CONNECTING THE “PEARLS”

The Master Plan Trails Element performs a very important function in achieving the Thornton vision for an interconnected system of parks, recreation facilities, and open space. Trails are intended to be the primary means by which these connections are made. Since 2012, the city of Thornton has added over 16 miles of trails to the city’s existing local trail system. Trail connection highlights since the previous 2012 Master Plan update include:

- New underpass at Holly Street at the Brantner Gulch Trail
- Trail Winds Trail: 134th Avenue to 136th Avenue
- New underpass at 104th Avenue at Grandview Ponds Open Space
- Eastlake Heritage Trail: Lee Lateral Trail from York Street to Colorado Boulevard

While the city has begun to link east/west trails to the regional system along the South Platte River and to trails in adjacent jurisdictions, the Trails Element focuses on identifying gaps in the current system and improving north/south travel connections.

TRAILS ELEMENT: EXPANDING THE FOCUS

Currently, the overall goal remains to develop a trail system that connects the city’s parks and open space system, responds to Thornton’s environmental resources, and provides for a wide variety of trail users (see Understanding the Trail Users on page 6-6) in the most cost-effective manner possible. As discussed in Chapter 3: Vision, Goals and Policies, the following priorities have been carried forward from the previous Parks and Open Space Master Plan:

- Create and connect recreational opportunities
- Provide long open space corridors
- Offer connections to other modes of transportation
- Support a variety of uses
- Promote Thornton’s unique, historic resources
- Raise awareness and educate users
- Complete key missing links

INTEGRATING PLANNING APPROACHES
To accomplish the above objectives, the Master Plan update of the Trails Element identifies activities and policies undertaken by various city departments, surrounding jurisdictions, and private stakeholders.

**Thornton Existing Trail System**

Thornton’s existing trail system includes four types of facilities (See Exhibit 6.1):

- **Regional Multi-Use Trails**, which are the primary “arterials” of the system and provide connections to major metro-area greenways and adjacent jurisdictions’ trails systems;
- **Local Trails**, which provide links from individual neighborhoods to recreational, cultural, and employment destinations, as well as connections to the regional system;
- **Dedicated Bike Lanes**, which are striped lanes located within the right-of-way to create a separate lane for cyclists, which provide on-street opportunities for recreational and commuter cycling; and
- **Paved Shoulders**, which are located at the far edge of the road and are wide enough to safely accommodate on-street cycling.

**PARKS AND OPEN SPACE RECREATIONAL TRAIL PLANNING**

- **Goal** – To develop a trail system that connects the city’s parks, recreation facilities and open space, responds to the city’s environmental resources, and provides for a wide variety of visitors in the most cost effective manner possible.

- **Implementation Strategy**
  – To develop off-road trails along natural drainage and irrigation ditch features as the primary means of making connections.

- **Status** – Completed project segments include 132.7 miles of off-street local and regional multi-purpose trails, and 42.8 miles of on-street bike lanes and 12 miles of paved

The off-road facility types comprise the majority of Thornton’s existing trail system, generally following natural drainage and irrigation ditch systems. Regional multi-purpose trails are typically wider and longer than local trails. Various proposed on-street routes have been mapped in previous planning efforts, but implementation of route identification and directional signage has generally not occurred. With the adoption of a “complete streets” policy (a policy that ensures that transportation improvements integrate walking, bicycling, transit, and motor vehicle use while promoting safe and efficient operations for all modes), additional bicycle lanes have begun to be striped on area streets.
Exhibit 6.1 Existing Trail System

THORNTON: 2015 EXISTING TRAIL SYSTEM
29 Miles: Regional Trails
103.7 Miles: Local Trails
42.8 Miles: Bike Lanes
12 Miles: Paved Shoulders
2011 Thornton Complete Streets Policy

Street rights-of-way are a critical component of public space and play a major role to establish the image and identity of a city, provide a key framework for current and future development, and contribute to the success and vitality of adjoining private uses and neighborhoods. In April 2011, the Thornton City Council adopted a policy to ensure that transportation improvements integrate walking, bicycling, transit, and motor vehicle use while promoting safe and efficient operations. For non-motorized users, particularly bicycle commuters, this includes using updated thoroughfare cross-sections that provide 6-foot bicycle lanes as part of new street construction projects. For retrofit and resurfacing projects, implementing complete streets policies may mean re-assessing street space allocation when repaving in an effort to narrow or eliminate motor vehicle travel/turning lanes to accommodate on-street bicycle lanes. However, Thornton’s build-out street plan calls for widening several existing four-lane arterial streets to six lanes. If that occurs, any corridors with six-lanes of traffic will not be suitable for bicyclist use, and a parallel alternative should be created at the time of the arterial widening.

Incorporating the philosophies that bicyclists and pedestrians are legitimate users of the street network, and that enhanced “complete street” corridors may serve as extensions of a community’s off-road trail system, represent major additions to the scope of the city of Thornton Parks and Open Space Master Plan. This comprehensive approach to trails planning better accommodates and incorporates the diverse needs of various trail user groups, as defined on page 6-6.

As a result, one of the major challenges to the development of a well-connected trail system – how to cross the arterial street network – can become less of a barrier to non-motorized travel once the park and street networks are thought of as an integrated system. Locations where on- and off-street facilities intersect have traditionally posed opportunities for conflicts between vehicles, pedestrians, and cyclists. Past trail planning efforts have therefore focused on providing grade-separated overpasses and underpasses of major roadway corridors. With the adoption of complete streets policies, the interface between corridors may also include enhanced designs for at-grade roadway/trail intersections as discussed at the end of this chapter.

Multi-Jurisdictional Plans

Plans and projects of adjacent jurisdictions and key stakeholders were reviewed for regional system integration and connectivity. Key planning initiatives incorporated into the Master Plan update include:

- Several short trail projects funded by Denver Regional Council of Governments (DRCOG), which are designed to provide neighborhood sidewalk and trail connections to the RTD FasTracks rail stations in Thornton;

- Connections to facilities in various open space, park, and trail plans developed by the adjacent jurisdictions of Westminster, Federal Heights, Northglenn, Broomfield, and Adams County;

- Extensions of on-street bikeways into Thornton in alignment with the network established in the Westminster 2030 Bicycle Master Plan and other neighboring jurisdictional plans; and

- Recommendations of the Thornton Comprehensive Plan to develop a Heritage Trail system of loops to highlight unique historical, cultural, and environmental features of the community. (See Appendix 12 for the Heritage Trail Concept Plan, which was adopted as part of the 2012 Master Plan update).
CITY OF THORNTON COMPLETE STREETS POLICY

- **Goal** – To improve access and mobility for all users of streets in the community by improving safety through reducing conflict and encouraging non-motorized transportation and transit.

- **Implementation Strategy** – To systematically add on-street bicycle lanes and sidewalk enhancements to Thornton streets in conjunction with street reconstruction and repaving, as well as new development construction.

- **Status** – Current and proposed non-motorized projects focus on striping bicycle lanes on arterial streets to link with bicycle facilities in adjacent jurisdictions, combined with wider sidewalks for pedestrians.

- Select local/collector streets will be additionally designated to complete key missing links in the City’s 2025 primary bike system.

**Exhibit 6.2 Multimodal Thoroughfares**

- Arterial streets with bicycle lanes (short/mid-term)
- Hwy 7 with existing paved shoulders
- Arterial streets with planned bicycle lanes (long-term)
- Collector street connections
- On-street bike lanes in adjacent communities
- Connecting trail segments
UNDERSTANDING THE TRAIL USERS

Key to the expanded focus of the Master Plan is an understanding that people use trails and bike facilities for different purposes and have varying comfort levels and expectations for their trail experiences. In general, the Master Plan uses the nationally recognized “design bicyclist” concept in which the planning and design of facilities considers the needs of three distinct classifications of users:

- **Type A: Advanced Bicyclists** – These are experienced riders who can operate under most traffic conditions. They comprise the majority of the current users of collector and arterial streets and are best served by the following:
  - Direct access to destinations usually via the existing street and highway system.
  - The opportunity to operate at maximum speed with minimum delays.
  - Sufficient operating space on the roadway or shoulder to reduce the need for either the bicyclist or the motor vehicle operator to change position when passing.

- **Type B: Basic Bicyclists** – These are casual or new adult and teenage riders who are less confident of their ability to operate in traffic without special provisions for bicycles. Some will develop greater skills and progress to the advanced level, but there will always be many millions of basic bicyclists. They prefer:
  - Comfortable access to destinations, preferably by a direct route, using either low-speed, low traffic-volume streets or designated multi-use facilities.
  - Well-defined separation from motor vehicles by providing space for bike lanes or separate multi-use trails.

- **Type C: Child Bicyclists** – These are pre-teen riders whose roadway use is initially monitored by parents. Eventually they are accorded independent access to the system. They and their parents prefer the following:
  - Access to key destinations surrounding residential areas (schools, recreation facilities, shopping, etc.)
  - Residential streets with low motor vehicle speed limits and volumes.
  - Well-defined separation from motor vehicles on arterial and collector streets or separate multi-use trails.

Most bikeway and trail planning initiatives combine Type B/C riders into a single user group that prefers access to off-road trails, a network of lightly traveled neighborhood streets, and bicycle lanes on streets with moderate traffic volumes and speeds. By contrast, Type A cyclists are generally best served by designing all roadways to accommodate shared use by bicycles and motor vehicles, with select corridors enhanced with wide outside lanes, paved shoulders, striped bicycle lanes, and/or multi-use trails designed to bicycle facility standards. In addition, different types of pedestrians enjoy Thornton’s trails system, and may generally be classified as:

- **Utilitarian Pedestrians** – People who use portions of the trail system to walk to work, to school, to shopping, or to take mass transit. These pedestrians make short trips and prefer direct routes of travel on hard, all-weather surfaces.

- **Athletes in Training** – This pedestrian group includes runners, joggers, and some walkers who use trail facilities for their workouts. Many athletes prefer a soft-surface, low-impact trail tread, designated mileage markers, and minimal roadway crossings or similar start/stop elements that disrupt timed exercise routines. Length of facility desired varies widely by skill and endurance level.

- **Social/Recreational Pedestrians** – Social activities conducted on multi-use paths include people walking dogs, meeting neighbors, hanging out with their families, enjoying nature, and exploring different parts of a community on foot. Due to the great diversity of pedestrians and uses, a system of stacked loop trails of varying lengths is often desired to be provided from a common starting point to offer multiple experiences.

- **Wheeled Pedestrians** – Wheeled pedestrians include a diverse group of people using in-line skates, kick scooters, skate boards, baby strollers, wheel chairs, etc. Such users generally prefer paved and maintained, all-weather surfaces and relatively flat grades.

- **E-Bikes** – Electric bikes are part of a wide range of Light Electric Vehicles (LEVs) that provide convenient local transportation. Generally designed for one person and small cargo capacity, the range and speeds of electric bikes are moderate. Most trips are less than 20 miles, although the latest advances in affordable lithium batteries may allow e-bikes to travel further distances. E-bikes are clean, quiet, and efficient LEVs, and offer many advantages.
IMPLEMENTING AN ACTION PLAN FOR 2025 AND 2040

The Trails Element chapter focuses on identifying a proposed primary network of trail and street corridors for implementation by 2025, consistent with regional DRCOG planning horizons, to provide a system of continuous cross-town routes of non-motorized travel, as identified in Exhibit 6.3. Additional proposed segments of local trails and roadway enhancements will occur off of, and feed into the primary network as part of the 2040 Trails Plan presented as a fold-out at the end of this section, Exhibit 6.7.

The 2040 Trail Plan unites the planning efforts of the Infrastructure, City Development, and Community Services Departments, and represents complete build-out of Thornton’s trails system through a combination of opportunity-based and need-based initiatives.

Opportunity-Based Projects

To date, implementation of specific trail segments has been primarily opportunity-based. Many trails have been built as part of land development and large infrastructure projects, others have been the result of securing open space funds and matching grant opportunities from regional, state, and federal agencies. Trail projects shall continue to be cost-effectively implemented as opportunities allow through ongoing development processes and roadway resurfacing and widening projects.

The 2040 Trails Plan, Exhibit 6.7, includes projects that have been proposed and are included in zoning and plat documents submitted to the city by developers; however, they have not been built. They are included in the planning process because they show intended and desired connectivity between specific trail segments. The City Development Services Department will continue to review and require land dedication and/or trail construction as part of urban growth in Thornton to promote safe and convenient connections within and outside of the development boundaries.

New street construction in developments will follow the Thornton Transportation Plan that requires on-street bike lanes and/or wide sidewalks on collector and arterial streets. The 2025 and 2040 Trails Plans will be referenced for street corridors targeted for 6-foot bicycle lanes. For pedestrian needs, targeted trail corridors along street rights-of-way will provide a 10-foot sidewalk on one side of the roadway and a narrower sidewalk on the other side.

Additionally, the Infrastructure Department will systematically implement numerous complete streets projects concurrent with their ongoing street maintenance program, which will provide on-street bicycle lanes and attention to non-motorized user needs at intersections as part of several upcoming roadway resurfacing projects. Projects programmed within the 2025 horizon are included as key components of the primary corridor system. Additional, shorter bicycle lane segments may also be constructed, connecting into and providing enhanced access to the larger, citywide system from various neighborhoods.

Comments received from attendees at public meetings and contained in the survey results indicate a desire for sidewalk improvements that also serve as links to important trail corridors. This requires ongoing coordination between city departments to ensure that missing links are integrated into future budget allocations.

Coordination and partnerships with other municipalities, Adams County, RTD, and irrigation ditch companies are viewed as additional strategies for opportunity-based development of regional trail projects.

Need-Based Projects

Several important projects have been identified that will require targeted funding outside of opportunity-based projects. The Trails Element chapter focuses on a needs-based assessment of key missing gaps in a system of primary corridors designed to provide geographic coverage across the community.

Criteria for determining the designation of the primary corridors include:
6. TRAILS ELEMENT

- Cross-town routes at least 2.5 miles in length;
- Initial network spacing every 1-2 miles;
- Network laid out to maximize use of regional trails and existing facilities combined with proposed projects with near-term implementation schedules;
- Seamless transition between facility types (on-road to off-road) to provide continuous routes of travel; and
- Alignment with connections to bike/trail facilities in the surrounding jurisdictions of Westminster, Federal Heights, Northglenn, Broomfield, Commerce City and Adams County.

The resulting system, which comprises the 2025 Trails Plan, provides nine primary corridors for east-west travel and eight corridors for north/south travel, as identified below in Exhibit 6.3. Missing links in the identified primary corridor network, as depicted in Exhibit 6.4 and detailed in Appendix 13.A, should receive priority for completion. These identified need-based projects should move forward independently of land development and roadway

Exhibit 6.3 2025 Trails Plan: Primary Corridor Network

2025 TRAILS PLAN: COMPLETE A SYSTEM OF PRIMARY CORRIDORS

#1: Highway 7
#2: E. 136th Avenue/Cottonwood Lakes Blvd/Summit Grove Pkwy
#3: Farmers’ High Line Canal Trail, Signal Ditch, and Lee Lateral Trail
#4: Brantner Gulch Trail
#5: Northglenn trail connections
#6: Grange Hall Creek Trail
#7: E. 100th Avenue
#8: E. 88th Avenue
#9: Niver Creek Trail
#10: Washington Street
#11: Big Dry Creek Trail
#12: Trail along FasTracks corridor
#13: Signal Ditch Trail/Madison Street and Woodglen Boulevard
#14: Yosemite/Todd Creek/Summit Grove Pkwy/Fairfax St/Birch Dr
#15: Colorado Blvd
#16: Marion St/Downing St/Dorothy Blvd/Hoffman Way
#17: South Platte River Trail

The 2025 Trails Plan System of Primary Corridors includes connections in adjacent jurisdictions to illustrate the complete desired connections of trail visitors regardless of jurisdiction. The city of Thornton would only be charged with completing the missing links within the city limits and within the planned growth area.
resurfacing projects if they are to be implemented within the targeted 2025 timeframe.

Working with POSAC, Community Services Department staff annually reviews unprogrammed system gaps and prioritizes missing links for annual capital improvements, leveraging outside funding support wherever feasible. Key missing segments to be completed by 2025 include the following, with an itemized listing contained in Appendix 13.B:

- Northeast extensions of the Big Dry Creek, Signal Ditch, and Lee Lateral/Todd Creek trails into growth areas and jurisdictions to the north;
- Development of the trail along an easement parallel to the FasTracks North Metro corridor;
- Accelerated programming of roadway restriping along E. 136th Avenue;
- Extension of the South Platte River Trail, and associated local trail connections, to link to the Adams County Regional Park and Fairgrounds; and
- Completion of short gaps in the Niver Creek Trail system.

### Exhibit 6.4 2025 Trails Plan: Priority Missing Links

#### 2025 TRAIL PLAN: PRIORITIZED MISSING LINKS

- 60% of Thornton’s targeted primary network is currently built
- 20% is comprised of Complete Street projects currently programmed for implementation by Infrastructure Department within the 2025 horizon, and/or represent low-cost designation of local streets as bicycle routes
- 20% remains as unprogrammed missing links to be completed by 2025
- Missing links outside of Thornton city limits and planned growth area are not included in the above percentages

The 2025 Trails Plan System of Primary Corridors includes connections in adjacent jurisdictions to illustrate the complete desired connections of trail visitors regardless of jurisdiction. The city of Thornton would only be charged with completing the missing links within the city limits and within the planned growth area.
The result will be a continuous trails network that overcomes existing north/south travel barriers and completes existing gaps in key east/west routes. As illustrated in Exhibit 6.5, approximately 63% of this system will route on off-road facilities that follow environmental corridors, while 37% is proposed to follow street right-of-ways to make key connections and fill unmet needs for bicycle commuters.

Once the 2025 Plan is completed, remaining unbuilt trail segments shall be reprioritized as secondary corridors and neighborhood connections. Future priority should be placed on local trail segments that can complete connections between primary corridors, thereby creating a finer grid of secondary facilities spaced ½ to 1 mile apart. The fold-out map that follows, Exhibit 6.7, depicts all existing and proposed facilities desired to be constructed by 2040 – including additional local trail connections, proposed trails approved for development, long-term roadway restriping projects to include on-street bicycle lanes, trailhead locations, and proposed grade-separated crossings.
PROMOTING THORNTON’S HERITAGE

A final component of the 2025 Trails Plan integrates Thornton’s Heritage Trail linkage concept. The Heritage Trail system is a series of loops that traverse culturally-significant zones within the city and create special educational and interpretive experiences for users. Multiple loops, each with a distinct historical, cultural, or environmental theme, were identified. The routes have been fine-tuned to connect and overlap with the primary corridor system, as illustrated below.

The Heritage Trail loops are differentiated from other city trails through a consistent signage and wayfinding program, including placement of ¼-mile markers to enable recreational users to track distances traveled. The design of each Heritage Trail and associated trailhead include distinct materials and furnishings, interpretive exhibits, and signage that reflect the project’s assigned heritage theme. Additional details of the trail themes are contained in the Heritage Trail Plan document. (Appendix 12).

Exhibit 6.6 2025 Trails Plan: Heritage Trail System

HERITAGE TRAIL LINKAGE CONCEPT

Goal – To convey Thornton’s spirit, character, and uniqueness by highlighting a diverse spectrum of regional themes pertaining to the community’s history, culture, and environment.

Proposed Themes –

A. Big Dry Creek Heritage Trail
   - wildlife corridors, oil and gas

B. Signal Ditch Heritage Trail
   - original families, irrigation ditches

C. Vista Heritage Trail
   - mountains, plains, environment, weather

D. Eastlake Heritage Trail
   - railroad, agricultural commerce, irrigation

E. Niver Nature Heritage Trail
   - native plant and animal life

F. Lambertson Lakes Heritage Trail
   - agriculture

G. Original Thornton Heritage Trail
   - 1950s Suburbia and Thornton’s Hollywood roots

H. Anglers Heritage Trail
   - evolution of landscape, animals, and human settlement
EXISTING TRAILS NETWORK AND PROPOSED 2040 TRAIL PLAN

Legend
Regional Multi-Use Trails
- Regional Existing
- Regional Missing Links
- Regional Existing Outside City
- Regional Missing Links Outside City

Local Trails
- Local Existing
- Local Missing Links
- Local Existing Outside City
- Local Missing Links Outside City

Bike Lanes/Routes
- Bike Lane/Route Existing
- Bike Lane/Route Missing Links
- Paved Shoulders Existing

Trailheads
- Existing Trailhead
- Proposed Trailhead

Trail Intersections
How to Read the Symbols
Symbol represents an existing At-Grade intersection “A”. The proposed improvement is an Underpass “U”

Existing Facility
- None Present
- At-Grade
- Overpass
- Underpass

Proposed Improvements
- At-Grade
- Overpass
- Underpass

Sources for proposed trails outside the city of Thornton or a non-Thornton owned properties were provided by the city of Thornton GIS Department and Adams County GIS Department for the purpose of this master plan update. These proposed alignments are conceptual and for planning purposes to illustrate desired future connections.
FACILITY CLASSIFICATIONS AND STANDARDS

An additional benefit of a coordinated inter-departmental planning approach is consistent use of design standards for all facilities regardless of the entity charged with implementation. The trail design guidelines that follow have been updated for consistency with established national and local transportation standards. Recommended design manuals include the following:

- **The American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities, 4th Edition, 2012** – the go-to design resource for on- and off-street bicycle facilities that are used for non-motorized transportation and/or constructed with state and federal funding.


- **City of Thornton Standards & Specifications: Typical Thoroughfare Cross Sections, revised August 2012** – a series of roadway cross-sections outlining required dimensions for rights-of-way, motor vehicle travel lanes, bicycle lanes, on-street parking provisions, medians, landscape buffers, and sidewalks.

- **City of Boulder: Pedestrian Crossing Treatment Installation Guidelines** - state-of-the-art guidance for enhanced at-grade crossings, including pedestrian crossing location criteria, specific crossing design treatments, technical literature research, and an evaluation of the effectiveness and safety of various treatments being tested at crossing locations in the city of Boulder.

The following table summarizes design standards to use when developing new trail connections. First presented is an overview of the various facility types, consistent with AASHTO and NACTO design guidelines. Second is a series of tables organized into regional, local, and on-street classifications. The design standards should act as a tool for city staff to evaluate trail connections in development proposals and plan for new trails within the city.

Updates to the original Master Plan trail standards include recommending use of detached sidewalks for the pedestrian component of trails that route within street corridors (elimination of attached sidewalks as a trail type except adjacent to on-street park parking), adding Heritage Trail loops and paved roadway shoulders as trail types, and expanding trail crossing guidance to address not only overpasses and underpasses, and various types of at-grade pedestrian crossing treatments.
### Exhibit 6.8 Trail Types

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Typical Width</th>
<th>Typical Surface</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| Detached Sidewalks       | 6'-10'        | Concrete or asphalt      | • Separated from curb by landscape buffer  
• Follows arterial and collector streets with moderate to high volumes of traffic  
• Designed for low speed users (pedestrians) |
| Multi-Use Trails         | 8'- 12'       | Concrete or asphalt      | • Located along drainages and/or irrigation ditches in parks, and through open space lands  
• Continuous routes with limited vehicular conflicts and frequent directional signage  
• Designed for low and moderate speed users (walkers, runners, cyclists, in-line skaters, etc.)  
• Lighting is required per city specifications |
| Soft-Surface Trails      | 2'- 10’       | Crusher fines or compacted organic material | • Located in open space in areas not prone to flooding  
• Continuous routes with limited vehicular conflicts and frequent directional signage  
• Designed for a variety of users (cyclists, hikers, runners, etc.) |
| Heritage Loop Trails     | 8’- 12’       | Any of the above         | • Special loops within the overall trails system designated with unique signing and mile markers  
• Tell the story of unique cultural, environmental, or historical themes  
• Designed for a variety of users (cyclists, hikers, runners, etc.) |
<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Typical Width</th>
<th>Typical Surface</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paved Roadway Shoulders (or clear zones)</td>
<td>4’-6’</td>
<td>Asphalt</td>
<td>• Continuous routes of travel on rural condition roads with no curb-and-gutter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Should use bicycle lane pavement markings at intersections to minimize vehicular conflicts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• May use “Share-the-Road” warning signs to alert motor vehicles to potential bicycle traffic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Designed for a variety of users (cyclists, hikers, runners, etc.)</td>
</tr>
<tr>
<td>On-Street Bicycle Lanes</td>
<td>6’</td>
<td>Concrete or asphalt</td>
<td>• Continuous routes with striped on-street lanes on urban condition roads with curb-and-gutter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Located between gutter and travel lane, or parking and travel lane</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Should continue presence of pavement markings at intersections to minimize vehicular conflicts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Use “Bike Lane” signs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Designed for high speed users (cyclists)</td>
</tr>
<tr>
<td>On-Street Bicycle Routes</td>
<td>12-14’ of usable lane width</td>
<td>Concrete or asphalt</td>
<td>• Shared lane with vehicles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Designated and mapped, ideally using “sharrow” pavement markings to indicate cyclist lane placement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• May use “Bike Route” signs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Designed for low volume streets that connect to other trail facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Designed for high speed users (cyclists)</td>
</tr>
</tbody>
</table>
6. TRAILS ELEMENT

**Regional Multi-Use Trail Facilities**

Regional trails provide connections to trail systems that cross jurisdictions (e.g. the South Platte River Trail) to neighboring jurisdiction trail systems (e.g. Grange Hall Creek Trail in Northglenn). The required facility type is a 10’-12’ multi-use trail or a set of parallel trails (10’ multi-use and 2’ - 10’ soft surface). The decision to construct a single or parallel trail facility is based on the anticipated trail use.

Regional trails typically use natural drainages or irrigation ditches as the basis for their routes. Development of some corridors will involve a major commitment to acquisition of trail easements or rights-of-way, design, and construction. Additional links are proposed that will connect these major trails to each other and to other destinations. Regional trail corridors need to incorporate grade separations or enhanced pedestrian crossing improvements to mitigate conflicts with motorized vehicle traffic.

**Regional Multi-Use Trail Facilities Specifications**

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Paved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>10-12’</td>
</tr>
<tr>
<td>Shoulders</td>
<td>2-5’</td>
</tr>
<tr>
<td>Cross Slope</td>
<td>1% min / 2% max</td>
</tr>
<tr>
<td>Vertical Clearance</td>
<td>10’</td>
</tr>
<tr>
<td>Maximum Grade</td>
<td>8.3%</td>
</tr>
<tr>
<td>Amenities</td>
<td>Signage, Lighting, Trash Receptacles, Benches, Dog Waste Stations</td>
</tr>
</tbody>
</table>

**Local Trail Facilities**

Local trails serve as important links between branches of the regional trail system, components of the parks and open space system, and specific destinations in the community. As such, they provide a series of interconnected recreational loops of varying lengths, which are appropriate for a wide range of users. The predominant facility is a 6’-10’ multi-use path that provides clear directional signage to regional trail facilities and local destinations, but can also include detached sidewalks and soft-surface trails. Attached sidewalks were formerly considered to be a local trail type, but have been removed from the Master Plan in favor of sidewalk facilities separated from vehicular traffic by a landscape buffer. Attached walks adjacent to neighborhood parks are preferred for on-street parking access.

Segments of local trails that are mapped as part of the 2025 Trails Plan primary corridor network shall be constructed to wider standards at 8’ minimum. Local trails need signed crossings and marked crosswalks when intersecting with motor vehicle traffic.

**Local Trail Facilities Specifications**

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Detached Sidewalk</th>
<th>Soft Surface Trails</th>
<th>Multi-use Trails</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>6’-10’</td>
<td>2’ to 10’</td>
<td>8’ to 12’</td>
</tr>
<tr>
<td>Shoulders</td>
<td>2-5’</td>
<td>2’-5’</td>
<td>2’-5’</td>
</tr>
<tr>
<td>Cross Slope</td>
<td>1% min / 2% max</td>
<td>1% min / 2% max</td>
<td>1% min / 2% max</td>
</tr>
<tr>
<td>Vertical Clearance</td>
<td>10’</td>
<td>10’</td>
<td>10’</td>
</tr>
<tr>
<td>Maximum Grade</td>
<td>8.3%</td>
<td>8.3%</td>
<td>8.3%</td>
</tr>
</tbody>
</table>
Heritage Trail Facilities

Segments of Heritage Trails that are mapped as part of the 2012 Heritage Trails Plan shall be constructed to wider standards, consistent with regional trail facilities. At minimum, Heritage Trails need signed crossings and marked crosswalks when intersecting with motor vehicle traffic.

<table>
<thead>
<tr>
<th>Local Trail Facilities Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Type</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Shoulders</td>
</tr>
<tr>
<td>Cross Slope</td>
</tr>
<tr>
<td>Vertical Clearance</td>
</tr>
<tr>
<td>Maximum Grade</td>
</tr>
</tbody>
</table>

Bike Lanes and Bike Routes

On-street bike lanes and bike routes can provide safe methods of travel between segments of off-street trails. Improvements may include striping bicycle lanes on both sides of the street where the road right-of-way can accommodate such a designation, or consistent signage and use of shared lane pavement markings (“sharrows”) that identify the street segment as part of a comprehensive routing system and indicate desired cyclist roadway position. Paved shoulders may serve as the bicycle travel lane on rural roadways without curb and gutter. In all locations, attention should be given to intersection designs to minimize potential conflicts between through-cyclists and right-turning motor vehicles.

<table>
<thead>
<tr>
<th>Bike Lane And Route Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Type</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Shoulders</td>
</tr>
<tr>
<td>Cross Slope</td>
</tr>
<tr>
<td>Vertical Clearance</td>
</tr>
<tr>
<td>Maximum Grade</td>
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</tbody>
</table>

STREET CROSSING GUIDANCE

The decision on what type of design treatments are appropriate at trail/roadway intersections requires balancing user safety and personal comfort needs with prudent traffic engineering principles and project cost and budget considerations.

Exhibit 6.9 provides guidance in determining where different types of trail crossings are needed. Desired crossing types shown in Exhibit 6.10 depend on the types of intersecting facilities – both vehicular and non-motorized – and may be a grade-separated or at-grade crossing design.

Grade Separations

Grade separations are desirable when a trail passes either over or under another trail, a water feature, a roadway, or a railroad. Grade separations help to minimize conflicts between motorized and non motorized users by providing a safe buffer between travel ways.
A goal for Thornton’s regional trail system is to provide uninterrupted connectivity. Overpasses and underpasses are therefore desired along all regional trails to provide continuous routes of travel removed from motor vehicle conflicts, especially when crossing major arterial streets. However, this may not be possible in some cases and enhanced at-grade crossing treatments can effectively be used as an alternative. When grade-separated structures are provided over/under a street corridor with on-street bicycle lanes, design of the structure should include appropriate connecting trails, ramps, and curb cuts to allow for cyclists to seamlessly transition between the intersecting on-road and off-road facilities. The decision to provide underpasses along local trails following various streams, drainages and irrigation ditches will depend on opportunities for cost-effective implementation, most likely in association with infrastructure improvements.

Existing and proposed grade separations are mapped on the Exhibit 6.7 2040 Trails Plan. This map is to be used as a long-range planning guideline that represents the vision for 2040 and will change based on actual trail alignments, developer negotiations, Capital Improvement Project (CIP) feasibility, etc.

### At-Grade Crossings

Intersections with streets and roadways are important considerations in the design of both trail and bike lane facilities. When intersections occur at-grade, a major design consideration is the establishment of right-of-way for various users. CDOT, AASHTO, NACTO, and MUTCD have usage warrants and design standards regulating various types of at-grade crossings.

A marked crosswalk is a pedestrian crossing that is delineated by white crosswalk pavement markings. It is important to note that legal crosswalks exist at all public street intersections whether marked or unmarked. However, the only way a crosswalk can exist at a mid-block location is if it is marked. All traffic control devices, including crosswalk markings and signs, must conform to the federal and state regulations for dimensions, color, wording, and graphics. To create highly visible roadway crossings for trail facilities, it is recommended to use ladder-style crosswalk markings in all locations along Thornton’s trail system.

Various crossings may be further enhanced by using a combination of the following, based upon site-specific needs, opportunities, traffic counts, and usage warrants:

- **Enhanced mid-block crossings** on arterials and collectors may include use of raised speed tables, colored and textured pavements used within the crosswalk area, retroreflective marking materials, landscape enhancements, or other traffic calming strategies.

- **Raised medians and center pedestrian refuge islands** should be considered for mid-block crossings on multi-lane roadways in urban and suburban areas to allow non-motorized users to find an acceptable gap in traffic for one approach direction at a time. Median refuge islands are appropriate where there are mixtures of a significant number of pedestrians, high volumes of traffic (more than 12,000 vehicles per day) and intermediate or high travel speeds. Crosswalks should cross perpendicular to travel lanes, but angle within the median refuge area to face oncoming traffic, then continue perpendicularly across the remainder of the street.

- **Curb extensions** should be considered for mid-block crossings on streets with on-street parking to enhance pedestrian visibility and shorten the distance and time required to cross the street. Curb extensions, or neckdowns, are created when the curbline is bulged out toward the middle of the roadway to narrow the width of the street.

- **A pedestrian traffic signal** may be used in a mid-block location after careful study of traffic characteristics. This is a conventional traffic signal with circular red, yellow, and green displays for motorists and Walk/Don’t Walk signals for pedestrians that is applied at a pedestrian crossing.

- **A pedestrian hybrid beacon** is a relatively new type of crossing treatment used to both warn and control traffic at a pedestrian crossing. Often called a HAWK Beacon, it is a hybrid between a pedestrian traffic signal and a stop
sign. It is actuated by a pedestrian push button, and uses a combination of circular yellow and red traffic signal displays to first warn motorists of a pedestrian that is about to cross the street, then require the motorist to stop for the pedestrian crossing, and then release the motorist to proceed once the pedestrian has cleared the crossing.

- **Pedestrian Activated Flashing Lights** are small rectangular yellow flashing lights that are deployed with pedestrian crossing warning signs. They are typically actuated by a pedestrian push button and flash for a predetermined amount of time, to allow a pedestrian to cross the roadway, before going dark. RRFBs are warning devices. They may be used on pedestrian actuated flashing signs, or embedded within the pavement of travel lanes as in-roadway warning lights.

- **Enhanced crosswalk signing** may be used to draw further attention to the crossing area. Techniques used in other communities include signs and bollards stating “State Law–Yield to Pedestrians” (used at 2 or 3-lane crossings) and pedestrian activated flashing signs (used primarily at multi-lane crossings).

For bicycle lane intersection design, NACTO is the most current and comprehensive resource for implementation guidance on colored lanes, bike boxes, median refuge islands, through bike lanes, combined bike/turn lanes, and other innovative treatments.

<table>
<thead>
<tr>
<th>Exhibit 6.9 Crossing Type Criteria</th>
</tr>
</thead>
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<table>
<thead>
<tr>
<th>Intersecting Corridor Type</th>
<th>All Regional Multi-Use Trails</th>
<th>Local Trails on Primary Network</th>
<th>Local Trails off Primary Network</th>
<th>Connecting Neighborhood Trails</th>
<th>On-Street Bicycle Lanes</th>
<th>On-Street Bicycle Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeways &amp; Active Rail Lines</td>
<td>• Provide bicycle/pedestrian underpass or overpass</td>
<td>• May route to closest existing street crossing if separate bike/pedestrian structure is cost prohibitive</td>
<td>• Use street crossings and structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial Streets without Bike Lanes</td>
<td>• Provide bicycle/pedestrian underpass or overpass</td>
<td>• Route to closest traffic signal</td>
<td>• Cross arterial streets at intersections with vehicular traffic signals</td>
<td>• Continue bike lane markings to and through intersections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial and Collector Streets with On-Street Bicycle Lanes</td>
<td>• Enhanced at-grade crossings are preferred for linkage between on- and off-road facilities</td>
<td>• Provide highly visible ladder-style crosswalks, possibly with some form of pedestrian crossing light</td>
<td>• Cross arterial streets at intersections with vehicular traffic signals</td>
<td>• Continue bike lane markings to and through intersections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local and Collector Streets without Bike Lanes</td>
<td>• Provide at-grade crossings with highly visible ladder-style crosswalks</td>
<td>• Provide highly visible ladder-style crosswalks</td>
<td>• Streets with bike lanes should have right-of-way over intersecting local streets</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Exhibit 6.10 Crossing Types

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Typical Width</th>
<th>Typical Surface</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle/Pedestrian Bridge or Overpass</td>
<td>10’- 14’</td>
<td>Wood, composite, concrete, or metal decking</td>
<td>• Min. clear width same as approaching path, ideally including an additional 2’ clearance on either side of trail&lt;br&gt;• 5% max. grade on approach ramps&lt;br&gt;• Railings/fences on both sides shall be a min. height of 42” for pedestrian facilities and 54” for bicycle facilities</td>
</tr>
<tr>
<td>Bicycle/Pedestrian Underpass</td>
<td>10’- 14’</td>
<td>Concrete</td>
<td>• Min. clear width same as approaching path, ideally including an additional 2’ clearance on either side of trail&lt;br&gt;• 10’ min. vertical clearance&lt;br&gt;• 5% max. grade on approach ramps&lt;br&gt;• Railings/fences on both sides shall be a min. height of 42” for pedestrian facilities and 54” for bicycle facilities&lt;br&gt;• Lighting is required per city specifications</td>
</tr>
<tr>
<td>Standard At-Grade Crossing</td>
<td>8’- 10’</td>
<td>Thermoplastic or tape</td>
<td>• Trail crossings of all streets should use highly visible continental crosswalk markings&lt;br&gt;• Crosswalk and associated curb ramps should be same width as approaching trail&lt;br&gt;• Acceptable for mid-block locations on local streets. Optional to include pedestrian-actuated signals based on needs</td>
</tr>
<tr>
<td>Enhanced At-Grade Crossing</td>
<td>8’- 10’</td>
<td>Thermoplastic or tape</td>
<td>• Recommended for mid-block locations on arterials and collectors&lt;br&gt;• Consider use of median refuge islands on multi-lane roadways&lt;br&gt;• Consider use of curb extensions on streets with on-street parking&lt;br&gt;• Optional to include raised speed table crossing treatments and/or pedestrian-actuated signals based on needs</td>
</tr>
</tbody>
</table>

Optional to apply crosswalk markings over colored or textured pavements