CHAPTER 3

THE ACTIVE NETWORK
PRINCIPLES AND FRAMEWORK

THIS CHAPTER PRESENTS THE PERFORMANCE PRINCIPLES AND FRAMEWORK OF GRAND ISLAND'S PROPOSED ACTIVE TRANSPORTATION NETWORK. These principles, derived from the analysis of existing conditions and opportunities, the community engagement process, and market preferences generate the overall system concept. The chapter describes the framework of the system and its individual components.

An effective network of bicycle and pedestrian facilities is based largely on the characteristics of both the individual community and the nature and preferences of its users. But its design and operation should also be guided by specific principles and performance measurements. Some of the world's best work in identifying design principles was done by the Netherlands Centre for Research and Contract Standardization in Civil and Traffic Engineering. This plan adapts the Netherlands concepts to the contexts of medium-sized American cities like Grand Island, identifying six guiding principles for an effective active transportation network:

- Integrity. The ability of a system to link starting points continuously to destinations, and to be easily and clearly understood by users.
- Directness. The capacity to provide direct routes with minimum misdirection or unnecessary distance.
- Safety. The ability to minimize hazards and improve safety for users of all transportation modes.
- Comfort. Consistency with the capacities of users and avoidance of mental or physical stress.
- Experience. The quality of offering users a pleasant and positive experience.
- Feasibility. The ability to maximize benefits and minimize costs, including financial cost, inconvenience, and potential political opposition.

These six principles express the general attributes of a good system, but must have specific criteria and even measurements that both guide the system's design and evaluate how well it works.

Figures 3.1 through 3.6 present criteria for each of the six guiding principles, and design guides and methods to manage performance. Each table includes:

- The **performance factors** relevant to each guiding principle. For example, the INTEGRITY principle addresses the ability of users to understand the system and use it to get to their destinations. Examples of performance factors that help satisfy this principle include clear wayfinding and directional information and continuity, ensuring that users do not confront dead-ends as they move along the route.
- The **measurements** that can be used to evaluate the success of the system and its ultimate design. For example, we can measure the effectiveness of a wayfinding system by its ability to guide users intuitively without either creating too many signs.
- The **performance criteria** that establish the design objectives and guidelines for each of these factors. For example, a wayfinding system should avoid ambiguities that confuse users and follow graphic standards that are immediately and clearly understood.

These attributes help guide network design and evaluation, but they are clearly aspirational – no network in a real place can meet all of these criteria all of the time.

Integrity issues.

When paths diverge, directional information that tells users where each alternative leads is very important to the user's peace of mind.

Where streets are designed to discourage through traffic, users need assurance that a street that looks like a continuous route connects to other parts of the network.

Figure 3.1: Development of the INTEGRITY Guiding Principle

Performance Factor	Measures	Performance Standard
Comprehensiveness	Number of connected destinations on system	Major destination types identified in the survey results and presented in the destinations analysis should all be accessible by the network. 100% of top destination types, 80% of all destinations should be served. New destinations as developed should be developed along the network or served by extensions.
Continuity	Number of discontinuities along individual routes	Users headed on a route to a destination should not be dropped at a terminus without route or directional information.* Even at incremental levels, route endings should make functional sense.* Transitions between facility types should be clear to users and well-defined. Transitions from one type of infrastructure. to another along the same route should avoid leading cyclists of different capabilities into uncomfortable settings.* Infrastructure should be recognizable and its features (pavement markings, design conventions) consistent throughout the system.
Wayfinding/directional information	Completeness and clarity of signage Economy and efficiency of graphics Complaints from users	Signs should keep users informed and oriented at all points. Sign system should avoid ambiguities that cause users to feel lost or require them to carry unnecessary support materials. Signs should be clear, simple, consistent, and readable, and should be consistent with the Manual on Uniform Traffic Control Devices. (MUTCD)
Route choice	Number of alternative routes of approximately equal distance	Ultimate system should provide most users with a minimum of two alternatives of approximately equal distance.* Maximum distance between alternative routes should be about 1/2 mile.*
Consistency	percentage of typical reported trips accommodated by the ultimate network.	Typically, a minimum of 50-70% of most trips to identified destinations should be accommodated by the bikeways network.*

* Standard applies primarily to bicycle network

Directness issues.

Right: Broadwell Avenue marks the seam between the ordinal grid oriented to true compass directions and the rotated grid oriented to the Union Pacific. At this location, approaching the Five Points intersection, a break in sidewalk continuity and signage requires pedestrians heading for major commercial destinations on the east side of the street to cross Broadwell twice. The back of curb sidewalks along an arterial street can also be uncomfortable for many pedestrian users.

Figure 3.2: Development of the DIRECTNESS Guiding Principle

Performance Factor	Measures	Performance Standard
Access	Coverage Access to all parts of the city	The network should provide convenient access to all parts of the city. As a standard, all urban residential areas should be within one-half mile from one of the system's routes, and should be connected to those routes by a relatively direct local street connection.*
Bicycling speed	Design and average speed of system	The network should permit relatively consistent operation at a steady speed without excessive delays.* System should be able to deliver an average point to point speed between 12 and 15 mph for users, although a portion of routes should permit operation in a 15 to 20 mph range.* (CROW adapted to American measurement)
Diversions and misdirections	Maximum range of detours or diversions from a straight line between destinations. "Detour ratio:" Ratio of actual versus direct distance between two points.	Routes should connect points with a minimum amount of misdirections. Users should perceive that the route is always taking them in the desired direction, without making them reverse themselves or go out of their way to an unreasonable degree. Maximum diversion of a straight line connecting two key points on a route should not exceed 0.25 miles on either side of the line.* (NACTO)
Delays	Amount of time spent not moving	Routes should minimize unnecessary or frustrating delays, including excessive numbers of stop signs, and delays at uncontrolled intersections waiting for gaps in cross traffic.* Routes should maximize use of existing signalized crossings.
Intersections	Bicycle direction through intersections	Bicyclists and pedestrians should have a clear and safe path through intersections. Two-stage crossings are sometimes necessary but should avoid conflicts between bicycles and pedestrians.

* Standard applies primarily to bicycle network

Safety issues.

Left: The Capital Trail displays characteristics of a well-designed sidepath – separation from the street, adequate width and good visibility, and infrequent driveway and street interruptions.

Figure 3.3: Development of the SAFETY Guiding Principle

Performance Factor	Measures	Performance Standard
Reduced number of crash incidents	Number of incidents Reactions/perceptions of users	The network should reduce the rate of crashes over ten year periods. Data collection should be sufficient to trace baseline data and measure the impact of improvements.
Appropriate routing: mixing versus separation of traffic	Average daily traffic (ADT) criteria for mixed traffic Traffic speed criteria for mixed traffic	System design should avoid encounters between bicyclists and incompatible motor traffic streams (high volumes and/or high speeds). Separation and protection of vulnerable users should increase as incompatibilities increase.*
Infrastructure, visibility, signage	Pairing of context and infrastructure solutions Mutual visibility and awareness of bicycle and motor vehicles	Infrastructure should be designed for utility by at least 80 % of the potential market. The Grand Island Bicycle and Pedestrian Survey indicates that a relatively large number of people are relatively uncomfortable with many streets and prefer higher levels of separation. Infrastructure applications should be matched with appropriate contexts. Warning signage directed to motorists should be sufficient to alert them to the presence of cyclists along the travel route. Surfaces and markings should be clearly visible to all users. Obstructions, such as landscaping, road geometry, and vertical elements, should not block routine visibility of pedestrians, cyclists and motorists. Trail and pathway geometries should avoid sharp turns and alignments that hide cyclists operating in opposing directions or create crash hazards for pedestrians. Where these conditions are unavoidable, devices such as mirrors and advisory signs should be used to reduce hazards.
Door hazards and parking conflicts	Number of incidents Parking configurations Location of bicycle tracking guides	Component design should track bicycles outside of the door hazard zone.* Back-out hazards of head-in parking should be avoided or mitigated when diagonal parking is used along streets.*
Intersection conflicts	Location and types of pavement markings Number of intersections or crossings per mile	Intersections should provide a clearly defined and visible track through them for cyclists and pedestrians. Sidepaths should generally be used on continuous segments with a minimum number of interruptions.
Complaints	Number of complaints per facility type	Complaints should be recorded by type of infrastructure and location of facility, to set priorities for remedial action.

* Standard applies primarily to bicycle network

Comfort issues.

The high rankings given to trails and protected bicycle facilities indicate that Grand Island area residents are most comfortable with separated trails, quiet streets, and protected bike lanes.

Figure 3.4: Development of the COMFORT Guiding Principle

Performance Factor	Measures	Performance Standard
Road surface	Quality and type of road surface Materials Incidence of longitudinal cracking and expansion joints	The network's components should provide a reasonably smooth surface with a minimum of potholes and areas of paving deterioration.* Roads should be free of hazardous conditions such as settlement and longitudinal cracks and pavement separation.* All routes in the urban system should be hard-surfaced, unless specifically designated for limited use.* Sidewalks in the network should be repaired or designed to minimize tripping hazards or obstructions such as equipment or poles.
Hills	Number and length of hills and inclines Maximum grades on segments for both long and short distances	Grades are generally not an issue in the Grand Island area network. However, if possible, grades on approaches to overpasses and underpasses should not exceed 7 % over a length not exceeding 400 feet in length; or 5 % over the course of a mile.* (AASHTO) Off-road climbing facilities should be provided where slow-moving bike traffic can obstruct motor vehicles and increase motorist conflict.*
Traffic stress	Average daily traffic (ADT) Average traffic speed Volume of truck traffic	Generally, the network should choose paths of lower resistance/incompatibility wherever possible and when the DIRECTNESS guideline can be reasonably met.* The network should avoid mixed traffic situations over 5,000 vehicles per day (vpd) without separated facilities, or should use alternative routes where possible.* (NACTO with modifications)
Stops that interrupt rhythm and continuity	Number of stop signs/ segment	Network routes should avoid or redirect frequent stop sign controls. The number of stops between endpoints should not exceed three (1 per quarter mile average) per mile segment.

* Standard applies primarily to bicycle network

Experience issues.

Grand Island's distinctive trail and street settings (the Cemetery Trail and Grand Island Avenue pictured here)and attractive neighborhoods create positive experiences for pedestrian and bicyclists.

Figure 3.5: Development of the EXPERIENCE Guiding Principle

Performance Factor	Measures	Performance Standard
Surrounding land use	Neighborhood setting Adjacent residential or open space use, including institutional campuses Adjacent street-oriented commercial	Surrounding land use should provide the network user with an attractive adjacent urban environment. It is desirable for at least 75 % of the length of the route should pass through residential, open space, or street-oriented (main street) commercial environments. However, this guide is advisory and should not be taken to limit necessary connectivity or service to major employment centers.* Routes should provide access to commercial and personal support services, such as food places, convenience stores, and restrooms.
Landscape	Location and extent of parks or maintained open space	Network should maximize exposure or use right-of-ways along or through public parks and open spaces. Environmental contexts to be maximized include parks, waterways and lakes, and landscaped settings.
Social safety	Residential development patterns Observability: Presence of windows or visible uses along the route Population density or number of users	The network should provide routes with a high degree of observability – street oriented uses, residential frontages, buildings that provide vantage points that provide security to system users. Areas that seem insecure, including industrial precincts, areas with few street-oriented businesses, or areas with little use or visible maintenance should generally be avoided, except where necessary to make connections or serve major destinations like industrial employment centers.
Furnishings and design	On-trail landscaping, supporting furnishings	Network routes should include landscaping, street furnishings, lighting, rest stops, graphics, and other elements that promote the overall experience. These features are particularly important along trails.

* Standard applies primarily to bicycle network

Feasibility issues.

Taking advantage of opportunities can provide major connectivity advances at relatively low cost.

Far right: Use of a pre-existing culvert in Sioux Falls, South Dakota to extend an important trail link under a major arterial street.

Right: This creek crossing provides an excellent and relatively inexpensive way to cross the US 281 barrier south of Husker Highway.

Figure 3.6: Development of the FEASIBILITY Guiding Principle

Performance Factor	Measures	Performance Standard
Cost effectiveness	Route cost Maximum use of low-cost components Population/destination density	The network should generate maximum benefit at minimum cost. Where possible, selected routes should favor segments that can be adapted to bicycle use with economical features rather than requiring major capital investments. Initial routes should be located in areas with a high probability of use intensity: substantial population density and/or incidence of destinations. Initial investments should integrate existing assets, extending their reach into other neighborhoods and increasing access to them. Major off-street investments should concentrate on closing gaps in an on-street system.*
Phasing and incremental integrity	Self-contained value Ability to evolve	The network should provide value and integrity at all stages of completion. A first stage should increase access and use in ways that make future phases logical. The network should be incremental, capable of building on an initial foundation in gradual phases. Phases should be affordable, fitting within a modest annual allocation by the city, and complemented by major capital investments incorporating other sources.
Neighborhood relationships and friction	Parking patterns Development and circulation patterns	The network should avoid conflict situations, where a route is likely to encounter intense local opposition. Initial design should avoid impact on potentially controversial areas, such as parking, without neighborhood agreement. Involuntary acquisition of right-of-way should be avoided wherever possible. Detailed planning processes to implement specific routes should include local area or stakeholder participation.

* Standard applies primarily to bicycle network

ATTRIBUTES OF THE NETWORK

Based on this development of the six guiding principles presented in the tables, the Grand Island area network design follows the following major attributes:

Tailored to User Groups. Planning a bicycle network for Grand Island and the surrounding area requires us to understand the specific market groups for the system. These groups include:

- Recreational users, including people traveling to parks and recreational features, especially the trail system, from their homes. It is important to understand that travel to recreational destinations are in fact transportation trips that substitute for trips by car.
- Students walking or biking to school.
- Residents who are actively interested in walking or biking for transportation, but are discouraged by barriers, including major streets, highways, and railroad crossings.
- Workers at major industries like JBS, an employer of over 3,000, who may find bicycle transportation or walking to be an attractive and affordable transportation option.

Destination-Based. The Grand Island area network should direct people of all ages to desitnations, whether they are parks, trails, schools, business districts, or the library. Destinations identified by the community as important help generate the structure of the network. The proposed network is more than a map of streets and trails. It is in fact part of a transportation system that takes people to specific places.

Function Model. Several reasonable models for network planning exist, with choices dependent on the nature of the city. In planning the Grand Island system, we identify a grid of routes designed to help users "read" the system with a minimum of supporting materials, To do this, have adapted a "transit model," that identifies major destination-based routes that connect points and destinations, almost as if they were bus lines.

Incremental Integrity. As shown in Figure 3.6 (Feasibility), incremental integrity – the ability of the network to provide a system of value at each step of completion – is an important attribute. The first step in completion should be valuable and increase bicycle access even if nothing else is done. Each subsequent phase of completion follows the same principle of leaving something of clear value and integrity, even if no further phases were developed.

Evolution. As part of the concept of incremental integrity, the system is designed to evolve and improve over time. For example, a relatively low-cost project or design element can establish a pattern of use that supports something better in the future. To use a cliché, the perfect should not be the enemy of the good.

Conflict Avoidance. Few important actions are completely without controversy, but successful development of a bicycle transportation system in Grand Island can and should avoid unnecessary controversy. On most streets, shared streets and signage can provide satisfactory facilities that focus on the positive and minimize divisive conflicts. Projects should demonstrate the multiple benefits of street adaptations. For example, bikeway design can slow motorists and keep unwanted through traffic out of neighborhoods, benefiting both cyclists and neighbors.

Use of Existing Facilities. Great existing features like Pier Park, Stolley Park, College Park and Central Community College, the Stuhr Museum, and others are integral to the active transportation system. Utility easements and drainage corridors like Moore Creek also offer great opportunities.

Fill Gaps. In some cases, the most important parts of a network involve small projects that make connections rather than long distance components. Often, these short links knit longer street or trail segments together into longer routes or provide access to important destinations. These gaps may include a short trail segment that connects two continuous streets together, or an intersection improvement that bridges a barrier. The development of the overall network is strategic, using manageable initiatives to create a comprehensive system.

Routes of Least Resistance. The Bicycle and Pedestrian Survey showed that much of the city's potential urban cycling market prefers quiet streets or corridors with some separation from motor traffic. It is not necessary to try to force bicycle access on major streets when more comfortable, lower cost options exist. For example, bicycle boulevards – lower volume streets that parallel major arterials – satisfy the comfort principle successfully. However, some important destinations, including major employers and shopping facilities are served by major arterials. Here, complete street guidelines should include bicycle and pedestrian accommodations in new major street projects. Signage systems can also be instrumental in guiding users efficiently to their destinations using comfortable routes made up of different street segments.

Barriers. In many cases, reducing the dividing impact of barriers such as major highways and streets, can be the mosty effective way of improving connectivity. Most people involved in this process view US 281 as an especially difficult barrier, even where crossed by multiuse paths. In other cases, existing trails cross busy streets, leading to concerns of parents about their children using the trail to get to school.

Regional Connectivity. Grand Island's potential network extends into the surrounding region. This plan's study area also includes Alda. The Riverway Trail may eventually extend east to the Platte River and long-range plans stretch out to Mormon Island State Recreation Area. Other potential considerations include the eventual routing of the US Bicycle Route System through Nebraska, probably following the Lincoln Highway corridor.

ACTIVE TRANSPORTATION NETWORK

Figures 3.7, 3.7a, 3.8, and 3.8a present the proposed active transportation network for Grand Island, based on the principles described previously in this chapter and possibilities for infrastructure development. Figures 3.7 and 3.7a focus on the on-street network, while 3.8 and 3.8a consider the off-street trail and shared use path components. This map shows the ultimate build-out by component type, and includes route designations that are used to describe infrastructure details. The components of the system include:

- On-Street Network. These corridors make up the primary on-street route grid. They form the bike and pedestrian arterials that link the parts of the Grand Island area. together. They also complement the trail system and in many ways connect neighborhoods and destinations to the growing regional pathway system. These routes use a variety of facility types, including quiet streets, multi-use shoulders, protected bike lanes, and in some cases sidepaths and short trail connections. Details of these routes are presented in Chapter Seven.

  Quiet Streets are sometimes referred to as "bicycle boulevards" or "neighborhood greenways" but function as a significant and cost-efficient part of an on-street network. They are typically local or collector streets with relatively low volumes that have good continuity and in many cases parallel higher order streets. They are far more comfortable for most cyclists and pedestrians than the busy corridors they parallel. Relatively minor adaptations, such as pavement markings, special graphics, and wayfinding can make these streets even more comfortable for a broad range of users. Bicycle boulevards are also fundamental to the community pedestrian network, and should ultimately have continuous, barrier-free sidewalk access along at least one side of the street.

- Multi-Use Trails. Grand Island's growing trail system, builds from two connected systems that ultimately can complete two major circumferential loops: the John Brownell Beltline, St. Joe/Stuhr/Riverway Trails in the south half of the city; and the Capital, Westside Connector, State, and Shoemaker Trails around the north and west sides of Grand Island. The most recent addition to the system is the Capital Avenue Trail, a high quality sidepath that now extends from Ashley Park to the west side of the city using the State-Capital Connector and Shoemaker Trails.

  Anticipated near-term connections include an extension of the Beltline to job centers on the east; eastward continuation of the Capital Trail, and a sidepath along North Broadwell to popular but isolated Eagle Scout Park and the Sports Complex. Other priority links include extension of the State-Capital Connector, which will provide access to the US 281 corridor; the first stage of the west circumferential loop with a link from the Stuhr Trail through the new hospital campus and to Cedar Hiils Park and south along Moore Creek; and a north extension of the South Locust Trail to connect with eastside on-street routes. Clear identification and wayfinding information will also integrate these trails into the overall network. These new paths are identified in the Network Map as Priority Trails.

  Later phase trails complete the outer legs of the two major circumferential loops and extend the system into other growth areas. Phasing concepts are discussed in more detail in Chapter Seven.

- Alda/Cornhusker Trails. These are long-term routes that connect Grand Island to Alda and the nearby Cornhusker plant, available to the city as a potential recreation area on the site of the former ammunition testing and storage facility. These paths follow easements and in some cases county roads.

- Study Corridors. These corridors include a corridor study for a northeast bypass for US 281 and for eventual widening of US 34 on the south edge of town. A corridor study would identify and evaluate a range of alternative concepts. Multi-modal facilities, specifically a path parallel to the roadway, are not included as part of the basic network but should be incorporated into the corridor

Above: Stagecoach Drive, part of a southside on-street link between the St Joe and South Locust Trails

Above: Underpass connection from Stuhr Trail west to new hospital site, a part of a priority trail extension to Cedar Hills Park.

Figure 3.7: Ultimate Grand Island Area Active Transportation Network

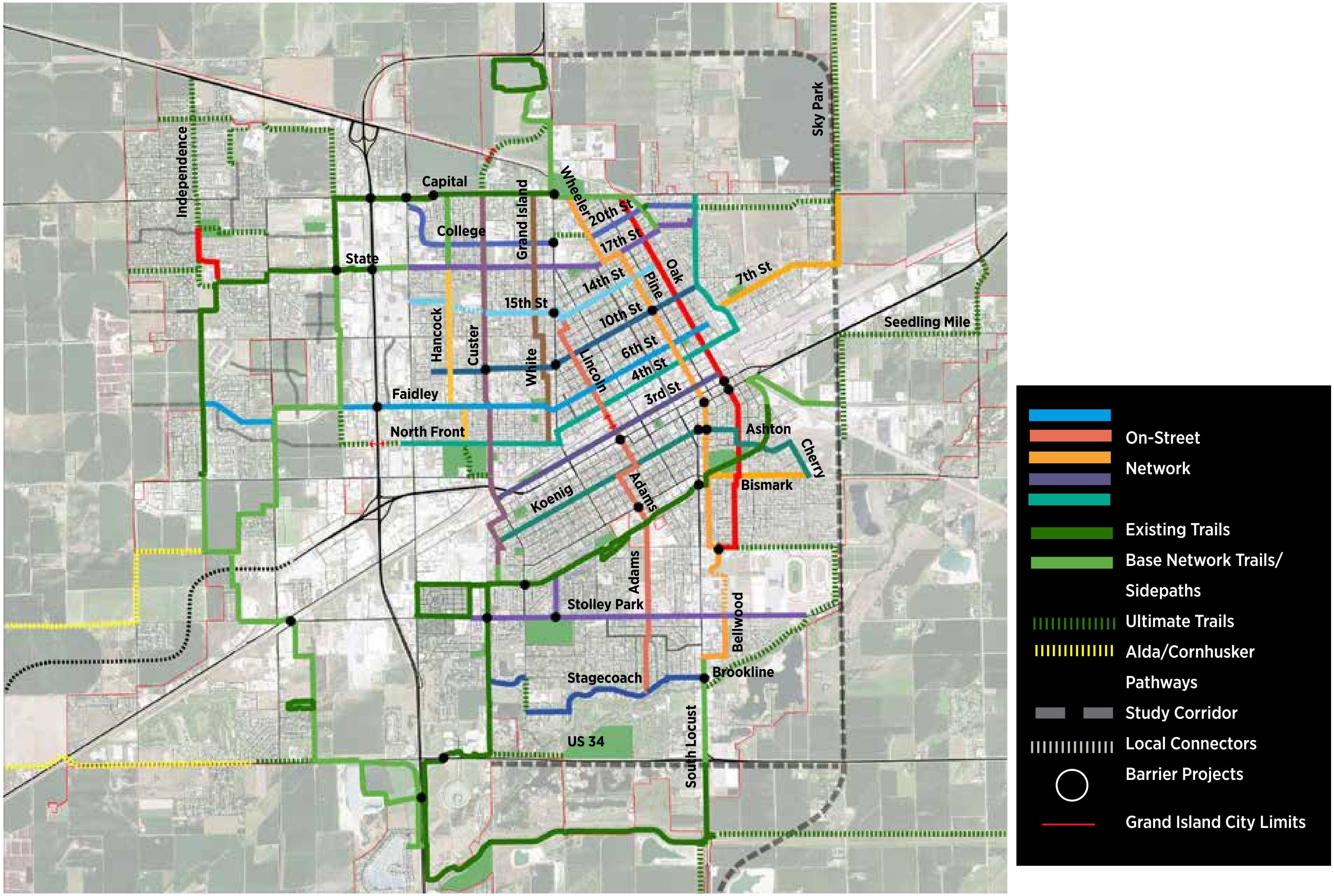
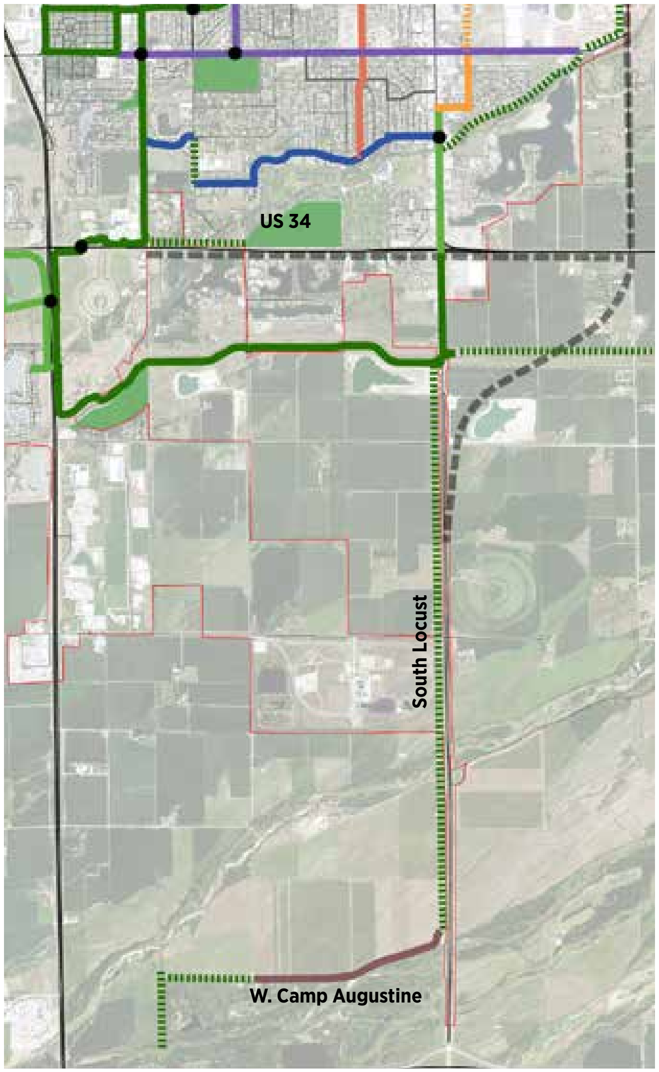
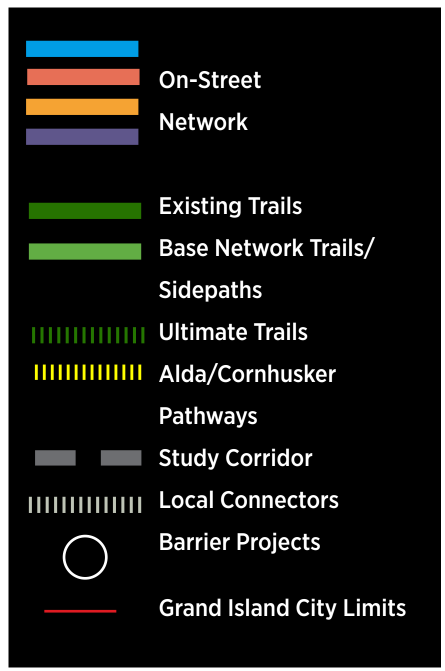


Figure 3.7a: Ultimate Grand Island Area Active Transportation Network: South Extension



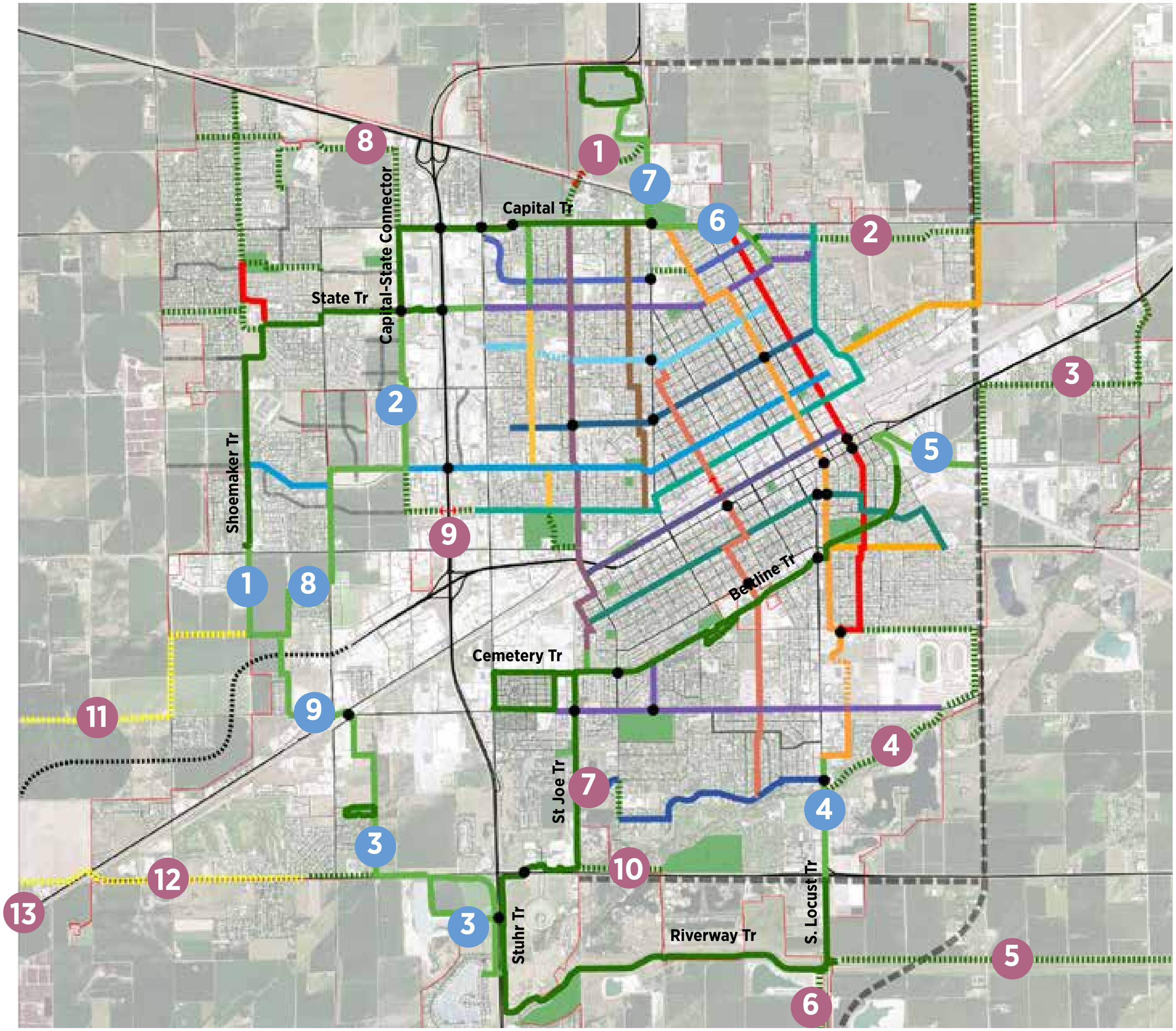
Left: Blaine Street underpass of US 30. This is a critical point in a north-south route that connects the Custer corridor with the St. Joe/Stuhr/Riverway trail system. Right: Right-of-way for a future extension of the Westside Connector that now links the Capital and State Trails parallel to US 281



study and the possible functional design.

- Neighborhood Connectors. These are short, primarily on-street routes, usually on low-volume local streets, that connect through routes and neighborhoods. Most require minimal infrastructure investment.

Figure 3.8: Ultimate Grand Island Area Active Transportation Network – Trails



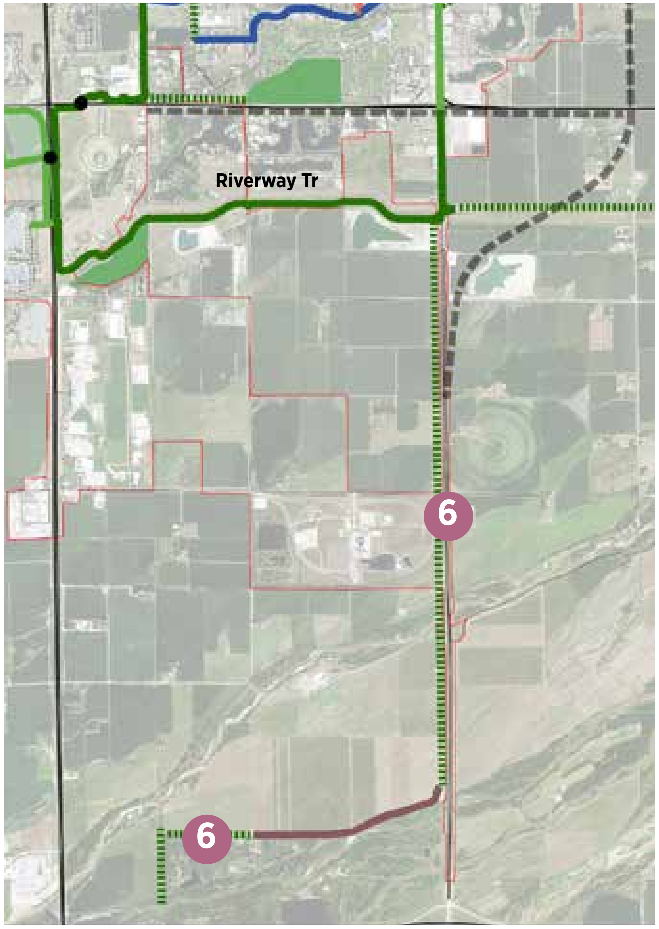
Priority Trails

1. Shoemaker Extension
2. Westside Connector
3. Cedar Hills Trail
4. South Locust Trail
5. Beltline Extension
6. Capital Trail East
7. Eagle Scout Link
8. Moore Creek Trail
9. Southwest Trail

Later Phase Trails

1. Veterans Legacy/Overpass
2. Sky Park Trail
3. Seedling Mile Trail
4. Wood River Trail
5. Riverway Trail Extension
6. Mormon Island (S. Locust)
7. Stagecoach Connector Trail
8. Northwest Trail
9. North Front Path/Overpass
10. L.E. Ray Park Connector
11. Alda/Cornhusker Trail
12. Alda/Husker Highway Trail
13. Alda Paths

Figure 3.8a: Ultimate Grand Island Area Active Transportation Network: South Extension – Trails



Above: John Brownell Beltline Trail at Pier Park. Left: Route for future south extension of Capital-State Connector Trail

Table 3.9: Trail Network Components

MAP KEY	NAME /DESCRIPTION	LENGTH (mi)	MAJOR DESTINATIONS SERVED	SYSTEM ROLE AND ISSUES
1	**Shoemaker Trail extension, Old Potash to Moore Creek.** Route continues existing trail alignment south to Moore Creek at the half section line between Old Potash and Stolley Park Road	.50	Shoemaker ES	First stage of link from westside to trail network on south edge of the city, a major priority of westside neighborhood residents. Completion of westside connection (Southwest Trail) may be accelerated, depending on construction of relocated US 30.
2	**Westside Connector extension, State to Faidley.** Later connection to potential bike/ped overpass over US 281 on North Front alignment	1.00	US 281 commercial and industrial corridor	Potentially vital north-south trail spine to major commercial services and future westside residential development. Includes spurs trails to major commercial centers where possible.
3	**Cedar Hills Trail,** Stuhr Trail to Cedar Hills Park	1.80	Stuhr Museum, new hospital and mixed use campus, Cedar Hills Park	South leg of westide connection of Beltline/St Joe/Stuhr trail system to Shoemaker Trail. Includes existing underpass of US 281.
4	**South Locust Trail,** Brookline to US 34	0.75	South Locust corridor, Walmart	Links most of network to South Locust, with Beltline, Riverway, St. Joe Trails and Pine Street route to create interconnected loops. Continues Pine Street bikeway route to form continuous east side connection to Capital Ave. Requires improved crossing to trail south of US 34.
5	**Belt Line Trail extension** to JBS plant and Stuhr Road, following city-owned ROW to US 30, and continuing along perimeter of Hall County correctional center property	0.90	JBS and major eastside industrial areas	Connects central city neighborhoods to area's largest single employment concentration, Important potential commuter route for workforce needing transportation choices
6	**Capital Trail East**, Capital Ave to 20th Street underpass	0.68	Ashley Park, Knickrehm ES	Follows Capital Ave and Plum Street. Connects to 17th and 20th Street underpasses of BNSF elevated main line, links east side of tracks to trail network

Table 3.9: Trail Network Components

MAP KEY	NAME /DESCRIPTION	LENGTH (mi)	MAJOR DESTINATIONS SERVED	SYSTEM ROLE AND ISSUES
7	**Eagle Scout Trail,** existing trail to Capital	0.75	Sports complex, Veterans Legacy site, Eagle Scout Park	Sidepath along Broadwell and pathway connection between sports complex and Eagle Scout, links major recreation area to trail network
8	**Moore Creek Trail,** Faidley to Shoemaker Trail extension	1.50	Existing and future southwest residential areas	Connects Faidley corridor and developing southwest areas via North Rd sidepath and Moore Creek drainageway. Major link of westside trail network
9	**Southwest Trail,** Moore Creek/ Shoemaker Trail connection to Cedar Hills Park. Route uses Stolley Park east to UP mainline crossing, continues south between Chief plant and cemetery and Memorial Park Road alignment to Husker Highway	1.65	Shoemaker ES, southwest development neighborhoods, Cedar Hills Park	Completes southwest trail connection from current Shoemaker Trail endpoint to Stuhr Trail and the rest of the mainline trail system. Completes a grand trail loop. May be accelerated with US 30 development, and uses a culvert as an underpass under the new road alignment.
1	**Veterans Legacy Trail / Overpass,** Capital Ave Trail to Sports Complex	0.80	Veterans Legacy site, Sports Complex, Eagle Scout Park	Connects to Custer bikeway and includes future overpass over UP. Incorporated as part of master plan for redevelopment of Veterans Home site
2	**Sky Park Trail,** St Paul to Sky Park Rd continuing alignment of East 20th Street	2.05	Airport and future industrial area	Connects east development areas to network. Extension to possible path along US 281 northeast bypass, to be determined by study corridor plan
3	**Seedling Mile Trail,** Stuhr Road to US 30 at Shady Bend	2.07	JBS, eastside industrial park, Seedling Mile ES, historic Lincoln Highway	Connects a relatively isolated eastside neighborhood to city network and industrial employment, improves sidewalk access in neighborhood. Provides good access route to county road system

Table 3.9: Trail Network Components

MAP KEY	NAME /DESCRIPTION	LENGTH (mi)	MAJOR DESTINATIONS SERVED	SYSTEM ROLE AND ISSUES
4	**Wood River Trail,** South Locust to Fonner Park and Stuhr	1.20	Fonner Park, South Locust corridor	Extends Stagecoach on-street route to Fonner Park and Oak St quiet street route, provides a loop with Stolley Park Rd and completes southeast network. Links with S. Locust Trail and Riverway to Hall County Park
5	**Riverway Trail Extension,** South Locust to Platte River and US 34	3.00	South Locust corridor, confluence of channels that created the "Grand Island" of the Platte	Regional extension of the trail network to shouldered highway and paved county roads to the east. Possible trailhead at US 34
6	**Mormon Island (S. Locust) Trail,** sidepath along South Locust to Mormon Island State Recreation Area, Camp Augustine Road, and segment along abandoned railbed with new crossing to state recreation area	4.90	Riverway Trail, Mormon Island State Recreation Area, I-80 travel services	Regional trail connection south to Platte River corridor and visitor services. Provides new uses for Mormon Island, including trailhead for Grand Island system.
7	**Stagecoach Connection Trail,** Stagecoach and Blaine to St. Joe Trail	.07	Access to main trail system for south tier neighborhoods.	Uses sidepath along Blaine between Stagecoach and Pioneer Blvd and a short trail segment with branch rail crossing to St Joe Trail, completing a south crosstown bikeway with the Wood River Trail proposal.
8	**Northwest Trail,** Capital and Connector Trail to George Park. Route uses north extension of Westside (State-Capital Connector), path around periphery of high school campus, Northview Dr, and local streets.	1.65 off-road	Northwest High School, Engelman ES, George Park, northwest neighborhoods	Connects northwest neighborhoods to overall city trail system, US 281 corridor, and major northside destinations east of the highway

Table 3.9: Trail Network Components

MAP KEY	NAME /DESCRIPTION	LENGTH (mi)	MAJOR DESTINATIONS SERVED	SYSTEM ROLE AND ISSUES
9	**North Front Overpass.** Grade separated bike/ped crossing over US 281	0.42	Westside Connector Trail, Ryder Park, North Front/4th Street route and business district	Strategic opportunity for grade separated overpass over US 281 at a location capable of accommodating ramps. Provides excellent network linkages.
10	**L.E. Ray Park Connector.** College Park/St. Joe Trail to park. Sidepath along Highway 34	0.55	St. Joe Trail, College Park, L.E. Ray Park	Connects park with considerable potential to citywide network. Future study of US 34 widening should include bike/ped configurations.
11	**Alda/Cornhusker Trail.** Shoemaker extension to Cornhusker Plant site and Alma, via Stolley Park Road and easements	5.75	Cornhusker Plant site, Alma	Links Alma to city trails system, provides access for off-road cyclists to Cornhusker Plan
12	**Alda/Husker Highway Trail.** Stuhr Museum to Alda Village Hall via Husker Highway, S. 60th Rd or joint use with rail siding, Schimmer Dr and Mulberry Street	5.63	Stuhr Museum, Alda	Links Alda to Grand Island and trail network
13	**Alda Path**, Sidewalk to close gaps in continuity of sidewalks along Myrtle, Pine, and Vine Streets	1.0	Alda Town Hall, Post Office, Highway 30 businesses	Local access

Table 3.10: On-Street Network Components: North-South

MAP LINE	NAME	ENDPOINTS AND ROUTE	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	INFRASTRUCTURE APPROACH
	Oak	Capital Ave (N) to Fonner Park (S)	Knickrehm ES, Lions Park, YMCA, Pier Park, Dodge ES, Beltline TrailFonner Park, Island Oasis	Major north-south route with low traffic and attractive neighborhoods. Grade crossing over UP, good continuity with few turns or diversions. Interchange with Pine Route to continue south. Major barrier is crossing of 1st and 2nd Street (US 30) one-way pair	Shared route/bicycle boulevard. Upgraded arterial crossings.
	Wheeler/ Pine	Ashley Park/ Capital Ave (N) to Husker Highway/ Walmart (S) Route: Wheeler/17th/ Pine/new connections	Ashley Park, VA Hospital, GI Christian HS, Trinity Lutheran School, Five Points (indirect),Downtown, Hall Co. complex, Pier Park, Beltline Trail, Fonner park, Island Oasis, S. Locust Corridor, Walmart and S. Locust Trail	Major destination rich, north-south route. Grade crossing over UP, one significant jog but otherwise good continuity from north to south. Connecting existing street segments south of Fonner Park with trail links completes a route to Husker Highway, Walmart, and Riverway Trail, completing a grand peripheral loop. Major barrier is 1st Street (EB US 30) crossing	Shared route/bicycle boulevard. Short path segments south of Fonner Park to complete north-south route.
	Grand Island/ White	Capital Ave (N) to North Front (S) Route: Grand Island Ave/9th/ White Ave	Veterans Home/Legacy Park site, Capital Trail, GI Catholic HS, Five Points, Housing Authority district, Jefferson ES, Broadwell Park	Quiet street route, including divided boulevard, that generally parallels Broadwell Street, providing an active trans alternative. Major barriers are Capital and Faidley crossings.	Shared route/bicycle boulevard. Upgraded arterial crossings. Possible path with park development in Grand Island Ave median
	Custer/ Blaine	Capital Ave and Trail (N) to Beltline Trail Route: Custer/ Blaine/1st/ Ingalls/Louise/ Curtis/Gates Pathway	Veterans site, Grand Island HS, Walnut MS, Housing Authority complex, St Francis Hospital/Ryder Park/ Gates ES/Beltline and St Joe Trails	Major north-south link serving largest secondary school campuses; grade separation at US 30 crossing unites north and south sides. Grade crossing with UP. Major barriers are crossings at Capital, relatively high traffic counts on corridor. Currently a route on GI trail map	Protected bike lanes and sidepath along Custer to Ryder Park. Bike lanes or path along Custer segment because of traffic volume; protected bike lanes on US 30 undercrossing; shared route to Gates School; upgrade of narrow path to connect to Beltline Trail

Table 3.10: On-Street Network Components: North-South

MAP LINE	NAME	ENDPOINTS AND ROUTE	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	INFRASTRUCTURE APPROACH
	Hancock	Capital Ave (N) to North Front (S) Route: Walkway/ utility corridor/ Hancock/ St Francis campus/Faidley/ Sherman/Ryder Park paths	Capital Trail, West Lawn ES, Walnut MS, Newell ES, St Francis Hospital, Ryder Park	Quiet street alternative parallel to Webb Road and Custer Street corridors.	Path/utility easement from Capital to State, bicycle boulevards, Ryder Park paths to join Custer/Blaine route at Old Potash
	Independence	George Park (N) to Shoemaker Trail Route: Independence/ Mansfield	George Park, Engleman ES, Westridge MS, Shoemaker ES, Shoemaker Trail	Westside neighborhood route connecting trail to George Park and future paths serving the park from the east. Future extension north possible with reconstruction of Independence Ave	Sidepath link along Independence from Mansfield to George Park. Possible southward trail connection to link to proposed Moore's Creek Trail.
	Lincoln/ Adams	Greenwich/15th (N) to Adams/ Stagecoach (S) Route: Greenwich/ Cotton/Lincoln/ Koenig/Adams	Jefferson ES, Public Library, Wasmer ES, Vocational campus, Beltline Trail, Barr MS, New ES	Central north-south route that serves major bike/ped destinations, including library. Major school concentrations and significant traffic along Adams south of Beltline Trail. Current surface crossing of UP mainline, but may be threatened as part of proposed Broadwell grade separation. Grade separation for ped/bike travel will be necessary between Broadwell and downtown crossings. Major barriers include 2nd Street (US 30) crossing and traffic loads south of Beltline Trail.	Shared route/bicycle boulevard north of Beltline Trail. Sidepath along Adams from Beltline to Stolley Park Rd. Pedestrian modification needed across 2nd St at library. Future Broadwell grade separation could require abandonment of other grade crossings, leaving virtually no ped/bike access between Downtown and Broadwell. A ped/bike accessible overpass should be included in Broadwell development plans.

Table 3.11: On-Street Network Components: East-West

MAP LINE	NAME	ENDPOINTS AND ROUTE	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	INFRASTRUCTURE APPROACH
	4th/St Paul	Capital (NE) to Webb and North Front (SW) Route: St Paul/ White/ 4th St/ North Front	Lincoln ES, Downtown, 4th St corridor, Ryder Park	L-shaped route from northeast to southwest part of city. St Paul segment parallels east side elevated BNSF. Continuation serves 4th Street international district. A future Broadwell Ave overpass at UP enables a direct path connection between 4th and North Front.	Multi-use shoulders on St Paul and wider parts of 4th and North Front; shared lanes elsewhere. Possible path connection between 4th and North Front should be integrated into a Broadwell grade separation.
	20/College	St Paul (E) to Webb and Capital (W) Route: 20th/ VA Hospital/ College/Rue de College	East side, Nickerehm ES, VA Hospital, Five Points area, Grand Island HS, West Lawn MS, Webb Rd commercial	Crosstown route for north side of city, uses 20th Street underpass under BNSF mainline. Requires path to link 20th and College segments along south edge of VA Hospital campus. Designed to provide an active option to high school students. Major barrier is Broadwell crossing.	Shared route/bicycle boulevard. Path through VA campus between Wheeler and Broadwell. Use of alternative facilities on busier segments of College around high school
	17th/State	18-St Paul (E) to Mansfield at Engleman School (via State St Trail) Route: 18th/ Plum/17th/State/ State St Trail	Five Points, GI Christian School, Grand Island HS fields, Conestoga Mall, Highway 281 retail, Engleman ES	Long crosstown route when on-street segments are combined with State Trail on west side. Uses 17th Street grade separation at BNSF. Barriers include moderate ADT on State, gap in trail coverage and crossing at 281 intersection, navigation through Five Points area.	Shared route/bicycle boulevard east of Broadwell; possible bike lanes to Webb; trail connection between Webb and State St Trailhead west of 281.
	14th/15th	Oak (E) to Hancock (W) Route: 14th/ Greenwich/15th/ 16th	Trinity Lutheran School, Westridge MS, Conestoga Mall	Crosstown route through central north side. Major barrier is Broadwell crossing. Continuity to Hancock includes path on south edge of Westridge MS campus	Shared route/bicycle boulevard. Path through Westridge campus from Custer to Hancock. Central east-west route through the north side

Table 3.11: On-Street Network Components: East-West

MAP LINE	NAME	ENDPOINTS AND ROUTE	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	INFRASTRUCTURE APPROACH
	10th St	St Paul (E) to Kennedy (W) Route: 10th St	Howard ES, Housing Authority complex, St Francis, Central Catholic campus, Newell ES	Major east-west route providing a comfortable norgth access to medical center and housing authority facilities than parallel Faidley route. Relatively high ADT on eastern end of corridor, moderating to west. Major but solvable barrier is Broadwell crossing. Route would be even more effective with connection to Webb, but such a corridor is not available.	Striped parking shoulder preferable east of Broadwell. Short path segment on hospital site anticipated in Hancock route would provide a direct connection to center of medical campus.
	Faidley/6th	Plum (E) to Shoemaker Trail (W) Route: 6th/ Faidley	Jefferson ES, Housing Authority complex, St Francis,	Crosstown route with excellent continuity, including the arguably easiest of Highway 281 surface crossings. Most direct service to key traffic generators, including medical offices and facilities and multifamily concentrations. ADT on Faidley west of Broadwell will be uncomfortable for less experienced cyclists.	Shared route/bicycle boulevard on 6th.Sidepath west of Broadwell. Trail alignment along drainageway between Ridgewood and North Road, returning to Faidley on-street through residential area
	3rd Street	Oak (E) to Blaine (W) Route: 3rd Street	Downtown, YMCA, Pioneer Park, Public Library, Memorial Park	Direct crosstown route, includes CBD main street district. Use grade separated crossing under Highway 30 viaduct	Multiuse shoulder wherever feasible. Shared lane in other areas

Table 3.11: On-Street Network Components: East-West

MAP LINE	NAME	ENDPOINTS AND ROUTE	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	INFRASTRUCTURE APPROACH
●	Koenig	Cherry and Bismark (E) to Ingalls/Gates School (W) Route: Cherry/ Ashton/Koenig/ Oak	Schuff Park, Beltline Trail, Pier Park, Wasmer ES, Buechler Park, Gates ES, Augustine Park	Central crosstown route with excellent neighborhood character. Major barriers are Locust/Walnut crossing and Blaine Street.	Shared route/ bicycle boulevard, with intersection enhancements at arterial crossings.
●	Stolley Park	Fonner Park (E) to St. Joe Trail (W) Route: Stolley Park Rd/ Cemetery Trail	Fonner Park, Barr MS, Stolley Park ES, Stolley Park, Grand Island Cemetery, Cemetery Trail, St. Joe Trail,	Direct crosstown route serving one of city's signature parks and education district. Stolley Park Road is being reconfigured in 2018 with three travel lanes and multi-use shoulders, open to bicycle traffic	Multiuse shoulders accommodating bikes to St. Joe Trail
●	Stagecoach	South Locust (E) to St Joe Trail (W) Route: Stagecoach Dr/ Blaine/Pioneer Blvd	South Locust corridor, St Joe Trail	Attractive connector route with possibility of link to St. Joe Trail. South Locust ped/ bike crossing and connections present issues for connectivity. Continuity to St Joe Trail requires crossing of UP branch	Shared route/ bicycle boulevard on Stagecoach, sidepath on Blaine, shared route on Pioneer with short path and new railroad crossing to complete link to St Joe Trail.

INFRASTRUCTURE TYPES

Table 3.12 summarizes the infrastructure types applicable to local street contexts and Figure 3.13 applies them to the to the proposed metro area network. These specific facility types are divided into off-street and on-street categories as follows:

Off-Street
- Multi-use Trails
- Sidepaths

On-Street
- Shared Lanes
- Bicycle Boulevards (or quiet streets)
- Multiuse Shoulders
- Advisory Bike Lanes
- Protected Bike Lanes

Multi-Use Trails

The Grand Island area bike and pedestrian network will continue to make extensive use of multi-use trails on separated rights-of-way. These trails display the highest level of user comfort in the survey. They are key recreational resources and, with strategic extensions, can expand their local and regional transportation functions. In urban settings, trails are paved, although more rural settings such as the linkages to Alda and the Riverway Trail east of Locust may utilize granular stone. Trails should comply with American Association of Street and Highway Transportation Officials (AASHTO) standards and Uniform Federal Accessibility Standards and the Americans with Disabilities Act Accessibility Guidelines.

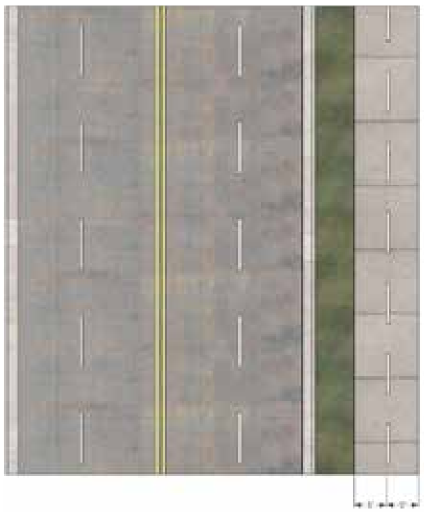
Based on AASHTO's Guide for the Development of Bicycle Facilities (2012), the appropriate paved width for multi-use trail is dependent on the context, volume, and mix of users. The minimum paved width for a two-directional trail is 10 feet. Trails that experience a high use and/or a wider variety user groups may warrant greater width from 10 to 14 feet.

Eight-foot widths are acceptable in circumstances such as areas with very limited right-of-way. A two-foot minimum graded shoulder (3-5 feet is more desirable) with a maximum 6:1 cross-slop should be provided as a recovery zone adjacent to trails. Grade crossings of arterial streets can present significant challenges for trails. Techniques for addressing these potential barriers are addressed in Chapter Five.

Grand Island's multi-use trails include the Beltline and St. Joe Trails (both rail to trail conversions), State-Capital Connector and Riverway Trails (along utility easements and/or drainage corridors), the Stuhr Trail, on the edge of a civic facility, and the Eagle Scout Trail in a public park. Future proposed multi-use trails include the Westside Connector extension, Moore Creek, and Beltline extension.

Sidepaths

Sidepaths (sometimes referred to as widened sidewalks) are typically two-way paths located adjacent to roadways and are separated from the stream of traffic by curbs. The sidepath accommodates pedestrians well and responds to potential cyclists who are uncomfortable riding in mixed



Sidepath sections. Sidepath width and construction standards are similar to those for multi-use trails. Top: Intersection crossing with high visibility crosswalks. Typically a 6-foot separation from the curb will provide reasonable visibility for pedestrians and bicyclists.

Above: Two-way sidepath along an arterial, a typical accommodation on contemporary streets.

traffic. In new projects, the added cost of these facilities is relatively small, since sidewalks are already required in most urban street projects. Sidepath widths are similar to those of multi-use trails.

The actual riding or walking surface should be separated from the back of the curb by landscaping or a contrasting pavement material. Research indicates that, to maximize safety, separation of the sidepath from a roadway should increase as road speeds increase

Challenges to sidepath safety include driveway and street intersections, including visibility, motorist awareness, ambiguities about who has the right of way, and cars that block the path. As a result, experienced cyclists usually prefer on-road facilities to roadside facilities. Yet, sidepaths, despite their shortcomings, are used frequently and remain popular with many users.

Conventional multi-use sidepaths should ideally be used in corridors with few driveway or street interruptions, and should not exclude use of on-road facilities when bike lanes and shoulders are feasible. They work best along arterial streets that have long stretches of relatively uninterrupted frontage. Sidepath crossings should be clearly defined by high visibility crosswalks and advisory signage to make motorists aware of the presence of the path.

Examples of sidepaths in the current Grand Island system include the Capital Avenue Trail. The proposed future system includes sidepaths along Faidley Avenue west of Broadwell and a link along North Broadwell to Eagle Scout Park.

Marked and Signed Shared Routes

Shared, low-volume streets make up a large part of the proposed Grand Island active network. On these streets, bicycles and motor vehicles operate within the same area. These streets should also have continuous sidewalks in good repair with barrier-free access on at least one side. These streets will typically have average

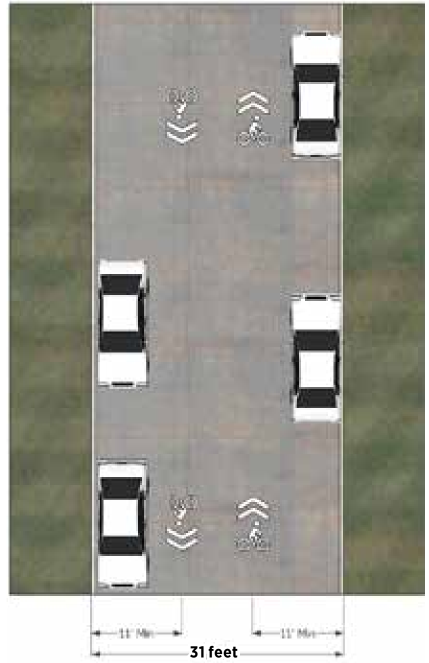
Top: Capital Avenue Trail. Above: Clayton Road sidepath in St. Louis County, Missouri. Note the highly visible crosswalk using high visibility markings and use of the trail crossing stack sign on intersecting streets.

daily traffic below 3,000 vehicles per day (preferably below 1,500 vehicles per day) and require relatively small infrastructure investment. Methods of identifying these routes include shared lane markings (sometimes called "sharrows)," often placed in the center of a travel lane between motor vehicle tire tracks to reduce wear and direct bicyclists away from the door zone of parked cars; wayfinding and/or bike route identification signs, identified as sign D11-1 by the Manual on Uniform Traffic Control Devices (MUTCD), the nationwide standard for roadway signage and markings); and motorist advisories such as the Bicycles May Use Full Lane sign, MUTCD sign R4-11).

In Grand Island, these local streets have a curb-to-curb width of 31 to 32 feet and usually (but not always) permit parking on both sides of the street. Because curbside parking on residential streets is not fully utilized, these streets at low volumes generally provide comfortable bicycling environments for most users.

Bicycle Boulevards (Quiet Streets)

Bicycle boulevards,sometimes called "quiet streets" or "neighborhood greenways" are something of a misnomer, because they are shared by pedestrians, bicyclists, and motor vehicles. They are low-volume, low-speed streets, modified to create greater comfort for both pedestrians and bicyclists, using treatments such as special signage, pavement markings (like shared lane markings), traffic calming devices such as bump-outs, and intersection modifications. Crossings of bicycle boulevards and major streets require special attention. Bicycle boulevards should have reasonable stop priority to provide continuity for bicyclists but not so much to become through routes for motor vehicles. The ideal bicycle boulevard provides both direct routing and good continuity; has traffic speeds at or below 25 mph, and average daily traffic below 3,000 vehicle per day. In Grand Island, bicycle boulevards are typically but not always on two-lane streets with width of or under 34 feet.



Marked routes. Left: Typical shared lane marking for a Grand Island street; Above: Shared lane marking installed.

Composite of possible bicycle boulevard treatments. (Alta Planning and Design illustration)

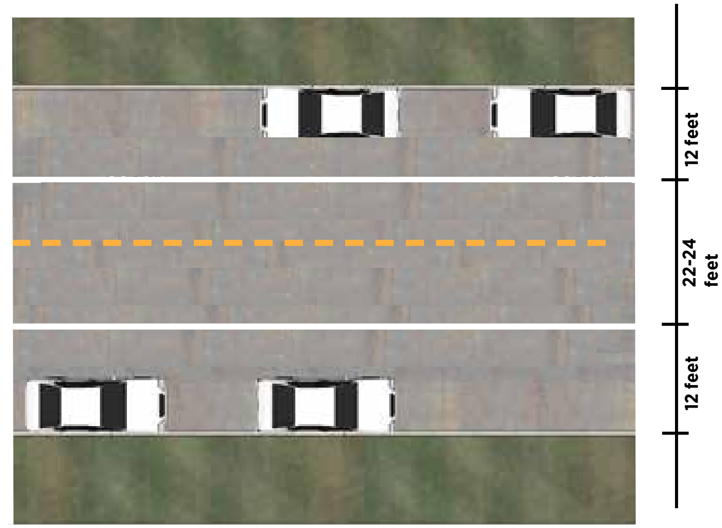
Bicycle boulevards in Topeka, KS. Topeka, which like Grand Island has an excellent secondary street system that lends itself to the bicycle boulevard concept. Topeka's facilities use shared lane markings and special street signs to mark the routes.The overall network has significantly increased bicycle travel in the city.

The Grand Island street grid is particularly adaptable to the bicycle boulevard concept. The Grand Island street network has an excellent grid of streets, many of which are largely residential in character, that could be favorable to the bicycle boulevard concept. It is important to note that in Grand Island, bicycle boulevard adaptation should not affect normal local street operation, including parking.

Parking and Multi-use Shoulders

A number of strategic streets in Grand Island have moderate daily traffic with a width of 37 feet and over. In most cases, these streets usually permit parking on at least one side. Some are also wide enough to accommodate conventional bike lanes providing exclusive space for bicycle travel adjacent to motor vehicle travel lanes. However, the exclusive bike lane concept has generally not received strong support in Grand Island.

In order to provide comfortable and safe accommodations for all users of these streets, the active network provides for two different types of shoulders: striped parking shoulders and multi-use shoulders.



Top: Typical section of a corridor with multi-use shoulders and 2-sided parking. Above: St Paul Avenue, a potential candidate street for multi-use shoulders or striped parking shoulders.

Striped parking shoulders apply to relatively wide, two- or three lanes streets with parking on both sides of the street and inadequate width for bicycle travel outside of shared travel lanes. On low-volume local streets with on-street parking, striped parking shoulders appear to manage traffic speeds through residential areas, help bicyclists properly

Ralph Rogers Ave in Sioux Falls, South Dakota. An example of a multi-use shoulder that accommodates but is not restricted to bicycle travel

track away from car doors, and keep parked cars from encroaching into travel lanes. Typical minimum width for local streets with parking shoulders on both sides and two travel lanes is 40 feet with 12-foot travel lanes. It is important to note the potential safety hazards of cyclists potentially weaving in and out of a parking lane and, as in other on-street settings, the need for cyclists to stay away from the "door zone" of adjacent parked cars. These hazards are reduced by using the Bicycle May Use Full Lane sign (MUTCD R4-11) and providing shared lane markings.

Multi-use shoulders provide a striped territory outside of travel lanes large enough to accommodate bicycle travel. Minimum width of a multi-use shoulder that prohibits parking is five feet; minimum width of a shoulder that also accommodates parking is 12 feet. Thus, typical width of a two-lane roadway with multi-use shoulders and no parking is 34 feet; with one-sided parking 42 feet; and with two-sided parking 48 feet. The reconstruction project for Stolley Park Road, to be implemented in 2018, will develop a three-lane facility with 5-foot paved shoulders, identified as multi-use

Advisory Bike Lanes

shoulders. This will provide comfortable territory for experienced adult riders on an arterial street and will not permit parking. However, the shoulders do provide a place for breakdowns and contingencies.

Advisory Bike Lanes

Advisory bike lanes are a type of shared roadway that clarify operating positions for bicyclists and motorists to minimize conflicts and increase comfort. Similar in appearance to bike

Two-way protected bike lanes in Lincoln, Nebraska (with curb) and Seattle, Washington (painted buffer with flexible bollards)

lanes, advisory bike lanes are distinct in that they are temporarily shared with motor vehicles during turning, approaching, and passing. This experimental treatment is most appropriate where traffic volumes are low to moderate (500 to 3,000 vehicles per day) and where there is insufficient room for bike lanes or multi-use shoulders. These may have wider applications in the Grand Island system, but for the purposes of this plan, are proposed in limited situations, including the continuation of Sycamore Street through Island Oasis on the Pine Street bikeway. They may also be used on paved rural roads with light traffic.

Protected Bike Lanes

Protected bike lanes are on-street facilities that provide a separation or buffer space between bicycle lanes and travel lanes. The Grand Island survey summarized in Chapter Two found that existing and prospective bicyclists significantly preferred the separated facilities over conventional bike lanes. Protected bike lanes may be provide either one-way directional movement or two-way movement. Two-way protected lanes are most effective along street segments with few driveway interruptions. Desirable minimum width for two-way facilities is ten feet, although 8 feet is acceptable in very limited conditions. (NACTO, *Urban Bikeway Design Guide*, 2014) On-street bike lane buffers and barriers are covered in the MUTCD as preferential lane markings (section 3D.01) and channelizing devices, including flexible delineators (section 3H.01). Curbs may be used as a channeling device, see the section on islands (section 3I.01). However, the use of raised buffers is not anticipated in the Grand Island plan.

In Nebraska protected bike lanes have been used in two projects – the two-way N Street Bikeway in Lincoln (NE), developed to very high design standards; and the Leavenworth/St. Mary's Bikeway in Omaha (NE), one-way lanes on a one-way pair defined by white lines. Adequate street width is necessary to provide proper buffering. The Grand Island concept proposes a two-way protected bike lane along a segment of Custer Street with no required on-street parking and few interruptions; and along connection between Custer Street and Blaine Street under Highway 30. Both applications are illustrated more fully in Chapter Seven. These facilities both involve a reallocation of existing street width rather than new, separated construction, and as such are part of an existing street maintenance program. However, their use as bicycle travel lanes is likely to require additional street maintenance in staff and budget to keep them in good repair and free of debris.

Table 3.12: Summary of Infrastructure Types in Grand Island Network

FACILITY TYPE	DESCRIPTION	EXAMPLES IN NETWORK
Multi-use trails	Separated trails on exclusive right-of-way. Some segments may be sidepaths adjacent to roadways.	Extensions of Westside Connector Trail, Moore Creek Trail, Beltline Trail east extension
Sidepath	Paths separated from but generally parallel to roadways and on public right-of-way	Capital Trail extension, segments of Custer Street bikeway, Adams
Shared and Marked Roadways	Low-volume, low-speed streets identified by signage, wayfinding, shared use lane pavement markings, but no major infrastructure changes. Often used to connect network to specific destinations.	Arthur Street between Beltline Trail and Stolley Park; Ingalls/Curtis Street from Blaine St to Beltline Trail
Bicycle boulevards	Low-volume, two-lane mixed traffic streets or groups of streets with direct continuity. May use special identification and wayfinding signage, traffic calming devices, controlled major intersections, continuous sidewalks. In Grand Island, typically but not always on 2-lane streets with width below 34 feet.	Pine Street, Oak Street, 14th/15th Street, Koenig Street, Lincoln Street. Major part of Grand Island network.
Striped parking shoulder	Area within a two- or three-lane street channel explicitly defined (usually by a white painted line) from travel lanes for parking. Bicycles are intended to operate in travel lanes. Used in conjunction with Bicycle May Use Full Lane sign and, optionally, shared lane markings.	College Street, North Front Street
Multi-use shoulders	Area within a two- or three-lane street channel explicitly defined (usually by a white painted line) from travel lanes, with adequate space to accommodate bicycle travel. May be used for parking with adequate width. Minimum shoulder width with parking is 12 feet (14 feet desirable), 5 feet without parking.	Stolley Park Road, parts of Custer Avenue and 3rd Street.
Advisory bike lanes	Shared roadway that clarify operating positions for bicyclists within shared travel lanes, typically used on segments that need definition of territory for bikes but are not wide enough for conventional bike lanes or multi-use shoulders.	Low-volume park roads, Sycamore Street through Island Oasis, very low-volume county roads
Protected bike lanes	Roadways with specific one- or two-way lanes for exclusive use by bicycles, separated by a buffer from moving travel lanes. Separation is accomplished by painted buffers often with vertical definition or a raised curb.	US 30 underpass connecting Blaine and Custer, segments of Custer Street

Figure 3.13: Infrastructure Types Applied to Network: North

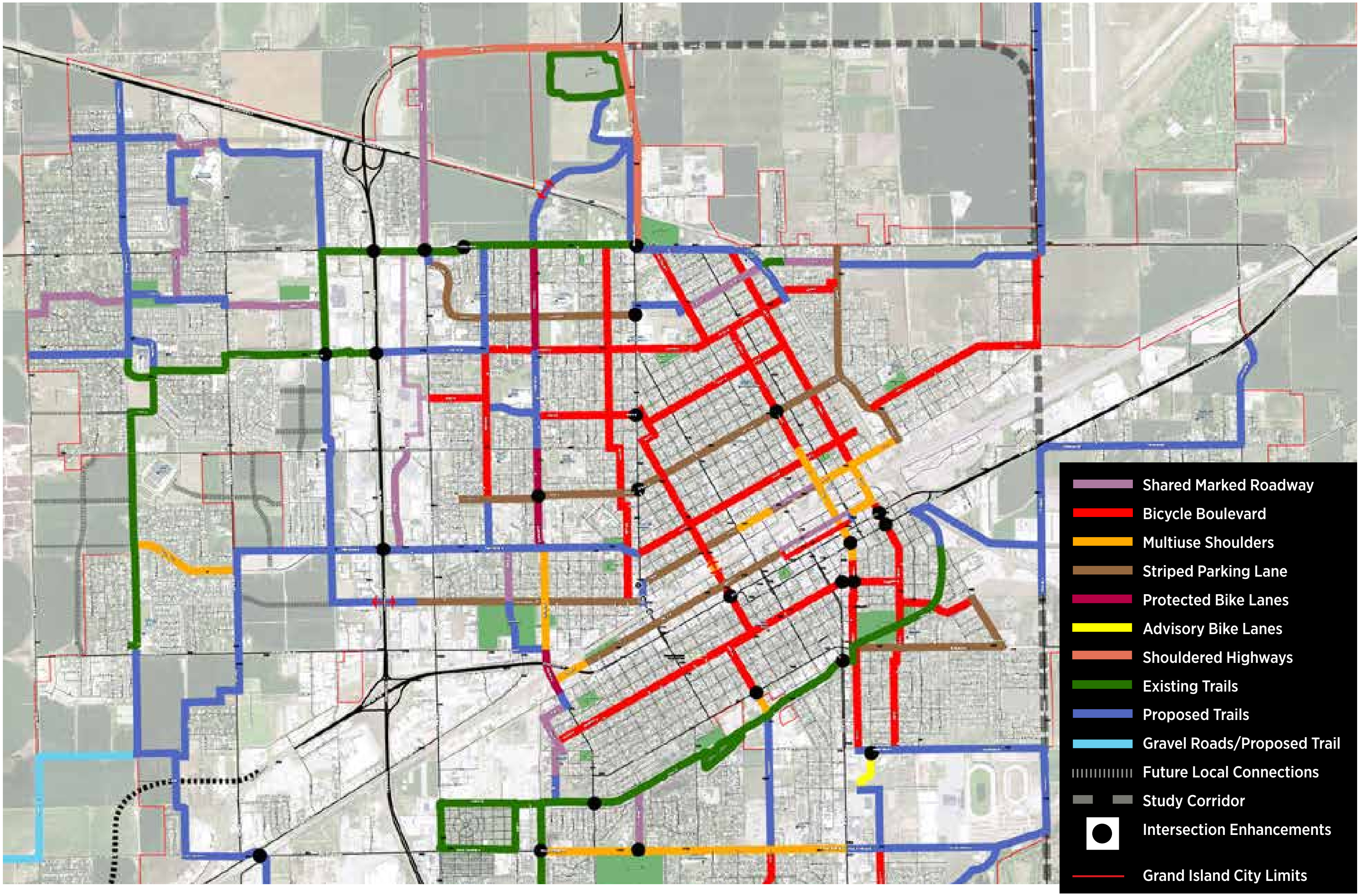


Figure 3.13: Infrastructure Types Applied to Network: South