is to encourage additional collaboration and discussion at the local level. These designs show potential opportunities that exist if and when different departments and agencies are given the opportunity to work together towards common goals.
- The three designs include Stormwater Best Management Practices recommended to improve water quality. These recommended Stormwater Quality Best Management Practices might require policy and/or regulatory changes prior to being implemented.

- The concepts presented are meant to move the conversation between city departments and DART forward and not to be the final word on green bus stop design in the City of Farmers Branch or within the DART Service Area.

Farmers Branch, Texas is a small town in the Dallas Fort Worth Metroplex with a growing residential population. Since the 2010 Census the population has increased by 10,000 people and based on current development trends population growth is expected to continue. New residential homes are under construction on the Westside and mixed use redevelopment is occurring in other areas at different scales. Farmers Branch has a large daily increase in population of workers. According to the 2015 Longitudinal Employer-Household Dynamics data provided by the US Census Bureau, among all cities in Dallas County the only one with a higher ratio of jobs to residents was Addison. The Farmers Branch Ratio is 1.88.

Public Transportation is operated by Dallas Area Rapid

Transit (DART). Farmers Branch is one of thirteen (13) DART member cities that voted to create and fund the transit agency with a one-cent sales tax. DART operates several services for transit users in the city of Farmers Branch including bus routes and light rail service. There are seven different bus routes that serve Farmers Branch with approximately 200 bus stops.

Ten Stops were selected for review in this study of how green infrastructure can be incorporated at a bus stop. Of the ten bus stops reviewed, three bus stops, one from each area, were selected and a more detailed design developed for a green bus stop (Sites 1, 2, and 3). The selection and designs are based ideas and discussions with City of Farmers Branch and DART Staff at meetings in April of 2019.

The selected bus stops provide examples of three types of circumstances: new development, public space and existing development. The designs take into consideration their surrounding conditions to realistically illustrate what can be expected from a Blue Green Grey bus stop design.



SITE 1 *NEW DEVELOPMENT CONCEPT*

Luna Road & Valley View Lane

Site 1 is a bus stop in the west side of Farmers Branch, southwest of the intersection of Luna Road and Valley View Lane. The lots on the southern side of Valley View Lane are undeveloped, which means there is a high potential for a comprehensive design. As the demand for development

increases, it is likely that development will occur soon on the land southwest and southeast of the intersection. North of Valley View Lane, commercial and industrial developments occupy most of the land. The current bus stop contains a bench, a sign, and a waste bin.

One benefit of the lack of development in the area is the freedom to design the bus stop with minimal limitations. Any infrastructure can be factored into the design of future developments. Anticipating the new developments,

another major opportunity is a shared use stormwater design. This essentially means that the stormwater runoff from the public right of way and the developed properties can be directed to one public stormwater infrastructure system. Sharing stormwater infrastructure between public and private entities efficiently manages and treats runoff from roofs, streets, and other paved areas.

To accomplish a shared use design, this would require an agreement with developers, which may pose a challenge.

Another possible constraint related to the shared use concept is regulating maintenance and operation of bus stop infrastructure, such as bioswales, bioretention cells, and proprietary devices.

The future development site area provides opportunities for shared stormwater infrastructure targeting runoff water quality management. Shared use stormwater infrastructure system can include a series of bioswales located on the rear side of the bus stop. Stormwater runoff from adjacent roads and developments can be collected and directed by a water quality inlet to the bioswales. The water quality inlet can be connected to a hydrodynamic separator to provide runoff pre-treatment before entering bioswales for

enhanced pollutant removal. Hydrodynamic separators capture solids, floatable pollutants, and oil and fuel spills at a relatively simple and low-cost maintenance. This bioswale system would thereby reduce runoff volume and enhance stormwater quality from existing and future private and public developments.

The integration of the shared use stormwater infrastructure and the typical enhancements to this bus stop would create a unique location that has the opportunity to educate uses about the need for these enhancements. Incorporating stormwater facilities at transit stops introduces new opportunities for mutual benefits and inter-agency collaboration, unlocking new project funding sources and leveraging complementary resources.



- 1 Current bus stop. This stop is located completely within the street ROW and does not have a current connection to a sidewalk
- 2 Existing Street Right Of Way. This area is large enough to accommodate green infrastructure best practices to benefit both the private development and the bus/road system.
- 3 Commercial Property: Connections to the future development and the bus stop will be necessary





1 *Enhanced Bus Stop*

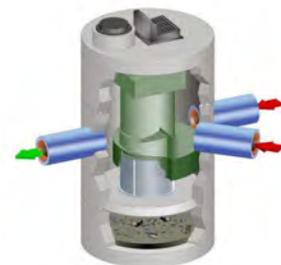
Bus stops within the City of Farmers Branch should meet the minimum requirements for special design set forth in the appendix of this report and recommended by NACTO.



Redmond California

2 *Water Quality Inlet*

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate.



Storm Water Solutions

3 *Bioswale & Enhanced Landscape*

Bioswales are linear channels designed to concentrate and convey stormwater runoff while removing debris and pollution. Bioswales can also be beneficial in recharging groundwater. Bioswales are typically vegetated, mulched, or xeriscaped.



Cornell University

4 *Trail/Sidewalk*

Integrating a trail/sidewalk adjacent to the bus stops is key for connectivity for users. Considerations should be taken when possible to design bus stops and sidewalks as separate facilities to avoid conflicts with circulation.



NACTO

5 *Existing Infrastructure*

When implementing enhanced bus stops existing infrastructure should be considered and tied into when possible. It is not the intent of this strategy to replace existing infrastructure, rather enhance it and improve the efficiencies of its use. Coordination with transit operators during the design phase will ensure that design and configuration of stormwater facilities does not conflict the current transit fleet, or potential future operational changes.



Conceptual Cost Estimate:

Enhanced Bus Stop	\$25,000-\$50,000
Water Quality Inlet	\$5,000
Bio Swale & Enhanced Landscape	\$15,000 - \$25,000
Trail/Sidewalk	\$5,000 - \$8,000
Tie into Existing Infrastructure	\$5,000 - \$8,000

*Carbon Sequestration, Air Pollution Removal, Energy Savings, and Stormwater Savings Combined - Source <https://www.texas-trees.org/wp-content/uploads/2019/04/Urban-Forest-report.pdf>
 **https://www.nrdc.org/sites/default/files/oce_13082701a.pdf. These include the cost to communities for waterway cleanups, street sweeping, stormwater capture devices, storm drain cleaning and maintenance, manual cleanup, and public education.
 \$11.20 is a 2013 value. BLS inflation = 1.09
 ***Bioretention/Bioswale stormwater management value range from NCTCOG Economic and Environmental Benefits of Stewardship <http://eebs.nctcog.org/user-guide.html>

Potential Sustainable Return on Investment

Site Data	Quantity	Unit Cost Value	Annual Value
Real Estate Area Enhanced	45,000 sf commercial	\$23.00 sf/yr	\$1,035,000 (rental)
Real Estate Value Enhancement (%)	20%	\$27.60 sf/yr	\$1,242,000 (rental)
Tree Canopy Ecosystem Services*	0.25 acres	\$505 per acre/yr	\$126
Trash Generation Managed	5 acres	25 lbs/acre/yr	125 lbs/yr
Social Value of Trash**	5,000 (population impacted)	\$12.21 capita/yr	\$61,050
Stormwater BMPs (acre)***	0.34 acres	\$1,050 to \$4,730 per acre	\$357 to \$1,608



SITE 2

PUBLIC SPACE CONCEPT

***Josey Lane & Golfing
Green Drive***

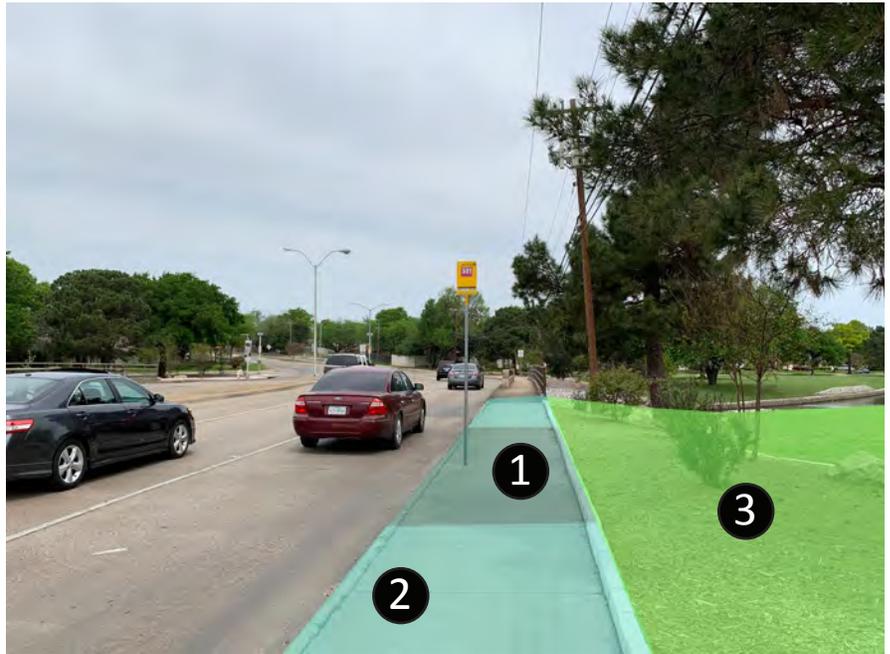
Site 2 is a bus stop in the central section of Farmers Branch, in a green space southwest of the intersection of Josey Lane and Golfing Green Drive. The bus stop is located south of Rawhide Park, a linear park that follows Rawhide Creek. This is a managed city park that is very well-perceived by the community. Currently, the bus stop is signified by a sign along the sidewalk. The city owns the land around the bus stop, which includes almost an acre of green space.

Access to the city's trail system and close proximity

to downtown establish this bus stop as an area with high connectivity. Located near an already existing park, this bus stop has the opportunity to become a public gathering space that local residents and park-goers can enjoy. Maintenance and educational programs are another opportunity that can involve the community and local businesses.

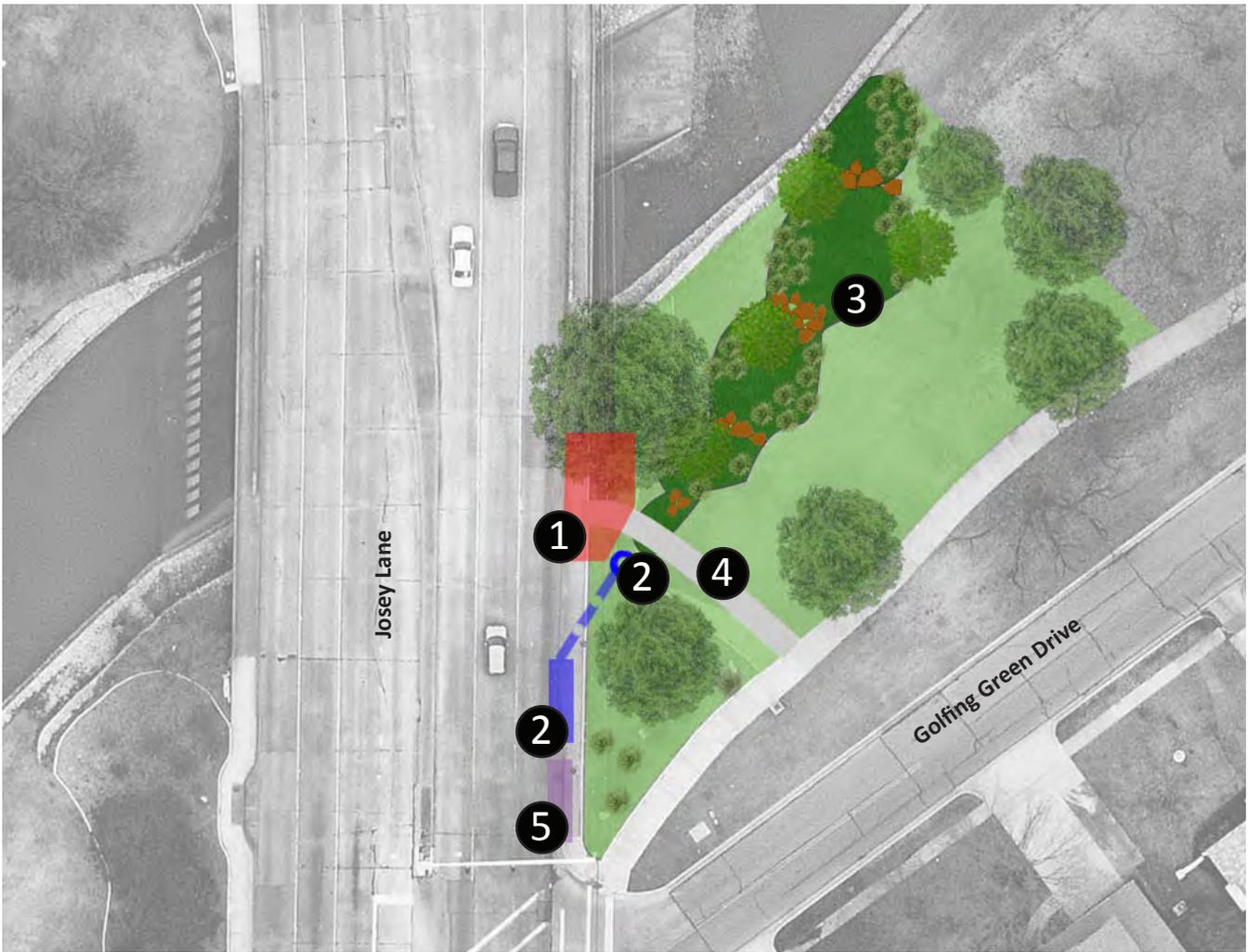
Constraints for this site include existing trees, landscaping, water and sewer lines, and electric lines. Integrating existing infrastructure is also a challenge for this location.

The bridge conveys stormwater south to an existing stormwater inlet at a sag in the road near the intersection of Josey Lane and Golfing Green Drive. The recommendation for improving stormwater management along Josey Lane is to construct an additional inlet (north of the existing inlet) that should capture the first flush of contaminated stormwater. This flush of water should be directed to a hydrodynamic separator, where debris and trash can be removed from the water. The hydrodynamic separator should discharge to a bioswale that filters and slows stormwater, directing flow to Rawhide Creek. This is also a viable option for stormwater along Golfing Green Drive.



- 1 Current “grandfathered” bus stop. This stop is located completely within the street ROW and on an existing sidewalk.
- 2 Existing Street Right Of Way
- 3 City Park Property: With limited room within the ROW to enhance this bus stop, the potential to coordinate with the city to improve both the park and the bus stop exists at this site.





1 *Enhanced Bus Stop*

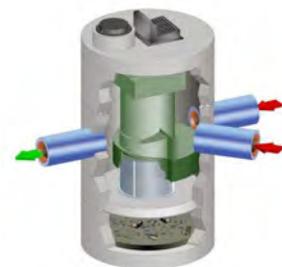
Bus stops within the City of Farmers Branch should meet the minimum requirements for special design set forth in the appendix of this report and recommended by NACTO. This bus stop has the potential to be built in coordination with park and stormwater improvements on city property.



Redmond California

2 *Water Quality Inlet*

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate.



Storm Water Solutions

3 *Bioswale & Enhanced Landscape*

Bioswales are linear channels designed to concentrate and convey storm water runoff while removing debris and pollution. Bioswales can also be beneficial in recharging groundwater. Bioswales are typically vegetated, mulched, or xeriscaped. The bioswale at this site has the potential to flush a significant amount of runoff from Josey Lane that otherwise enters Farmers Branch Creek straight from the storm system.



Cornell University

4 *Trail/Sidewalk*

Integrating a trail/sidewalk adjacent to the bus stops is key for connectivity for users. Considerations should be taken when possible to design bus stops and sidewalks as separate facilities to avoid conflicts with circulation. Site 2 has the potential to incorporate a park trail and respite adjacent to the bus stop.



NACTO

5 *Existing Infrastructure*

When implementing enhanced bus stops existing infrastructure should be considered and tied into when possible. It is not the intent of this strategy to replace existing infrastructure, rather enhance it and improve the efficiencies of its use. Coordination with transit operators during the design phase will ensure that design and configuration of stormwater facilities does not conflict the current transit fleet, or potential future operational changes.



Conceptual Cost Estimate:

Enhanced Bus Stop	\$25,000-\$50,000
Water Quality Inlet	\$5,000 - \$7,000
Bio Swale & Enhanced Landscape	\$25,000 - \$40,000
Trail/Sidewalk	\$5,000 - \$8,000
Tie into Existing Infrastructure	\$6,000 - \$9,000

*Carbon Sequestration, Air Pollution Removal, Energy Savings, and Stormwater Savings Combined - Source <https://www.texas-trees.org/wp-content/uploads/2019/04/Urban-Forest-report.pdf>
 **https://www.nrdc.org/sites/default/files/oce_13082701a.pdf. These include the cost to communities for waterway cleanups, street sweeping, stormwater capture devices, storm drain cleaning and maintenance, manual cleanup, and public education.
 \$11.20 is a 2013 value. BLS inflation = 1.09
 ***Bioretention/Bioswale stormwater management value range from NCTCOG Economic and Environmental Benefits of Stewardship <http://ebs.nctcog.org/user-guide.html>

Potential Sustainable Return on Investment

Site Data	Quantity	Unit Cost Value	Annual Value
Real Estate Area Enhanced	17,424 sf	\$170 sf	\$2,962,080 (taxable value)
Real Estate Value Enhancement (%)	20%	\$204 sf	\$3,554,496 (taxable value)
Tree Canopy Ecosystem Services*	0.25 acres	\$505 per acre/yr	\$126
Trash Generation Managed	11 acres	25 lbs/acre/yr	275 lbs/yr
Social Value of Trash**	5,000 (population impacted)	\$12.21 capita/yr	\$61,050
Stormwater BMPs (acre)***	1.3 acres	\$1,050 to \$4,730 per acre	\$1,365 to \$6,149



SITE 3 *EXISTING DEVELOPMENT CONCEPT*

*Josey Lane and Valley
View Lane*

Site 3 is a bus stop in the central section of Farmers Branch, northwest of the intersection of Josey Lane and Valley View Lane. Located in the “downtown” area of Farmers Branch, this bus stop is highly active. Some of the popular destinations surrounding the station include Dollar Tree, First Cash Advance, Jefferson Dental Care, McDonalds, Panda Express, Walgreens, and Walmart. Because this area is already developed, implementation of the bus stop design will need to be retrofit based on existing development.

The regions surrounding Site 3 has been designated as the “Four Corners” of downtown Farmers Branch. There have been multiple studies and comprehensive plans to increase development in the area. Farmers Branch City Council adopted the Four Corners Vision Plan in 2008, which aims to transform this area into a mixed-use environment that supports retail, residential, and office spaces. In this report, community feedback suggested many concepts that overlap with Blue Green Grey design concepts, including covered areas, defined crosswalks, outdoor sitting

areas, water features, and street furniture. The plan recommends improving streetscapes along Josey Lane and Valley View Lane in order to attract development interest and encourage multimodal transportation. Farmers Branch also published its Central Area Comprehensive Plan in 2012, which builds upon the Four Corners Vision Plan to employ Complete Streets strategies along the two main roads. To further develop the “City in a Park” theme that Farmers Branch is known for, this report suggests streetscape enhancements and roadway aesthetics.

Utilizing a Blue Green Grey design at this specific bus stop location would be extremely beneficial for the downtown sector of Farmers Branch. A green space surrounded by retail

spaces would not only provide an enjoyable place to wait for transit users, but it would also enhance the quality of life for all citizens of Farmers Branch who regularly visit this central area. Increased activity around the bus stop would also encourage restoration of the outdated development to trigger economic growth.

The main constraint for this bus stop is the existing development. The current bus stop consists of a small area next to the sidewalk with a sign and a bench. One problem highlighted in the Four Corners Vision plan is the expansive coverage of unused and open parking lot area. It could be beneficial to utilize some of the adjacent parking lot space to provide a pocket park and improve the bus stop. Additional constraints include electric, storm, sewer, and water lines.





1 *Enhanced Bus Stop*

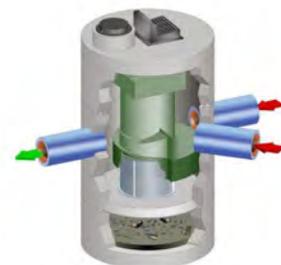
Bus stops within the City of Farmers Branch should meet the minimum requirements for special design set forth in the appendix of this report and recommended by NACTO. This site is a retro-fit to an existing commercial development. Improvements at this site could benefit the private and public infrastructure adjacent to the bus stop. Coordination with the development could allow for the bus stop to get large to accommodate more amenities.



Redmond California

2 *Water Quality Inlet*

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate.



Storm Water Solutions

3 *Bioswale & Enhanced Landscape*

Bioswales are linear channels designed to concentrate and convey stormwater runoff while removing debris and pollution. Bioswales can also be beneficial in recharging groundwater. Bioswales are typically vegetated, mulched, or xeriscaped. This site provides the potential to enhance the entry to a private development along with correcting a major drainage issue in the parking lot.



Cornell University

4 *Existing Infrastructure*

When implementing enhanced bus stops existing infrastructure should be considered and tied into when possible. It is not the intent of this strategy to replace existing infrastructure, rather enhance it and improve the efficiencies of its use. Coordination with transit operators during the design phase will ensure that design and configuration of stormwater facilities does not conflict the current transit fleet, or potential future operational changes.



Conceptual Cost Estimate:

Enhanced Bus Stop	\$25,000-\$50,000
Water Quality Inlet	\$5,000 - \$7,000
Bio Swale & Enhanced Landscape	\$35,000 - \$60,000
Tie into Existing Infrastructure	\$6,000 - \$9,000

*Carbon Sequestration, Air Pollution Removal, Energy Savings, and Stormwater Savings Combined - Source <https://www.texastrees.org/wp-content/uploads/2019/04/Urban-Forest-report.pdf>
 **https://www.nrdc.org/sites/default/files/oce_13082701a.pdf. These include the cost to communities for waterway cleanups, street sweeping, stormwater capture devices, storm drain cleaning and maintenance, manual cleanup, and public education.
 \$11.20 is a 2013 value. BLS inflation = 1.09
 ***Bioretention/Bioswale stormwater management value range from NCTCOG Economic and Environmental Benefits of Stewardship <http://ebs.nctcog.org/user-guide.html>

Potential Sustainable Return on Investment

Site Data	Quantity	Unit Cost Value	Annual Value
Real Estate Area Enhanced	43,560 sf commercial	\$13.00 sf/yr	\$566,280
Real Estate Value Enhancement (%)	20%	\$15.60 sf/yr	\$679,536
Tree Canopy Ecosystem Services*	0.32 acres	\$505 per acre/yr	\$162
Trash Generation Managed	1.25 acres	25 lbs/acre/yr	31 lbs/yr
Social Value of Trash**	5,000 (population impacted)	\$12.21 capita/yr	\$61,050
Stormwater BMPs (acre)***	0.1 acres	\$1,050 to \$4,730 per acre	\$105 to \$473

PLANNING/ DESIGN CHECKLIST

During the design concept selection process, it is important to evaluate each site individually and consider all opportunities and constraints based on existing conditions. Ask questions that show the potential of the bus stop with a Blue Green Grey design.

- How many transit users use this bus stop weekly?
- What are the surrounding developments, and what type of demographic do they attract?
- Is this area connected to active areas in the community?
- What is feasible?
- What might pose a challenge against the design?

Answering these questions is the first step to give a general understanding of what can be accomplished with a retrofit design. In order to evaluate further, a checklist has been developed. This provides a set of metrics that can be applied to all bus stops to illustrate

which areas of the bus stop are successful, and which can be improved upon.

The following page shows a checklist that can serve as the minimum evaluation criteria when deciding to move forward with a Blue Gray Green strategy on a bus stop design. This checklist and process is designed to be fluid and some elements not listed here can be added as evaluation criteria if the site or context sees fit.

This strategy can be implemented on new construction or retrofit designs as the benefit to the site and community can be the same.

Benefits																				
Reduces Treatment Loads	Improves Water Quality	Reduces Storm System Load	Mitigates Flooding	Reduces Discharge Pollution	Increases Groundwater Recharge	Conserves Energy	Improves Air Quality	Reduces Urban Heat Island	Improved Habitat	Improved Aesthetics	Increases Recreation	Opportunity for Public Education	Reduced Noise Pollution	Improves Quality of Life	Community Engagement	Improves Public Health	Attracts Ridership	Increases Safety or Comfort	Improves Connectivity	Brings Economic Growth

Design Concepts	Blue																			
	Rainwater Harvesting/Irrigation																			
	Bottle Filling Stations																			
	Hydrodynamic Separator																			
	Bioswales/Bioretenion																			
	Shared Use with Development																			
	Floatables/Debris Management																			
	Real-Time Data <i>Meteorological Trash/Debris Water Bottles Not Used Potable Water Offset by Greywater</i>																			
	Water Influent/Effluent Monitoring																			
	Green																			
	Community Gardens																			
	Pollinators																			
	Native Species																			
	Drought Tolerant Plants																			
	Riparian Corridor Restoration																			
	Reduced Light Pollution Lighting																			
	Reduced Fertilizers/Pesticides																			
	Low Albedo Surfaces																			
	Air Flow Management																			
	Cool Roofs																			
	Vegetated Canopy																			
	Structural Canopy																			
	Solar Panels																			
	Emissions Reduction																			
	Air Filtration																			
	Carbon Sequestration																			
	Shared Use Landscaped Areas																			
	Living Laboratories																			
	Digital Displays																			
	User Tracking/Apps/Rewards																			
	Linked System Data Tracking																			
	System Wide Branding/Messaging																			
	Continuous User Feedback/Tracking																			
	Grey																			
	Crosswalks																			
	Sidewalk Enhancements																			
	Video Surveillance																			
	Police/Fire Emergency Contact Access																			
	Traffic Calming																			
	First Mile/Last Mile																			
Waste Management/Trash Bins																				
Sound Barrier																				
Bike Storage																				
Vendors																				
Site Furniture																				
Signage																				
Charging Station																				
Corporate Ridership Programs																				
Vendors/Food Trucks																				

Acknowledgements

We would like to thank...

City of Farmers Branch
North Central Texas Council of Governments
la terra studio
Urban Ecoplan
DART

Appendix

DART should be contacted to remove or install all shelters, benches, trash cans, and bus stop signage. Design Guidelines for DART shelters, benches and trash cans. The following dimensions are a guide when designing a bus stop.

Please contact DART to verify all dimensions and information related to bus stops and shelter placement. At bus stops that meet certain criteria for boarding and surrounding land use DART will install additional items at the stop such as a bench or shelter.

These additional items must fit in the existing public right-of-way. If the shelter, bench or trash can are to be placed on private property an easement must be recorded giving DART permission to place their items outside of the public right of way.

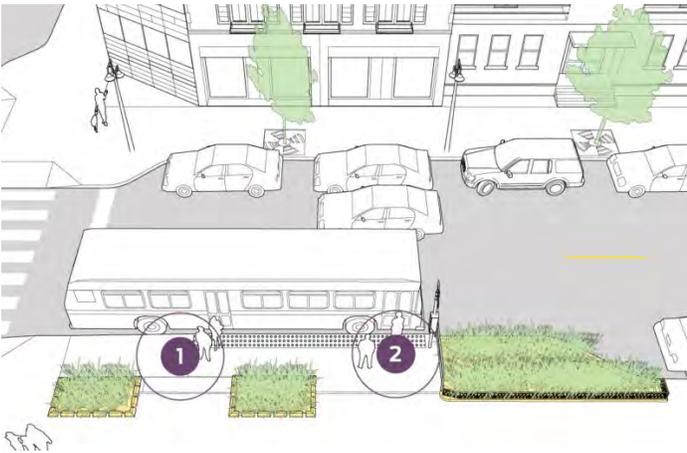
General site design considerations when implementing sustainable bus stops.



Bioretention cells incorporated into bulb-style transit stops improve the passenger waiting experience, but require special consideration to maintain accessible loading and clear sightlines for transit operators.

Incorporating stormwater facilities at transit stops introduces new opportunities for mutual benefits and inter-agency collaboration, unlocking new project funding sources and leveraging complementary resources.

Refer to the Transit Street Design Guide for further guidance on transit stop design. - NACTO



1. At minimum, a 4-foot clear path must be available from the pedestrian through-zone to any transit door, as well as into transit shelters and to access any transit amenities (e.g. ticket vending machines, maps, and wayfinding).

2. A solid, stable boarding pad that is 5 feet wide by 8 feet deep must be accessible to at least the front door to accommodate deployment of bridgeplates or ramps for passengers using wheelchairs. Ten foot wide boarding pads are often preferred by the transit operator to allow flexibility accessing the stop. Any cells or plantings must not impede accessible paths.

Tree branches and plantings must not block transit vehicles or sightlines approaching the platform. For the approach side of the stop, select low-growing vegetation or trees where branches will not conflict with approaching vehicles. - NACTO

**Staff Review and Input on Developing Green Bus Stops
DART & City of Farmers Branch**

This report evaluates the use of green infrastructure and the potential for it to enhance and improve curbside bus stops within the right-of-way and in conjunction with adjacent development on private property. DART requires an easement on private property in order to place shelters, benches or trash cans outside of the existing road right of way.

Ten existing and planned bus stops were selected to study and discuss with both DART and City of Farmers Branch staff. This project proposed “what if” scenarios for staff level discussion. Using existing sites and gathering utility, topography, and adjacent land uses was helpful when evaluating the use of green infrastructure at each site.

The three sites that designs are provided for in this report are the ones best suited for Green Infrastructure Bus Stops. They are sites that are developing or redeveloping and have frontage on a corner or one roadway.

While green infrastructure has not been proposed at any of the 10 bus stops, this project’s goal was to look at real sites in order to best identify challenges to installation of green (stormwater) infrastructure. Existing right of way, utility and adjacent land use plans were reviewed for each site.

The goal was to think realistically about how to address challenges to development of bus stops and green infrastructure in the right of way. The three Green Bus Stop Designs provided in this report were selected based on feedback and discussion during these staff presentations and discussions. Selecting three sites allowed for the best representation of the possible use and possible benefit of green infrastructure at bus stops.

Developing in the right of way and in coordination with existing traffic, property boundaries, utilities and drainage presents challenges. Coordination between staff of different departments and between various agencies is important to project success.



Four Corners Shopping Area

Four Corners Shopping Area (South of Valley View on Josey)

Two Existing Bus Stops located in the city's main commercial area with shopping, medical services, restaurants and retail. The buildings, parking and infrastructure were all constructed at different times and parcels have different owners. There is planned infill development including a City Medical Clinic with retail commercial uses.



Stop ID: 21233 Josey@ Valley View-N-MB



Stop ID: 22089 Josey@ Eric-S-MB

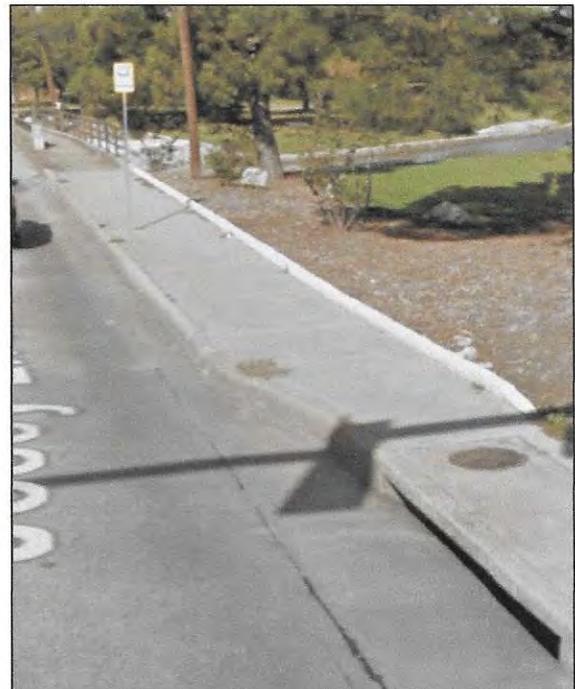


Rawhide Creek

Josey Lane Bus Stops are adjacent to Rawhide Creek, City trails and public open space.



Stop ID 1906, Josey @ Golfing Green-N-FS



Stop ID: 18362, Josey @ Golfing Green-S-FS

Westside Development Bus Stops Existing & Proposed Bus Stops

Development is occurring on the Westside of Farmers Branch. Large vacant parcels have been approved for residential projects that will develop over the next several years. The conceptual plans for future development are shown on the map below. The Red and Yellow dashed lines indicate the location of the proposed Westside Trail. The Westside Trail is part of the regional network. The trail will connect this new development to both the DART Rail Station and the Campion Trail. There is bus service on Valley View and Luna Road



- 1. Stop ID: 26882 Valley View @ Luna –E-FS (currently in a vacant field, no sidewalks)
- 2. Stop ID: 20911 Luna @ Valley View –S-FS (currently in a vacant field, no sidewalks)
- 3. Proposed Bus Stop located approximately 90 feet north of intersection
- 4. Proposed Bus Stop located approximately 90 feet south of the intersection
- 5. Proposed bus stop approximately 90 feet north of intersection
- 6. Proposed bus stop approximately 90 feet south of intersection

Project Meeting Takeaways

Two meetings were held to discuss ten bus stops with staff in the City of Farmers Branch and DART staff members. Meetings were held in the City of Farmers Branch in April of 2019 with DART staff and City of Farmers Branch staff.

Both meetings were well attended by various departments. The use of green infrastructure and how bus stops are reviewed during the development process was discussed.

After a presentation by the consultant's staff asked questions and discussed how green infrastructure and transit could be used harmoniously.

Meeting Summaries

- DART Presentation and Staff Discussion of Green Bus Stops, April 1, 2019
- Farmers Branch Presentation and Staff Discussion of Green Bus Stops, April 30, 2019

City of Farmers Branch Green Bus Stop Design Guidelines
Project Meeting April 1, 2019

DART, Dallas Area Rapid Transit
1401 Pacific Avenue, Dallas, TX 75202

Attendees

DART

Planning & Development

Ali Rabiee, Director Mobility Capital Projects
Jennifer Jones, Senior Manager
Steve Patrnick, Manager, Service Planning
Patricio Gallo, Project Manager
Hans-Michael Ruthe, Project Manager
Brenda Sadberry, Manager

Passenger Amenities/Facility Services

City of Farmers Branch

Sustainability & Public Health

Shane Davis, Director
Renee Esses, AICP, CFM, Special Projects Manager
Mikel Wilkens, PE, ENV-SP, Urban Ecoplan
Brad Moulton, ASLA, la terra studio

Consultant Team

NCTCOG

Sustainable Development

Eric Connor, AICP, Transportation Planner
Shawn Conrad, Senior Transportation Planner
Jing Xu, Senior Transportation Planner
David Garcia, Transportation Planner I

Meeting Summary

City of Farmers Branch staff and the consultant team presented information about the grant and project goals. The meeting was approximately two (2) hours with a presentation by City of Farmers Branch staff and consultant team and discussion about the project and existing challenges siting and maintaining bus stops in the DART service area.

A presentation was made by Renee Esses, Mikel Wilkens and Brad Moulton (see attached). Discussion during the presentation is summarized on the following page. Discussion topics included the following:

- Current challenges when siting bus stops;
- Possible Green Bus Stop Design Guidelines use by DART staff & member cities;
- Maintenance of bus stops

Next the consultant team will meet with City of Farmers Branch staff to discuss the project. Draft Green Bus Stop Design Guidelines will include the input and ideas received at both meetings.

The following is a list of observations, experiences and suggestions to consider when developing Green Bus Stop Design Guidelines for the City of Farmers Branch:

- On narrow street right of way there isn't much room available for bus stops or shelters.
- If the sidewalk area and right of way are extremely narrow, DART has to ask adjacent property owners for an easement or to dedicate additional right of way in order to meet ADA standards for the bus stop.
- Low vegetation and shrubs can attract rodents near stops
- Generally there is a lack of sidewalk connectivity in the service area
 - DART is currently reviewing sidewalks in the service area to identify gaps
- Adjacent property owners don't want the bus stop at their location
- For safety, reasons bushes and shrubs must be pruned from the bottom up to address visibility issues and prevent an individual from hiding behind it.
- Trees present several maintenance challenges
 - Trees that attract large numbers of birds require more frequent cleaning.
 - Bird waste can interfere with operation of solar lighting on shelters.
 - Ornamental trees that drop flowers or berries
 - Can cause safety issues if they block security cameras

DART staff suggestions suggested consideration of the following when placing trees near bus stops:

- Solar lighting at bus stops
 - Make sure solar panels aren't shaded
 - Plant species that will not attract large numbers of birds to roost
- Safety – very important
 - Coordinate with DART and/or local police so security cameras are not blocked
 - Shrubs might need to be trimmed from the bottom up to prevent people hiding
- Place trees away from power lines to prevent the power company from pruning or cutting down in the future.
- Type of trees selected for placement near bus stops is very important so they don't create additional need for cleaning
- Look at the (low growth, hyper localized) types of vegetation being used locally by NTTA. It enhances the roadway and appears to be lower maintenance.
- Consider adding parking for scooters and bikes because currently they can block walkways

DART Bus Stop Maintenance

- DART maintains the bus stop pole and sign. If there is a shelter DART maintains the shelter area. DART will install and remove shelters, benches, signage.
- If a bus stop is only a bus stop sign and pole maintenance is the property owner's responsibility. Mowing, repairs, etc. are addressed by the city or property owner.

City of Farmers Branch Green Bus Stop Design Guidelines
Project Meeting April 30, 2019

City of Farmers Branch
13000 William Dodson Parkway
Farmers Branch, TX 75234

Attendees

City of Farmers Branch

Planning & Zoning

Public Works

Parks & Recreation

Information Services

Sustainability & Public Health

Tina Firgens, Director

Danielle Rix, P.E. Project Engineer

Phillip Thomas, Operations Manager

Natalia Davis, Public Works Coordinator

John Roach, Special Projects Manager

Pam Smith, Park Landscape Manager

Brian Jones, GIS Administrator

Shane Davis, Director

Renee Esses, AICP, CFM, Special Projects Manager

Consultant Team

Mikel Wilkens, PE, ENV-SP, Urban Ecoplan

Brad Moulton, ASLA, la terra studio

NCTCOG

Eric Connor, AICP, Transportation Planner

Meeting Summary

The City of Farmers Branch staff and consultant team presented information about the grant and project goals. The meeting was approximately 2 hours allowing for a presentation by the consultant followed by discussion and questions.

The consultants made a presentation to DART staff from several departments. The presentation was similar to the one given at the DART headquarters on April 24, 2019. The goal of the presentation was to share the project and get input from each department. The presentation for the Farmers Branch Staff included the following topics:

- Review of current DART Bus Service within Farmers Branch;
- Benefits and use of green infrastructure in the right-of-way (single vs multipurpose stormwater systems);
- Possible Green Bus Stop design Guidelines used by City of Farmers Branch staff,
 - Type of green infrastructure permitted/recommended
 - Application process and review timeline
 - Construction Inspection, and
 - Long term maintenance of infrastructure
 - East Side Plan recommendations for use of green infrastructure
- Bus stop planning and design criteria resources
- Applicability of guidance on green infrastructure to other private or public development in Farmers Branch.

The following list of observations, experiences and suggestions to consider when developing Green Bus Stop Design Guidelines for the City of Farmers Branch:

- Planning is the right place to start the review the impact to bus stops during the development process.
- Challenge is ownership and long-term maintenance. Should the city acquire property for the green infrastructure vs requiring during development.
- Parks mentioned the installation of green infrastructure means that environmental education is an option. It is important to maintain routes that are walkable with good visibility in parks.
- A natural edge for the creeks with no additional gabions is desirable.
- Design guidelines should be feasible to implement.
- Interested in funding options.
- What is the incentive for a property owner to participate in this – where are the opportunities for public/private partnerships.
- What are the guidelines for biosla.es, bio-retention and planers, etc.
- Picture of places where green infrastructure exists would be helpful when explaining and discussion options for green infrastructure.
- Known examples of bus stops that are desirable and enjoyable would also be helpful when discussing implementation.
- Discussion about how green infrastructure could be multifunctional and also about how these strategies can be a part of meeting the MS4 Permit requirements.

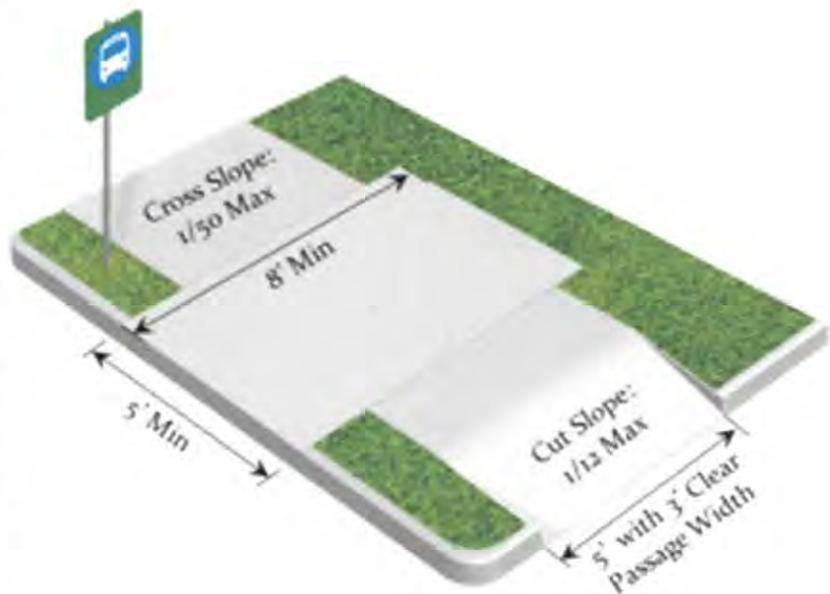
Why is it important to consider bus stop design during the planning process?

Many of the existing bus stops within Farmers Branch are grandfathered because they were installed prior to the current ADA requirements. As new development occurs on streets with existing bus service the bus stops can be made accessible for those with disabilities. According to the NACTO Transit Street Design Guide (page 66):

Designs that provide universal accessibility at stops and stations not only increase the equity of transit systems, but also reduce operational costs. Making fixed route transit service simpler, more comfortable and more convenient for passengers using mobility devices can reduce the need for costly paratransit trips, reduce dwell time at stops, and, by substituting for ramp or lift deployment, eliminate or reduce the use of one of the most expensive subsystems on a transit vehicle.

Considerations when designing sidewalks/walkways on a street with an existing bus route and bus stops should include installation of a bus stop pad that meets ADA slope requirements.

The slope of the pad from the sidewalk to the curb should be taken into consideration so that installation of the bus stop can occur without removing the newly constructed sidewalks. It is cost efficient if the placement of an existing or future bus stop is done as part of a development plan review.



Americans with Disabilities Act of 1990 - Minimum requirements for a bus stop accessibility for riders with disabilities is 5'x8' loading pad with connected sidewalks of 3' clear passage width, 1/50 (or 2%) maximum cross slope, and 1/12 curb cut slope.

Additional ADA information and guidance available online

<https://www.access-board.gov/guidelines-and-standards/transportation/facilities/ada-standards-for-transportation-facilities>



Well designed developments can include green elements like trees and shrubs, include good sidewalk connectivity and yet a bus pad installation is not feasible to install a bus pad the meets the ADA slope requirements. While landscaping can provide an important buffer and provide benefits both visibly and for stormwater management the connection to the curb is essential for bus stop boarding and alighting.



When considering development adjacent to a street with an existing bus line it is important to consider future and existing bus stop locations and incorporate the stop into the overall in the design. New development that includes sidewalks will not always meet ADA requirements for Bus Stops because of the difference in elevation between the new sidewalk and existing curb.

Overview of Americans with Disability Act (ADA) for Transit Stops
 More information and guidance available online www.access-board.gov

1001 General

1001.1 Scope. Every station, bus stop, bus stop pad, terminal building or other transportation facility shall comply with the applicable provisions of Chapters 2 through 9, the applicable provisions of this chapter, and Chapter 11.

1002 Bus Stops and Terminals

1002.1 General. Bus stops and terminals shall comply with 1002.

1002.2 Bus Stop Pads. Where new bus stop pads are constructed at bus stops, bays or other areas where a lift or ramp is to be deployed, they shall comply with 1002.2.

Advisory

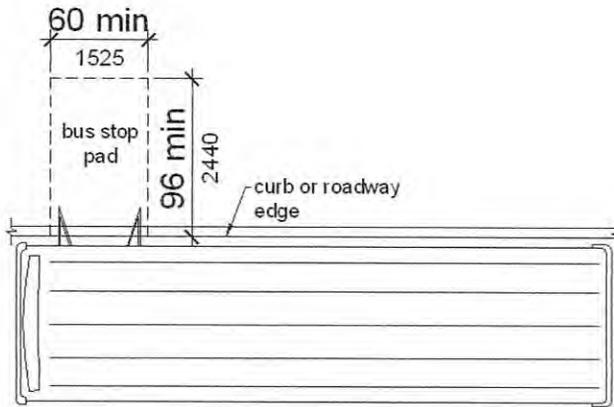
1002.2

At bus stops where a shelter is provided, the bus stop pad can be located either within or outside of the shelter.

1002.2.1 Surface. Bus stop pads shall have a firm, stable surface.

1002.2.2 Dimensions. To the maximum extent allowed by legal or site constraints, bus stop pads shall have a clear length of 96 inches minimum measured perpendicular to the curb or vehicle roadway edge and a clear width of 60 inches minimum measured parallel to the vehicle roadway.

Figure 1002.2.2

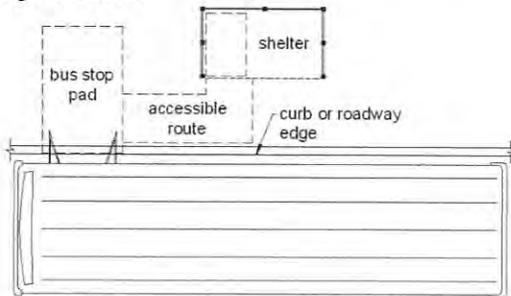


1002.2.3 Connection. Bus stop pads shall be connected to streets, sidewalks or pedestrian paths by an accessible route complying with 402.

1002.2.4 Slope. The slope of the bus stop pad parallel to the roadway shall, to the extent practicable, be the same as the roadway. For water drainage, a maximum slope of 1:48 perpendicular to the roadway is allowed.

1002.3 Bus Shelters. Where provided, new or replaced bus shelters shall provide a minimum clear floor or ground space complying with 305. Such shelters shall be connected by an accessible route to the boarding area required by 1002.2.

Figure 1002.3



1002.4 Signs. New bus route identification signs shall comply with 703.4.1. In addition, to the maximum extent practicable, new bus route identification signs shall comply with 703.4.

EXCEPTION: Bus schedules, timetables and maps that are posted at the bus stop or bus bay are not required to comply with this requirement.

1002.5 Bus Stop Siting. Bus stop sites shall be chosen such that, to the maximum extent practicable, the areas where lifts or ramps are to be deployed comply with 1002.2 and 1002.3.

Additional Guidance for Cities and Transit Agencies

Based on the stakeholder meetings additional tools could be developed by the City of Farmers Branch or DART to assist staff with review of bus stops and how to integrate utilities and new development practices such as green infrastructure.

Bus Stop Design Guideline Examples

COTA Bus Stop Design Guide, Central Ohio Transit Authority

<https://www.cota.com/wp-content/uploads/2016/04/Bus-Stop-Design-Standards.pdf>

TRANSFORT, Fort Collins, CO

http://www.ridetransfort.com/img/site_specific/uploads/Final_Design_Standards.pdf

King County Department of Transportation Metro Transit Division, Construction Information Center

<https://www.kingcounty.gov/~media/transportation/kcdot/MetroTransit/Construction/guidelines/KC-M-CIC-NotificationGuidelinesCityofSeattle-20140511.ashx?la=en>

Central Jersey Transportation Forum, Development Review Checklist for Consideration of Transit

https://www.dvrpc.org/CentralJerseyForum/ActionTeams/pdf/Forum_Transit_Checklist.pdf

Toolkit for the Assessment of Bus Stops Accessibility and Safety

Appendix A. Comprehensive Bus Stop Checklist

<https://www.nadtc.org/wp-content/uploads/NADTC-Toolkit-for-the-Assessment-of-Bus-Stop-Accessibility.pdf>

General guidelines for locating bus stops can also be found in the Transit Cooperative Research Program, Report 19, Guidelines for the Location and Design of Bus Stops

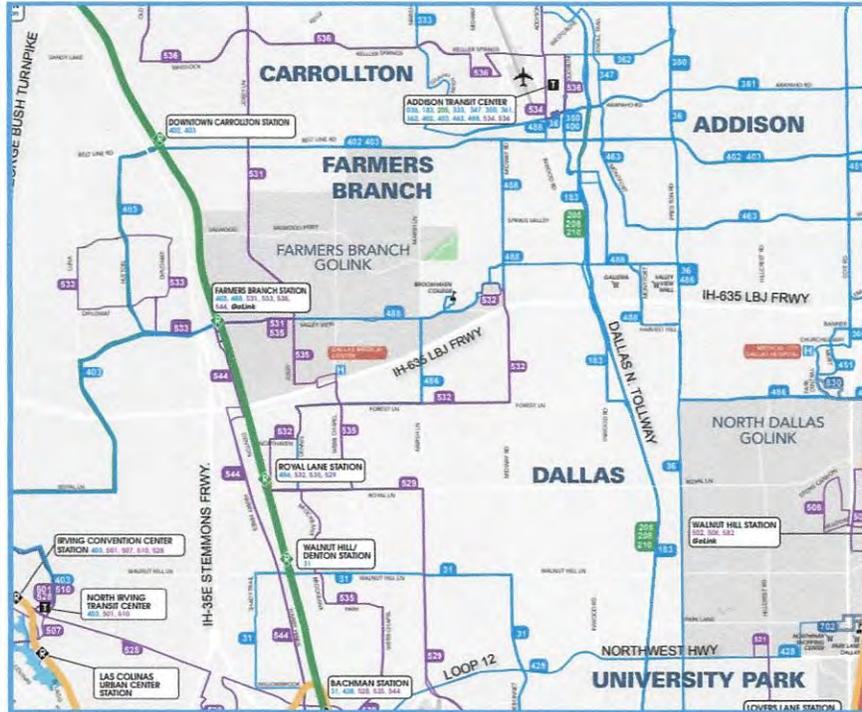
https://nacto.org/docs/usdg/tcrp_report_19.pdf

Green Infrastructure should be evaluated on a case by case basis when being proposed in the right of way. Obtaining the location of existing utilities and working with the city public works and engineering department is a critical first step in designing the features.

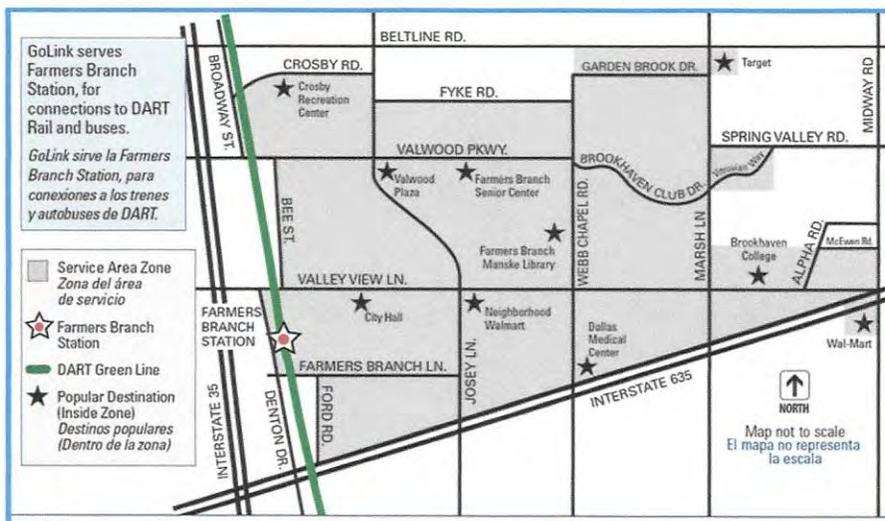
DART Bus & Rail Services in Farmers Branch as of December 2019

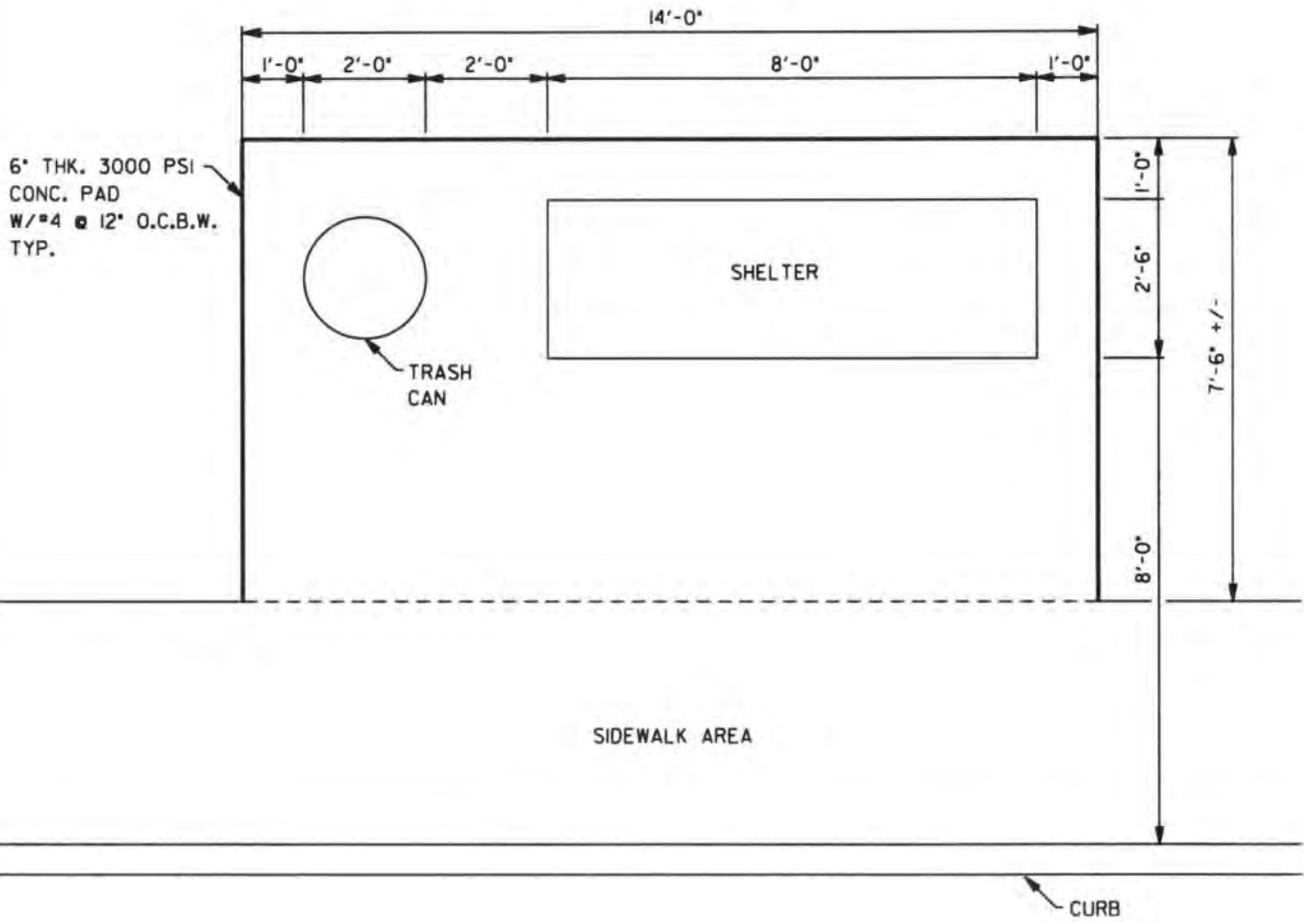
The City currently has bus and rail service. Farmers Branch is one of thirteen member cities of DART, Dallas Area Rapid Transit.

- Bus Routes <https://www.dart.org/maps/pdfmaps/DARTSystemMapQuadC12aug19.pdf>
- Light Rail Green Line <https://www.dart.org/maps/printrailmap.asp>
- DART Rides <https://www.dart.org/riding/dartrides.asp>



- GoLink <https://www.dart.org/riding/GoLinkFarmersBranch.asp>



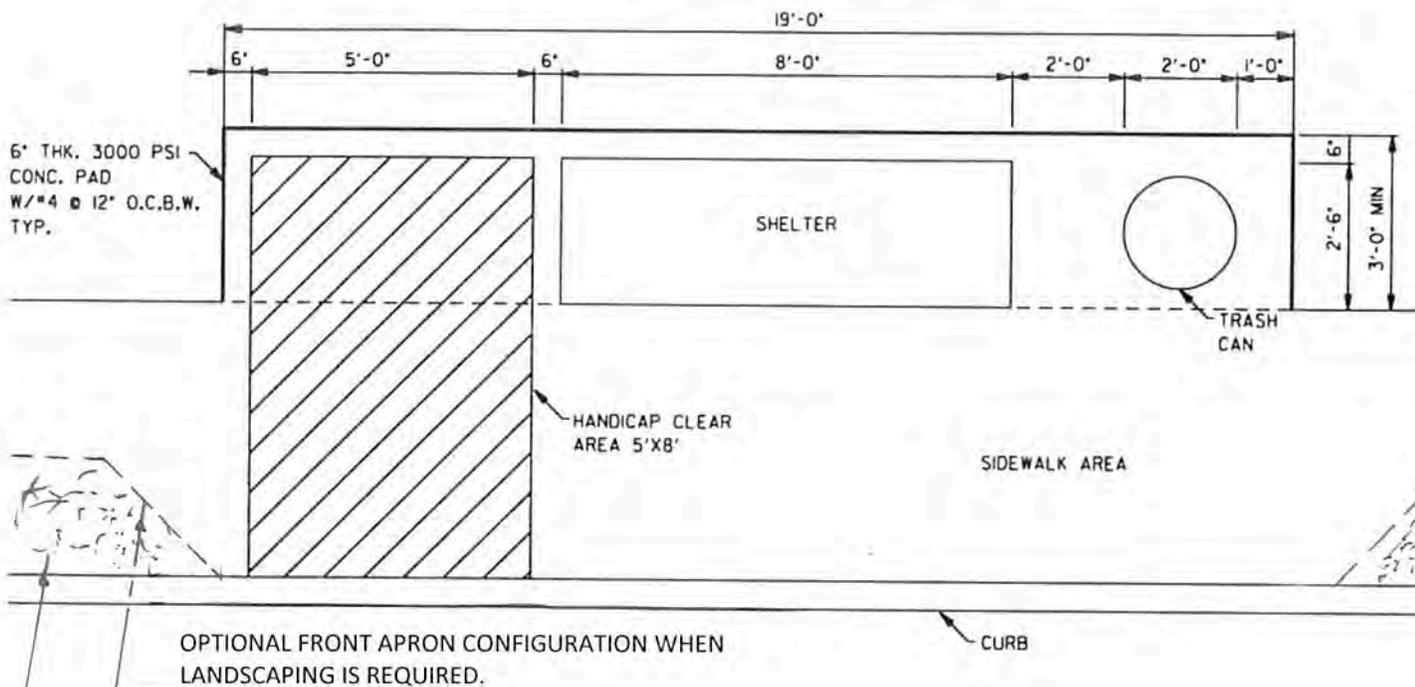


TYPE 'B' SHELTER PAD

TYPICAL SHELTER

MARCH
2011

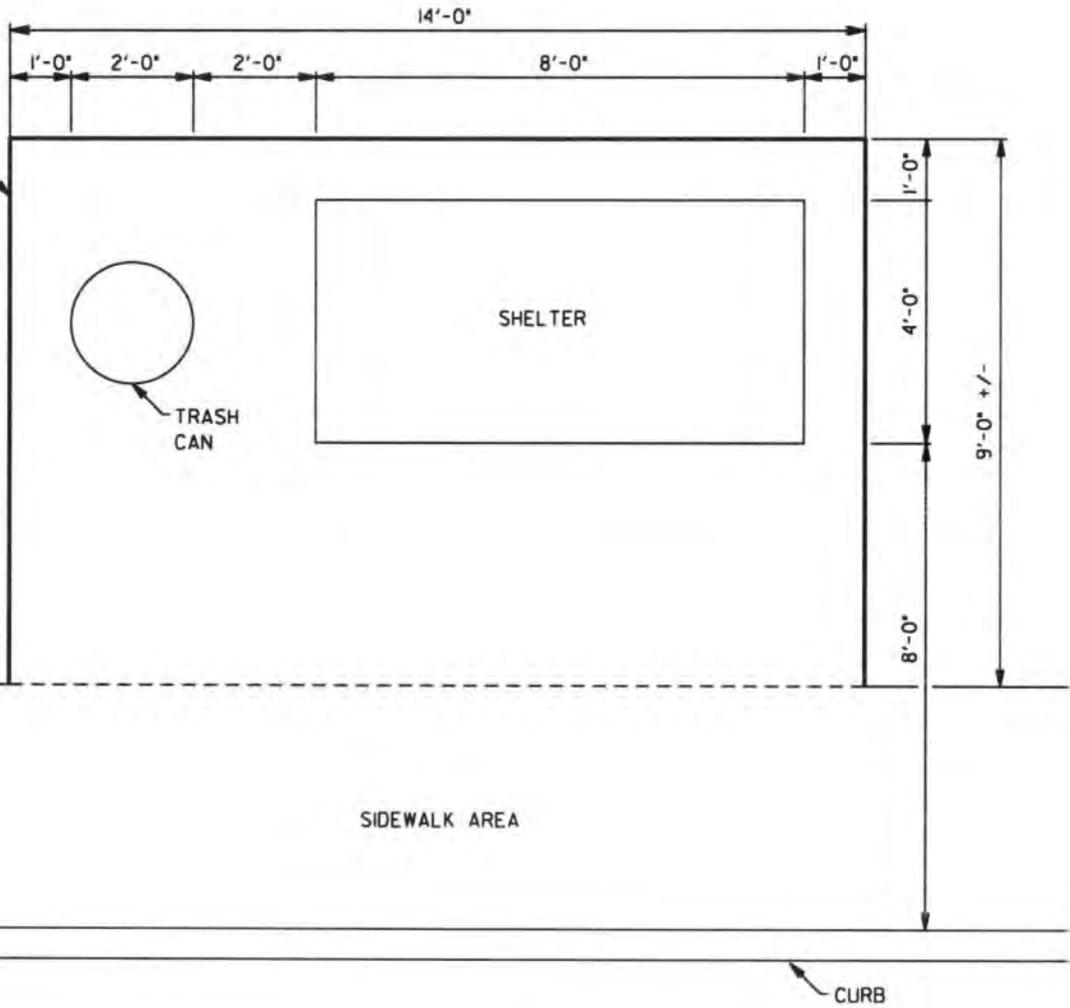
ISSUED BY
DART



TYPE 'B' SHELTER PAD
LIMITED R.O.W.

TYPICAL SHELTER	
MARCH 2011	ISSUED BY DART

6" THK. 3000 PSI
CONC. PAD
W/ #4 @ 12" O.C.B.W.
TYP.



TYPE 'A' SHELTER PAD

TYPICAL SHELTER	
MARCH 2011	ISSUED BY DART

