

9.0 SUSTAINABLE TRANSPORTATION

When transportation investments consider economic, environmental, and social issues, it creates opportunities to improve all travelers' quality of life. The concept of sustainable transportation looks beyond traditional transportation improvements to consider the ways that the transportation system will impact the health, wealth, and overall well-being of communities in the future.

In 2009, the US Department of Transportation (USDOT), the US Department of Housing and Urban Development (HUD) and US Environmental Protection Agency (EPA) formed the *Partnership for Sustainable Communities* to improve access to affordable housing, provide more transportation options, lower transportation costs, and foster sustainable communities. The partnership established six livability principles which describe the multidisciplinary nature of sustainable development:

- Provide more transportation choices: Develop safe, reliable, and economical transportation choices that lower household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.
- Promote equitable, affordable housing: Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase economic mobility and lower the combined cost of housing and transportation.
- Enhance economic competitiveness: Improve economic competitiveness by giving workers reliable and timely access to employment centers, educational opportunities, services, and other basic needs, as well as expanded business access to markets.
- Support existing communities: Target federal funding toward transit-oriented, mixed-use development, and land recycling. This enhances community revitalization, improves the efficiency of public works investments, and safeguards rural landscapes.
- Coordinate and leverage federal policies and investment: Align federal policies and funding to remove barriers to collaboration and increase the effectiveness of governments to plan for future growth. This includes smart energy choices like locally generated renewable energy.
- Value communities and neighborhoods: Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods.

In response to the HUD *Sustainable Communities Regional Planning Grant Program*, a partnership of seventeen cities, counties, and MPOs in Long Island, the Hudson Valley, and southern Connecticut formed the New York-Connecticut Metropolitan Region Sustainable Communities Planning Consortium to develop a regional plan of sustainability. The Naugatuck Valley Council of Governments, because of its membership in the Greater Bridgeport and Valley MPO, participated in the project. The Consortium developed a regional plan for sustainable

development that leverages the region's robust transit network to achieve more sustainable growth. The primary goal of the plan is to foster sustainable development and transportation. More information about the plan is available here: <https://www.nymtc.org/Regional-Planning-Activities/Sustainability-Planning/NY-CT-SCI>.

By taking a multi-disciplinary approach to planning, coordinating land use, transportation, and environmental planning professionals, the NVCOG actively promotes the principles of livability and sustainable transportation in ongoing planning work. Regional projects and programs work to actively address obstacles to sustainable development, such as reliance on highways and roadways, limited and fragmented bus and rail service, and gaps in the active transportation network. Residents, municipal leaders and officials, and other stakeholders of the Naugatuck Valley region recognize the finite limit on land and natural resources and the implications of insufficient access to reliable and efficient transportation for travelers.

To adhere to the livability principles, there should be more emphasis on mode choice, public transit opportunities, low impact development/green infrastructure, equity, sustainable development, housing, and the interconnectedness of transportation planning and transit supportive land uses. The key focus of the plan is to fundamentally change the perception of city centers from car-dominated to multimodal and construct transformative improvements that will be the catalysts for economic revitalization, livable communities, and sustainable transportation choices.

9.1 SUSTAINABLE CT

Sustainable CT is a voluntary municipal certification program to recognize thriving and resilient Connecticut municipalities that are taking actions toward sustainability. One of the program's goals is to broaden the understanding of sustainability, looking beyond the environment to include the economy, housing, transportation, culture, equity, public services, and events. This perspective on sustainability echoes the six livability principles identified by the *Partnership for Sustainable Communities*. *Sustainable CT* is a nonprofit that has identified a broad range of sustainable best practices. Municipalities choose from a menu of *Sustainable CT* actions, implement them, and earn points toward certification. Every *Sustainable CT* action can produce multiple community benefits, demonstrating how local action can have a statewide impact. Currently, Cheshire, Southbury, Waterbury, and Woodbury have achieved Bronze status, and Bristol has achieved Silver status. More information about NVCOG's involvement with *Sustainable CT* is available here: <https://nvcogct.gov/what-we-do/environment/sustainable-ct/>.

Transportation is one of the thirteen *Sustainable CT* action categories. The “*Clean and Diverse Transportation Systems and Choices*” category contains many sub-categories and actions on which municipalities and the NVCOG may collaborate to improve sustainability of the region’s transportation system. Examples include implementing complete streets, promoting effective parking management, encouraging smart commuting, supporting zero emissions vehicle deployment, and promoting public transit and other mobility strategies.

The following sections discuss these transportation-related sustainable actions and how the region may collaborate with municipalities to help them achieve *Sustainable CT* certification.

IMPLEMENT COMPLETE STREETS

The goal of these actions is to reward steps toward building more complete street facilities. Complete streets is a holistic approach to planning, designing, and building a street environment that prioritizes safe access and connectivity for all users. From training and planning to project construction, this subcategory affords municipalities opportunities to score points at any stage of adding complete streets to their community.

NVCOG supports this process by developing regional planning documents and templates which may be locally implemented. Additionally, where funding is regionally distributed, such as LOTCIP, the NVCOG encourages project sponsors to take steps that would support these goals by “*allow(ing) safer access for all roadway users—including motor vehicles, pedestrians, bicyclists, and transit users—regardless of age, ability, income or ethnicity.*”

At the September 9, 2022, meeting of the NVCOG Policy Board, the chief elected officials of the nineteen NVCOG municipal members, including the fifteen members of the CNVMPO, voted to adopt the CTDOT’s Complete Streets Policy, ensuring that all roadway projects examine the impact to all users. At that meeting, the policy board adopted a Vision Zero goal, which aims to

eliminate fatalities and serious injuries, through a series of actions that include broader adoption of complete streets principles. The NVCOG aims to develop a region-wide Complete Streets plan to identify high-priority improvements, as well as a series of best practices that can be implemented across the nineteen-municipality region.

PROMOTE EFFECTIVE PARKING MANAGEMENT

Sustainable CT recognizes the importance of making existing parking more efficient, reducing parking demand and encouraging mode shift, as well as fostering walkability. Effective parking management mitigates environmental impacts like excessive land consumption, degraded water quality, exacerbated heat island effects, and reduces greenhouse gas emissions by encouraging alternative modes of transit.

Within the region, the NVCOG is preparing to undertake a parking utilization study that will examine the average occupancy rates of public parking within the region's downtown or village center areas. This study aims to provide zoning officials with real world data as they make decisions regarding minimum/maximum parking requirements for development within these districts, as well as to inform decisions about future development potential. Additionally, NVCOG regularly monitors use of the CTDOT maintained commuter lots along major arterial roads and at Waterbury Line rail stations. There is potential for additional regional actions on parking, and NVCOG staff across the transportation, land use, and environmental planning units will ensure that future projects and studies provide municipal officials with data that can help to address this challenging issue.

ENCOURAGE SMART COMMUTING

To meet the goals of this action, communities must show that they are providing options for their employees to use alternative modes of transportation when commuting to work.

The NVCOG has actively worked with CTDOT and municipalities to identify opportunities for alternative means of travel. This includes expanding the existing bus system, additional service and better facilities along the Waterbury Branch Line, and new options like Bus Rapid Transit (BRT). The Route 8 & Waterbury Branch Line Transit Oriented Development and Alternative Modes Assessment Project, expected to be completed in 2023, is a prime example of providing additional modes of travel that are as or more appealing than a single occupant vehicle. In the coming years, new studies in the region will include a look into micro/flex transit options, improved active transportation, building out infrastructure for micro-mobility options like e-scooters and e-bikes, and additional fixed route bus service enhancements.

The CTDOT's CTRIDES program provides valuable assistance in promoting smart commuting. It serves as the Department's public facing entity to share information about public transit, vanpool, carpool, and other demand management strategies. Future advertising and sharing of this program will be a vital strategy toward advancing this goal.

SUPPORT ZERO EMISSIONS VEHICLE DEPLOYMENT/MANAGE MUNICIPAL FLEETS

Sustainable CT encourages communities to transition their municipal vehicle fleet and create infrastructure for zero emission vehicles (ZEV) that city officials, residents, businesses, and travelers may use. While the goal is increased deployment of ZEVs within the municipal fleet, there are many intermediate steps municipalities can take, like inventorying existing infrastructure. For example, the municipality of Plymouth worked with the region to acquire hybrid vehicles that reduce fuel consumption. Additionally, the NVCOG is actively developing data and publishing information about existing ZEV infrastructure.

A map of existing electric vehicle charging stations in the NVCOG region is available here:
<https://arcg.is/0yuH0u>.

COG staff also monitors grant opportunities related to installing electric vehicle charging stations and provides the information to member municipalities. The Region will continue supporting its member cities and towns while also promoting regional grant funding for the expansion of infrastructure. The National Electric Vehicle Infrastructure (NEVI) Program is part of the Infrastructure Investment and Jobs Act, allocating \$5 billion to create a nationwide, interconnected network of DC fast charging stations. The CTDOT will manage the state's share of NEVI funding. The FHWA approved CTDOT's NEVI plan in September 2022, which is available here: <https://portal.ct.gov/-/media/DOT/documents/dsustainabilityandresiliencyunit/CTDOT-Approved-NEVI-Plan-2022-2023.pdf>.

In December 2021, Governor Ned Lamont signed Executive Order No. 21-3, which prevents CTDOT from using state funds to purchase diesel buses after 2023 and mandates a plan for electrifying the state's bus fleet by 2035.

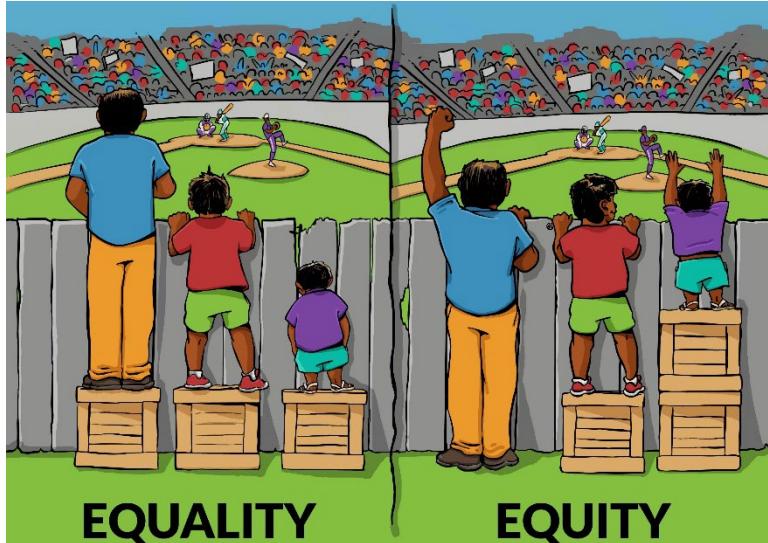
PROMOTE PUBLIC TRANSIT AND OTHER MOBILITY STRATEGIES

For most travelers, public transportation is the best alternative to single occupancy vehicle travel. *Sustainable CT* will reward actions that promote and enhance public transportation, including better coordinating public transportation with walking and bicycling.

NVCOG regularly works with *CTtransit* to gather data, analyze ridership trends, improve existing transit options, and advocate for new connections where there is a documented demand. Active public engagement is at the heart of this work, which includes inviting regional stakeholders to NVCOG Board meetings and partnering with complementary organizations to communicate information about existing services. By participating in public engagement events and creating opportunities for further engagement in their communities, municipalities may earn credit for this action category.

EQUITY

Equity is about fairness and the ability of everyone to get what they need in order to improve their quality of life. It is a practice which underlies the six livability principles and, as such, is a component and benefit of sustainable action. The Title VI regulations prescribe equity policy for more inclusive decision-making, improved access to services, and sharing of benefits with all current and future residents, regardless of race, income, ability, age, gender, sexual orientation, etc. *Sustainable CT* advances equity by asking municipalities to demonstrate its application in municipal decision-making processes. NVCOG is committed to applying the practice and pursuit of equity to all transportation planning work and partnering with its municipalities toward more inclusive and meaningful participation in planning.



Source: Interaction Institute for Social Change | Artist: Angus Maguire.
interactioninstitute.org and madewithangus.com

9.2 TRANSIT ORIENTED DEVELOPMENT (TOD)

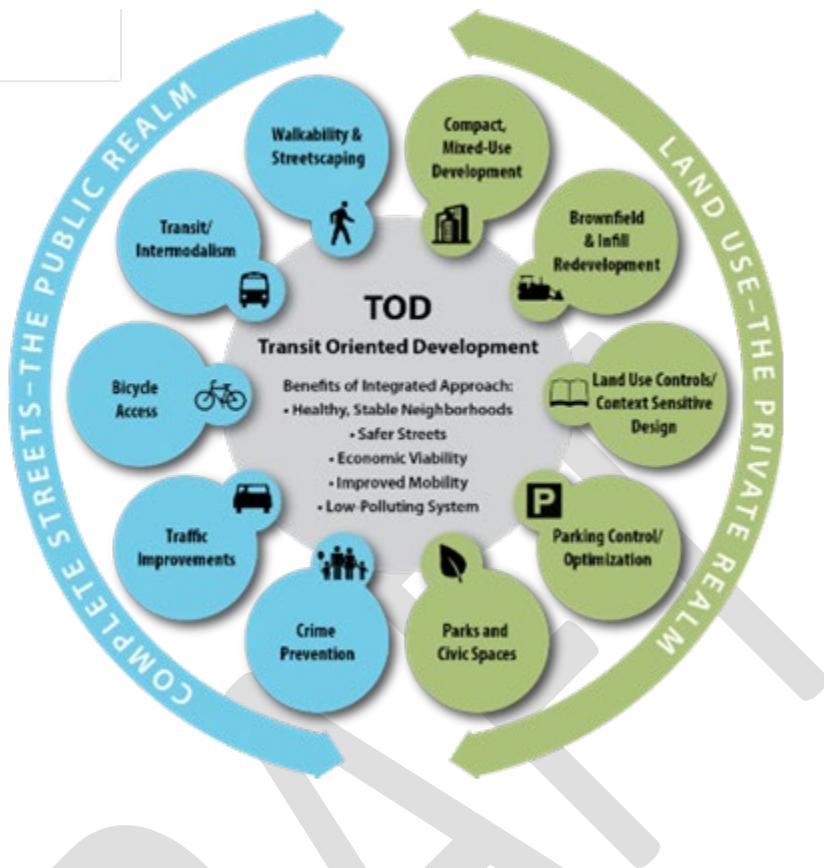
The freedom of movement associated with individual automobile ownership comes with tradeoffs. Suburban sprawl has chased development farther and farther from our downtowns, leading to lower density development and increased reliance on private vehicles. The result of this is congestion, pollution, and other costs associated with automobile ownership and inefficient land use. Based on 2021 ACS estimates, and excluding those that work from home, approximately 87.2% of people in the NVCOG region drive alone to work, largely because of the region's auto-centric infrastructure and the lack of viable alternative modes. Communities in the region are seeking ways to increase the use and accessibility of public transportation, cycling, and walking. Promoting these alternatives will better support the area's aging population, ease congestion, address environmental concerns, and enhance town centers.

Many communities recognize the problems associated with low-density development and current zoning practices that separate land uses by type (e.g., residential, commercial, industrial). In response, they are promoting new developments that provide more reliable transportation options, provide mixed-income and affordable housing, and expand opportunities for economic development. The goal is to create nodes within a community that reinforce the existing character of communities, preserve historic downtowns, and enhance opportunities for healthy, walkable and safe neighborhoods to flourish.

New principles have emerged that are aimed at reducing dependency on the automobile by encouraging land uses that support public transit. Transit oriented development (TOD) is a strategy to encourage pedestrian-friendly, mixed-use development projects near transit facilities, resulting in more livable and sustainable communities. TOD is a proven economic growth strategy that integrates land use, transportation, and the environment to generate new housing, jobs, more inclusive public spaces, and more sustainable and walkable communities. Transit-oriented development is an important part of any transportation plan, as it is a form of development that encourages people to use trains and buses, walk, or ride their bike.

Successful TODs include:

- Compact, mixed-use development, including a range of housing choices, within a quarter of a mile of a transit station or transportation hub. The goal is to be able to walk from where you live to a train or bus station in 10 minutes.
- A network of streets, ideally in a traditional street grid with short blocks, that allow for safe walking and bicycling and access to transit stations or transportation hubs.
- High-quality intermodal improvements that help people use trains, buses, bicycles, carpools, and walk rather than use a single-occupancy vehicle.



Transit oriented development involves nearly all aspects of community development, including land use planning, site development, and market analyses. TOD requires careful review of a variety of considerations, including land use regulations and zoning, contextual site design, infrastructure capacity, and market and demographic conditions. Accordingly, planning for TOD should be a collaborative community process. Public involvement is critical to promoting TODs and defining the scale, density, style, architectural character, and street environment unique to each community.

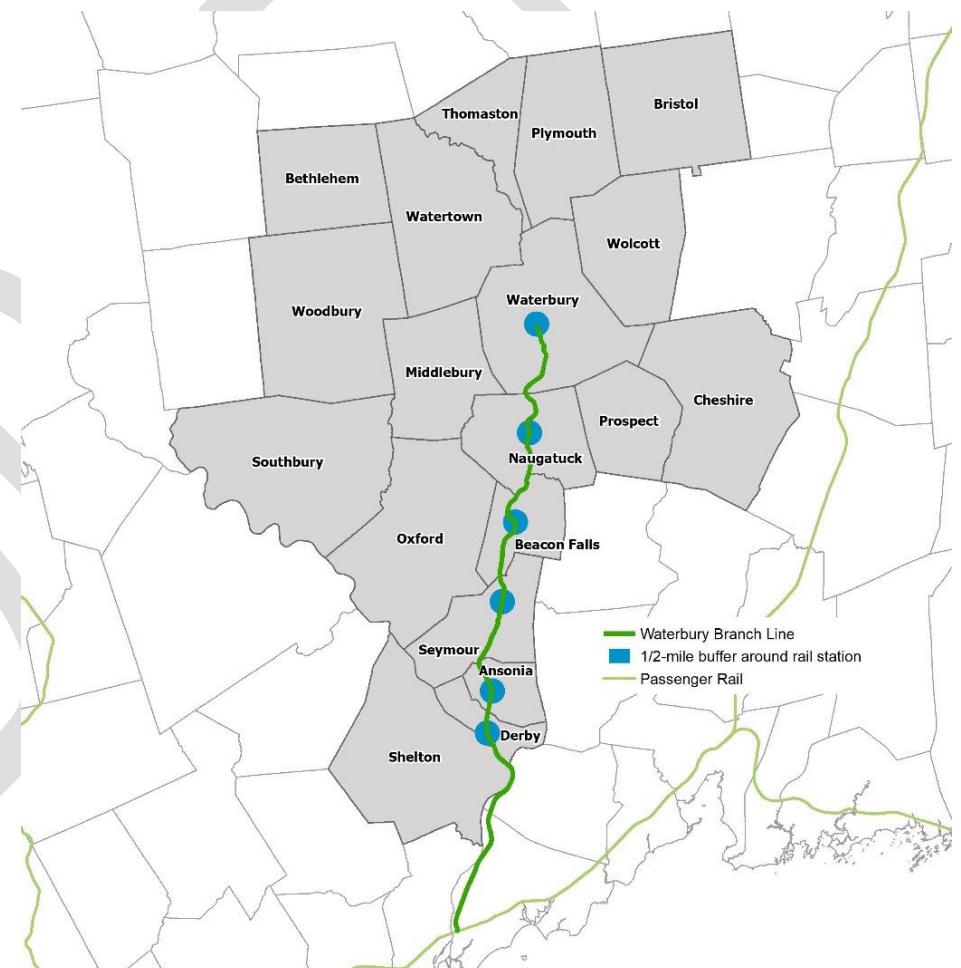
There are common elements and design strategies for all communities to consider:

- Complementary Mixed Uses: New infill developments mix retail on the ground floor with commercial offices or apartments on the floors above. The proximity and density of these uses make developments more walkable and mean that people can visit multiple destinations without having to drive.
- Building Height: Buildings that implement TOD principles are typically at least two stories. However, the optimal height and spacing of buildings can vary depending on land and infrastructure constraints, market conditions, width of the street, and the rhythm and intensity of surrounding development.

- Continuous Street Wall: All new buildings abut the sidewalk to create a direct connection between the public right-of-way and new buildings. It is also important to minimize gaps between buildings to enclose the street with active uses.
- Architecture: Buildings should incorporate TOD principles of flexible area and bulk requirements that allow for reduced setbacks and flexible height and lot coverage regulations. The architecture should complement the appearance and materials of existing buildings. Well-proportioned windows, interesting and varied rooflines, articulated cornices, ornate building entries, and special details at gateway corners can make a TOD development successful.
- Off-Street Shared Parking: There should be little surface parking for new infill development near station areas in order to directly integrate the station into the city, emphasize transit and non-motorized modes, as well as enhance safety of pedestrians and bicyclists. Shared parking between complementary uses is encouraged.

The neighborhoods best suited for transit-oriented development are those located within a half-mile of a transit station. The Naugatuck Valley communities that host a Waterbury Line rail station are prime candidates for TOD. In a north-to-south orientation, these are Waterbury, Naugatuck, Beacon Falls, Seymour, Ansonia, Derby, and Shelton. While opportunities for TOD should not be limited to areas near a rail station, they provide direct access to employment centers in Bridgeport and Stamford, as well as New York City.

Most towns and cities in the Naugatuck Valley are prime candidates for TOD. They have compact historic urban centers, public water and sanitary sewer lines needed to support mixed-use and higher density developments, and access to the



Waterbury Line and fixed-route bus service. TOD can help position these communities for a revitalization and retrofit their central business districts to recapture a dense, vibrant urban character. TOD can also improve access to jobs because, in a compact, mixed-use district, people can live close to where they work, or they can walk to a transit station to access jobs or educational opportunities in other nearby cities.

While the goals of TOD may be similar from one community to another, each development will be unique. It is very important that TOD respect and complement the form, density, character, and community values of each station area and downtown. Customizing TOD projects is critical to ensure they are appropriate for their urban context, accepted by the public, and attractive to private investors.

As part of the alternate modes assessment, the NVCOG has identified opportunity sites in proximity to the rail stations that could become TODs. In addition, “*Model Blocks*” were developed for each community based on the results of public input and visual preference surveys. The “*Model Block*” concept is not intended to impose a design but to help towns visualize a form of mixed-use, compact development that optimizes use of valuable downtown infrastructure, complements existing development, builds a customer base for merchants, builds transit ridership by bringing people closer to train and bus stations, and lets people live closer to where they work. The “*Model Block*” represents a development strategy for underused parcels.



[Model Block concept in Beacon Falls.](#)

Land development is only one aspect of TOD. It is imperative to have complementary transit service. While the Naugatuck Valley has rail infrastructure, it suffers from poor service and a state of poor repair. If TOD is going to capture residents, jobs, and businesses, improvements to the WBL are essential.

There are also opportunities to bring bus rapid transit (BRT) to the Bridgeport Avenue corridor in Shelton, which would connect the Derby-Shelton train station and downtown Bridgeport. Shelton has experienced significant corporate and industrial development in several areas outside the downtown core, the Bridgeport Avenue corridor being a prime example. With ready access to Route 8 and proximity to corporate and financial markets in both Fairfield County and

New York City, large tracts of open land are attractive for commercial and corporate development. Over the last 45 years, mid-sized retail centers, condominiums, hotels, corporate office parks, and mixed-use developments have been constructed. There is potential for more development in the Bridgeport Avenue corridor, but residents' concerns about traffic and other impacts from growth have put the focus on how non-automobile modes of transportation can accommodate new growth.

One option for TOD is the development of a “*Neighborhood Transit Hub*”, or *NTH*, which is a transit stop with robust multi-modal connections, including but not limited to buses, taxis, private vehicles, and non-motorized transportation. An *NTH* can also be a pulse-point where transit vehicles from different routes converge, timing their stops so that transferring from one route or service is easy. Providing effective and predictable transit encourages surrounding residential and commercial development, which, in turn, support transit. Coffee shops, bookstores, restaurants and convenience stores provide services to transit riders and area workers, new customers for private development, and more “eyes on the street” to improve safety and security. Other possible elements of an *NTH* include a village green that adds place-making value to nearby developments, a taxi and/or shared vehicle stand, bus shelters and other transit conveniences, commuter parking, and multi-use paths and bike lanes.



Overview of Neighborhood Transit Hub concept.

9.3 COMPLETE STREETS POLICY

Streets are an integral part of our cities and towns, providing and facilitating the movement of people and goods. The road network has direct impacts on a community's quality of life, connecting neighborhoods and providing access to businesses, jobs, schools, and a wide range of public and private services. In addition, the highway system facilitates connections to neighboring cities and towns, regions, and states. Historically, the goal of transportation improvement programs has usually been to make roadways as efficient as possible, prioritizing the flow of vehicular traffic while minimally considering the needs of pedestrians, bicyclists, and other non-motorized users. This has resulted in overbuilt roadways, long pedestrian crossing distances at intersections, limited bicycle infrastructure, and traffic signal timing and phasing that favors vehicle movements over other users. Streets are integral to the development of a high-quality sense of place, but the emphasis on vehicle movement has resulted in street environments that are unpleasant, and often dangerous, to non-motorized users.

Complete Streets is a holistic approach to planning, designing, and building a street environment that accommodates and enables safe access for all users, emphasizing the needs of individuals that traditional transportation planning has ignored, such as the elderly, people with disabilities, BIPOC communities, and people without access to a vehicle. More than just a safety strategy, a Complete Streets approach reduces vehicle miles traveled, energy consumption, and greenhouse gas emissions, enhances mobility and safety for all, and encourages walking and bicycling for transportation, recreation, and exercise. Instead of focusing on moving automobiles as quickly as possible, a complete street emphasizes multimodality, traffic calming, and employs variable paving material, street trees, rain gardens, and other streetscaping elements to create a visually interesting environment that is more comfortable for all users. While a complete street embraces many common elements, each application is unique and its features reflect the land use, needs, and characteristics of the area.

Key elements of Complete Streets include:

- Bicycle facilities: protected bicycle lanes or sidepaths, signage and appropriate pavement markings, and bicycle racks or parking.
- Bus features and amenities: bus pull-outs, demarcated bus areas, dedicated bus lanes (where appropriate), shelters, and clear and accessible paths.
- Pedestrian enhancements: accessible sidewalks, perpendicular crosswalks with striping, pedestrian signal enhancements, curb ramps, and short crossing paths and curb bump outs.
- Traffic calming actions: reduced lane width, textured paving material, intersection bump-outs, crosswalk bump outs, curb extensions, center refuge islands, and raised intersection tables.

- Streetscaping and green infrastructure: pedestrian-scale street lighting, street furniture, wayfinding signage, decorative paving, and buffers between the street and sidewalk to create a sense of place.
- Green infrastructure: appropriate urban trees, landscaping, bioswales and rain gardens, and pervious paving materials.
- ADA compliant features: sidewalk ramps, detectable warning strips and warnings, accessible pedestrian signals, short crossing lengths, and longer walk intervals.
- On-street parking treatments: delineated parking spaces and curb/sidewalk bump-outs.
- Access management actions: driveway consolidations, modifications, and closures.



The image at the left illustrates a street design that does not consider the needs of non-motorized travelers. On-street parking and access is uncontrolled, and there is no safe place for pedestrians to cross.



The following photo shows how the same street environment would look as a complete street. Variable paving materials, designated crosswalks, striped bicycle lanes, defined on-street parking, and streetscaping elements make the street inviting to all users and create a much more visually interesting place.

Complete Streets has been general practice in the region for several years, and NVCOG aims to include complete streets elements and integrate non-motorized needs into all projects, plans, and programs. In 2022, the NVCOG Board endorsed CTDOT's Complete Streets Policy, formally recognizing Complete Streets as a design and policy priority for all projects in the region. NVCOG plans to develop a regional Complete Streets Plan, which will include a more specific regional policy. Implementing Complete Streets at a regional level will be crucial in helping NVCOG achieve our Vision Zero goal of eliminating all roadway related fatalities and serious injuries by 2050.

Although NVCOG has not yet formally adopted a regional Complete Streets Policy or Plan, various projects and studies in our region have already incorporated complete streets elements:

- [Derby Route 34 Reconstruction](#): new sidewalks with curb bump-outs, upgraded storm drainage, lighting and streetscape features
- [Derby-Shelton Bridge Enhancements](#): protected bi-directional cycle track, textured pavement, buffers with planters, larger pedestrian space, connection with Derby Greenway and Shelton Riverwalk
- [Bristol Route 229 Corridor Study](#): recommended improvements include narrower travel lanes, sidewalk construction, new crosswalks, multi-use path, bicycle parking, bus shelters and passenger facilities, and wayfinding signage
- [Waterbury West Main Street Study](#): recommended improvements include a road diet, curb bump-outs, pedestrian actuated crossing devices, bus pull-outs, protected bi-directional cycle track, bicycle parking, textured pavement, and other streetscaping elements

Rendering of the
Derby-Shelton Bridge



9.4 GREEN INFRASTRUCTURE/LOW IMPACT DEVELOPMENT

Much of the transportation network comprises paved or hard surfaces in urban and suburban environments, greatly contributing to surface water pollution. As rainwater falls on impervious surfaces, it runs off, usually to a system of gutters, ditches, storm drains, and conveyances, and discharges directly into streams, rivers, and wetlands. With it, the rainwater carries pollutants including dust, lubricants, tire rubber, animal waste, traction sand, salt, and anything else that may have built up since the last rainfall and deposits it directly into the receiving water. Typical methods of dealing with storm water cause unnaturally heavy peak flows during and shortly after rain events, drastic water temperature spikes, and sometimes erosion of streambanks, washouts, and damage to culverts and bridges, impacting the reliability of the transportation network.

Green infrastructure (GI) and low impact development (LID) are alternative planning, design, and construction best management practices that aim to mitigate some of the environmental impacts of the transportation network by mimicking the pre-construction hydrology of a site. The principal goal of GI and LID is to slow, filter, store, evaporate and/or infiltrate stormwater close to its source, through both structural and non-structural planning and design techniques designed to minimize stormwater impacts.

Non-structural techniques begin with good land use planning and design aimed at minimizing the amount of impervious surface associated with a development, and properly siting development with surface water impacts in mind. Some non-structural GI best management practices include:

- Cluster development: Minimizing the amount of area that is disturbed by development to preserve natural stormwater infiltration functions and minimize the amount of roadway and other infrastructure needed to serve a development.
- Infill development and redevelopment: Prioritizing infill development and redevelopment of vacant or under-utilized parcels over development of forest or farmland.
- Lawn reduction: Minimizing lawn areas in favor of more natural vegetation cover, integrating native species where possible.
- Green streets: Designing roads that are not excessively wide, better relate to the service and function they provide, avoid steep grades, and incorporate vegetation such as bioswales and planter boxes.
- Green parking: Smart parking design and management including appropriately sized parking lots, shared parking, utilizing permeable pavement where possible, and incorporating covered garages to reduce the amount of impervious parking lot cover.
- Green materials: Designing with proper materials in mind including natural materials and native plants.

On-site structural green stormwater infrastructure can also greatly reduce the amount of runoff entering traditional storm water systems and surface receiving waters. Typically, these features treat a specific amount of runoff, with overflows built-in to default to traditional stormwater systems during more extreme events. In some cases, traditional stormwater infrastructure is not necessary. Some structural GI best management practices include:

- Bioswales – shallow vegetated depressions that infiltrate or temporarily store runoff.
- Rain gardens – landscaped areas designed to receive and infiltrate stormwater quickly, typically including native plants.
- Permeable pavement – by eliminating fines in asphalt or concrete, or using pavers with spaces in between, water can flow through the pavement and sub-base into the ground below.
- Tree boxes – similar in appearance to traditional street tree planters, but designed to retain, filter and infiltrate stormwater. These are often connected to a stormwater system to handle excess flows.
- Storm water planters – a small, contained vegetated area that collects and treats storm water using bioretention. They typically contain native, hydrophilic flowers, grasses, shrubs, and trees. The planters require periodic maintenance to ensure the system functions properly; insufficient maintenance can lead to poor drainage and potential flooding.
- Rainwater storage and repurposing – Cisterns and rain barrels collect and store runoff for later use, typically irrigation, reducing scarcity of drinking water supplies and energy needed to treat and deliver drinking water.
- Vegetated roof – lightweight planter systems can be integrated into rooftops to slow rainwater which is taken up by low maintenance plants. These roofs help insulate buildings and help mitigate the heat-island effect in urban areas.

Connecticut's "*Municipal Separate Storm Sewer System (MS4) General Permit*" went into effect in 2017 and applies to all NVCOG municipalities with the exception of Bethlehem. An MS4 is the municipally owned system of drains, conveyances, pipes, outfalls, etc. that transmits runoff to surface waters. As a condition of the permit, municipalities are required to "disconnect" directly connected impervious area (DCIA). Impervious surfaces are considered disconnected if runoff from the impervious surface does not enter the MS4, or if the volume of runoff generated from one inch of rainfall on a site is infiltrated or treated. Since municipalities do not have direct control of privately owned parking lots, driveways, rooftops and other impervious surfaces, they are left with town owned facilities and roads from which they can directly disconnect DCIA. Towns can comply with the permit through retrofitting existing facilities and designing new facilities with green infrastructure.

Watershed groups and environmentalists promote GI and LID techniques as a proven way to protect surface water quality during new construction and improve water quality for existing

stormwater systems. Several watershed protection groups in the NVCOG region have recently completed Watershed Plans: The Mill River Watershed Plan (2018) includes parts of Cheshire and Prospect; the Pomperaug River Watershed Plan (2018) covers parts of Woodbury, Southbury, Bethlehem, and Watertown; and the Pequabuck River Watershed Plan (2019) includes parts of Bristol and Plymouth. These plans include examples of GI retrofits that can help improve water quality, many of which are in public rights-of-way along roadways and public parking lots. These examples are a good place for municipalities to start minimizing impacts of the transportation network on stormwater.

Currently, there is a limited number of green infrastructure and low-impact developments in the NVCOG region. Examples of completed projects include bioswales with educational signage on Freight Street in Waterbury and the Byam Road Fire Station Rain Garden in Cheshire.

For future projects, planning, and corridor studies, NVCOG recommends the use of GI and LID best management practices wherever practical. When necessary, NVCOG will assist municipalities in MS4 compliance and provide training to municipal staff regarding implementations and maintenance.

9.5 SOLAR ENERGY

In 2021, in partnership with SolSmart, a U.S. Department of Energy program, NVCOG is working to streamline and promote the installation of solar energy within the region. The main goals of the program are to remove unnecessary barriers for development in solar installation, promote best practices throughout the region, educate and train staff, provide resources to municipalities, residents, and developers, reduce soft costs or indirect costs for solar implementation, and for NVCOG to gain recognition as a renewable friendly region.

Expanding the low-carbon electric grid will lead to a more sustainable transportation system that is not as dependent on fossil fuel powered vehicles and increase the environmental benefits of electric vehicles (EVs). Vehicle-to-grid technology is a smart charging technology that allows car batteries in EVs to give back to the power grid. For solar power, this is most critical at night, when solar panels cannot generate any additional energy. Vehicle-to-grid can improve efficiency of power distribution, expand capacity for renewable energy storage, and reduce energy costs.

The expansion of NVCOG's solar grid could have also have benefits for transportation-related infrastructure and amenities. Solar-powered bus stations and/or shelters could provide digital timetables, route information, and promotional panels, as well as heat in the winter months. In the more distant future, solar energy could have implications for electric-powered buses and rail.