THE BIKE HAYS MASTER PLAN

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PLANNING • DESIGN

Hays

THE
BIKE HAYS
MASTER PLAN

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INTRODUCTION

The City of Hays is ideally positioned to make this wonder vehicle an important part of its transportation picture. The city is compact, so most trips are relatively short. It has a network of wide, relatively quiet streets that connect parks, schools, and activity centers. Hays has a vital downtown, distinctive park and recreation resources, historic and cultural attractions with appeal to both visitors and residents, fine neighborhoods, a boulevard system, and a great university campus. Its flat topography makes bicycling in Hays both a pleasure and highly accessible to most people.

Bicycles and Hays are made for each other, and cycling can play an important role in the city's transportation system. This plan is dedicated to encouraging Hays' citizens to use this healthy, low-impact, and pleasurable form of transportation as part of their daily routines. Bicycling in Hays can be a useful and convenient form of transportation for many purposes that are part of daily life: work, school, visiting friends, parks and recreation, shopping, and many others. But it is profoundly satisfying to reach our destinations under our own power and to experience the city and its people in new and more personal ways.

We know that bicycling for transportation does not meet everyone's needs and that most trips in Hays will continue to be made by car. But people should have choices, including the option to feel safe and comfortable using the healthy, sustainable, and socially satisfying means of mobility that the bicycle offers.

Why a Bikeway Plan? Goals of this Master Plan

People in Hays have a strong interest in health and active transportation. In 2007, the city developed a plan for trails with many good ideas that with unlimited funds would give the city a great pathway network. However, trails are very expensive, often costing as much as $300,000 per mile. The proposed system, while excellent, was simply unaffordable to the city. Furthermore, the new federal transportation bill – MAP-21 – has significantly reduced funding for transportation alternatives, and the State of Kansas is one of only two states to opt out of the Recreational Trails Program (RTP), electing to reprogram its share of funds for roads.

This plan takes a different direction, based on developing an affordable network of bicycle facilities. This concept makes maximum use of the city's largest infrastructure investment: its street system. It uses trails and exclusive pathways to fill gaps in the system. Trails remain a major part of an ultimate system, but the immediate need is to get people into the habit of using bicycles for routine trips.

A BikeHays bicycle infrastructure system, then, is guided by the following goals:

Goal One: Increase the number of people who use the bicycle for transportation as well as recreation. A measurement of the success of this plan will be significantly increasing the percentage of trips for a variety of purposes.

Goal Two: Improve bicycle access to key community destinations. A bicycle transportation system should get people comfortably and safely to where

they want to go. Bicycles are used most often for recreational trips, and these trips to parks, ball games, and recreation centers are important contributors to overall travel in the city. Therefore, the system serves all of the city's parks, and links them into a unified green network. But it also serves important community destinations and sources of travel, such as the FHSU campus, Downtown, and other retail centers.

Goal Three: Use bicycling as part of an effort make Hays more sustainable at three levels: global, community, and individual. Trips made by bicycle promote community sustainability in three ways:

- **Global sustainability.** Bicycle transportation reduces fossil fuel use and greenhouse gas emissions, helping the city reduce its impact on the global environment. The Hays system is especially suited to short trips, for which cars are both least efficient and most polluting. A bikeable Hays will not save the planet. But as a great sage said about 2,000 years ago, "It's not your job to finish the task, but you are not free to walk away from it."

- **Community sustainability.** A good and heavily used bicycle transportation system can help reduce the cost of government by marginally reducing the need for more expensive projects. Also, on a social level, bicycling enhances the quality of civic life, helping us interact with each other as people. Places that lead in bicycle transportation also tend to attract people because of their community quality.

- **Individual sustainability.** Incorporating physical activity into the normal routine of daily life for everyone from kids to seniors makes all of us healthier, and reduces overweight and obesity rates and improves wellness and lowers overall health care costs.

Goal Four: Increase safety on the road for motorists, bicyclists, and pedestrians. Improved safety is a critical goal for any transportation improvement, and good infrastructure can reduce crashes and increase comfort for all users of Hays' transportation network.

The Measures of Success: Guiding Criteria for an Effective Bicycle Transportation Network

The design of any bicycle transportation system should be guided by criteria that can be used to evaluate individual components and the effectiveness of the entire network. The Netherlands' Centre for Research and Contract Standardization in Civil and Traffic Engineering (C.R.O.W.), one of the world's leading authorities in the design of bicycle-friendly infrastructure, has developed especially useful requirements to help determine the design of bicycle systems. Drawing on C.R.O.W.'s work in its excellent design manual, *Sign Up for the Bike,* an urban bicycle network should generally fulfill six basic requirements:

- **Integrity** (or, in C.R.O.W.'s term, Coherence): Hays' bikeway network at all points in its evolution forms a coherent system that links starting points with destinations. The network is understandable to its users and fulfills a responsibility to convey them continuously on their paths.

- **Directness:** The bikeway network should offer cyclists as direct a route as possible, with mini-

mum detours or misdirections.

• Safety: The bikeway network should maximize the safety of using the bicycle for transportation, minimize or improve hazardous conditions and barriers, and in the process improve safety for pedestrians and motorists.

• **Comfort:** Most bicyclists should view the network as being within their capabilities and not imposing unusual mental or physical stress. As the system grow, more types of users will find that it meets their needs comfortably.

• **Experience:** The bicycle network should offer its users a pleasant and positive experience that capitalizes on the city's built and natural environments.

• **Feasibility:** The bicycle network should provide a high ratio of benefits to costs and should be viewed as a wise investment of resources. It is capable of being developed in phases and growing over time.

These criteria and the system design principles that logically follow from them are discussed in detail in Chapter Two.

Organization of the Plan

The Bike Hays Master Plan presents its analysis and recommendations in the following chapters:

Chapter One: Hays' Bicycling Environment. This chapter examines existing conditions in the city that pertain to bicycling, including resources that help determine a future bikeway system such as destinations, existing facilities, and opportunities.

Chapter Two: The Bikeway Network: Principles and Structure. This chapter establishes overall principles that guide the proposed network. It presents a complete conceptual system of on-street bikeways, paths, and multi-use trails.

Chapter Three: Facility Design Guidelines. This chapter presents the vocabulary of facilities and street adaptations proposed for the Hays network, based on the city's specific street characteristics and environmental features. It concludes by applying the infrastructure types to the conceptual bikeway network and its various routes.

Chapter Four: Implementation. This section establishes criteria that determine the sequence of development and proposes an initial network, based on serving all parts of town and early feasibility.

Chapter Five: Support Programs. The League of American Bicyclists describes five "E's" as components of a bicycle-friendly community (BFC) program and judges BFC applications accordingly. These program categories are Engineering, Education, Encouragement, Enforcement, and Evaluation.

Chapters One through Four largely address the Engineering component; Chapter Five recommends initiatives that support these infrastructure investments to achieve bicycle transportation's full potential as part of the Hays access environment.

CHAPTER 1

CONTEXT AND OPPORTUNITIES

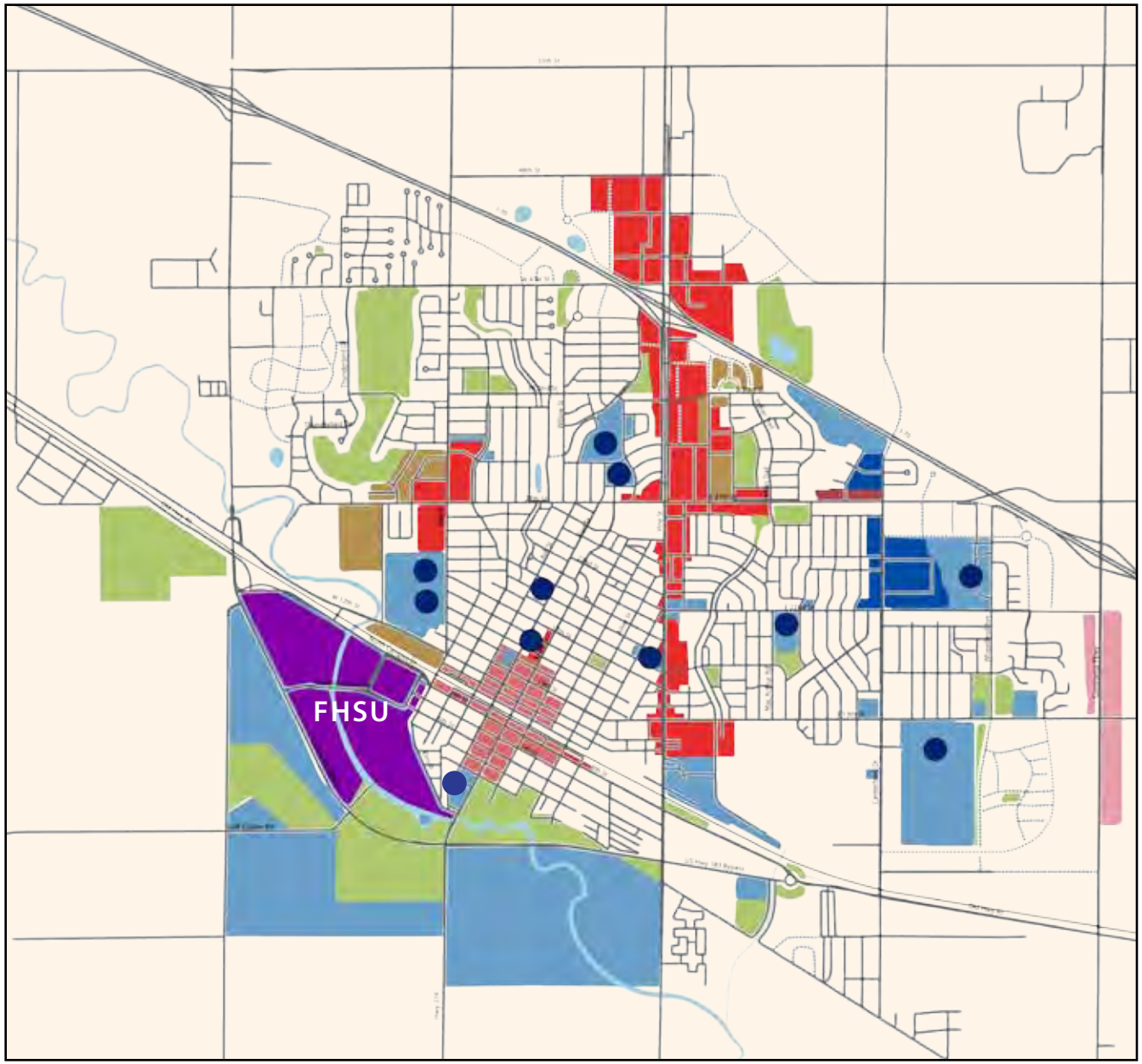
This chapter describes key characteristics and features that affect the design of Hays bikeways network, including:

- **Destinations**
- **Street Connectivity and Types**
- **Network Opportunities**

Destinations (Map 1)

Residential, commercial, office, and civic land use patterns all influence bicycle network design, but major destinations, the places that attract people for learning, recreation, employment, civic or cultural life, shopping, entertainment, or other activities – should be directly served by the system. Figure 1.1 displays the deployment of many of these significant destination points in Hays, including:

- **Educational facilities,** including elementary and secondary schools as well as Fort Hays State University.
- **Major park and recreation facilities,** including large multi-purpose parks, among which are the new Bickle-Schmidt Sports Complex, Municipal Park, and Frontier Park; the city's excellent system of neighborhood parks; the Hays Recreation Center; and the existing undeveloped Hiking Trail.
- **Hospitals and medical facilities,** including the Hays Medical Center campus and surrounding facilities.
- **Key public destinations and museums,** including the Hays Public Library, the Sternberg Museum, the Ellis County Museum, City Hall, and Historic Fort Hays.
- **Commercial centers adaptable to bicycle transportation,** including the Chestnut Street District, the Mall and other major commercial uses on North Vine, and the 27th and Hall district.
- **Major employment concentrations,** including office clusters, downtown, and the Commerce Parkway corridor as feasible.
- **Environmental and Open Space Features,** such as the Big Creek corridor.
- **High Density Residential.** Apartment districts tend to generate high concentrations of potential users. In Hays, these areas are likely to have significant off-campus student populations, who will find bicycles to be a convenient way to travel to classes.



Map 1:
Destinations

- High Density Resadential
- Commercial Districts
- FHSU
- Civic Facilities
- Schools
- Downtown
- Business Parks
- Medical Facilities
- Parks

Street Connectivity and Types (Map 2)

Like many Midwestern and Great Plains cities, Hays' arterial street system is built on the section-line grid that dates back to the surveys and land divisions of the Homestead Act. Within that grid, the Hays street system adjusted to geographic features that add significant character. For example, the grid is rotated in the original town south of 27th Street and west of Vine to align with the railroad. On other quadrants, drainageways influenced land development patterns. In general, street patterns in Hays have several attributes that lend themselves to bikeway development. These include:

- **Good local street continuity.** Within the grid created by through arterials, Hays' secondary streets connect to each other, creating an internal system that is relatively easy to navigate through. These streets generally have low traffic volumes, making them comfortable for most prospective cyclists. However, this continuity tends to be broken at section lines, and particularly by the cross axes of Vine Street and 27th Street. Additional safe connections from north to south and east to west across these corridors would improve a bicycle facility network.

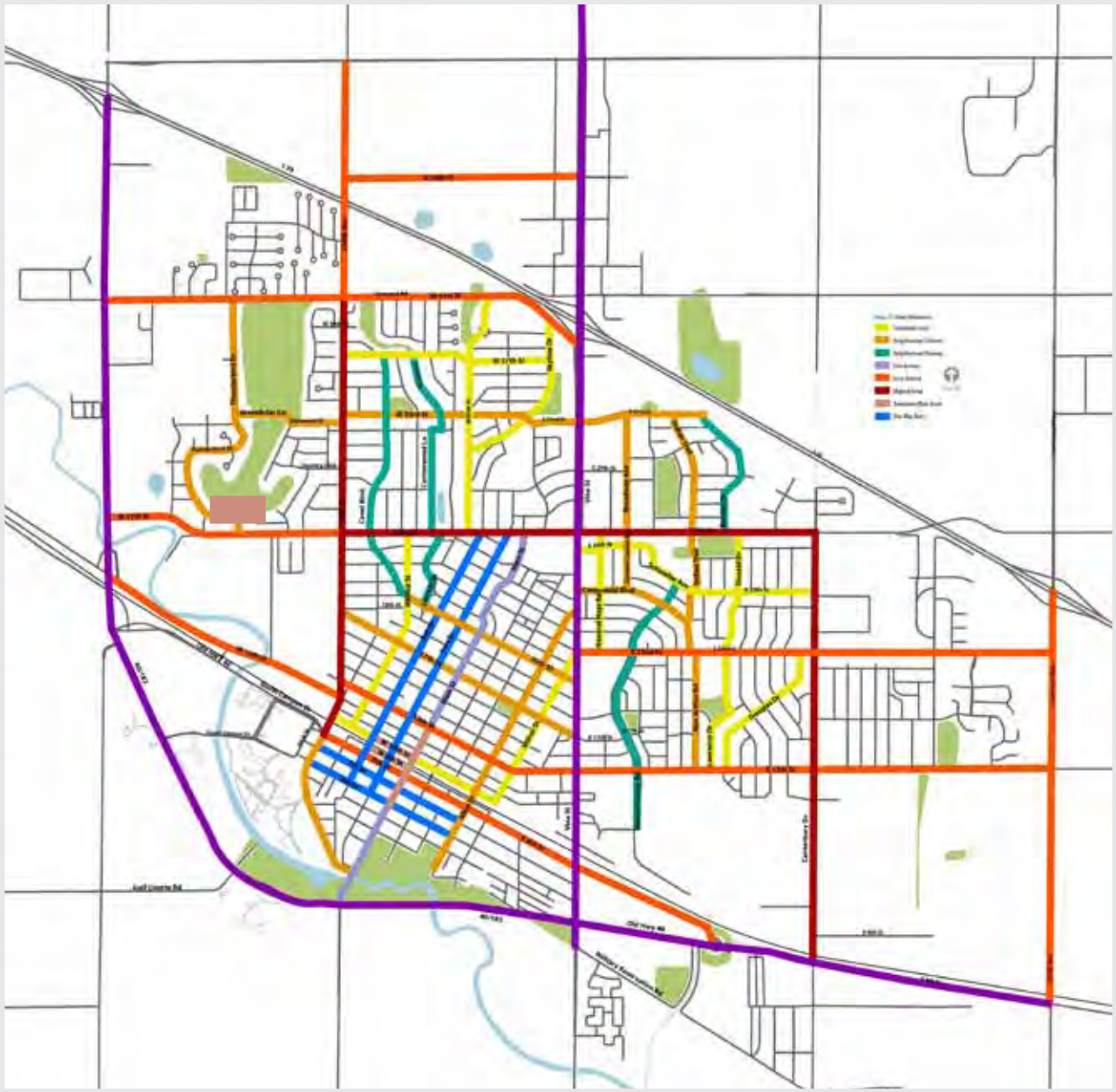
- **Street width.** Hays' wide streets provide generous space that allow motorists and bicyclists to share the road comfortably. In many cases, bicycle facilities will tend to reduce excessive speed on local streets.

- **Parkways.** Hays' divided parkways along drainage corridors, established by Canal Boulevard, Lincoln Drive/Cottonwood Avenue, and General Custer Road, create attractive bike and pedestrian corridors.

Table 1: *Street Contexts*

Street Type	Lanes	ADT	Street Width (ft)	Speed (mph)	Continuous length (miles)	Other Features	Examples
Continuous Local	2	Under 1,000	26-40	25	0.5-1.0		Haney Drive
Continuous Neighborhood Collector	2	Under 3,000	30-44	25	0.5-2.0	Traffic control at major intersections, residential and commercial contexts	Indian Trail, 33rd Street
Neighborhood Parkway	1 with median	Under 3,000	Over 100 in ROW	25	1.0-2.0	Drainageway in median, may have traffic control at major intersections.	Canal Blvd, General Custer
Civic Avenue	2	Under 5,000	32-55	25-30	1.0-2.0	Traffic control at major intersections, mixed uses, street oriented houses	Main Street
Local Arterial	4	4,000- 8,000	36-45	30-35	1.5-4.0	Traffic controls, major local traffic carriers	13th St, 22nd St.
Major Arterial	3-5	7,000-12,000	42-50	35	1.5-4.0	Traffic control at major intersections, mixed uses	27th St, Hall St
Regional Arterial	5	Over 12,000	Over 48	35-50	2.0-6.0	Major highway corridors, substantial commercial use	Vine St, 183 Bypass
Urban One-Way Pairs	1-2	2,000-4,000	24-32	30	Over 2.0	Traffic control at major intersections; mixed uses with commercial, office, residential; on-street parking	Fort/Ash
Downtown Main Street	2-3	3,000-7,000	50-60	25-30	Downtown	Traffic control at major intersections; mixed uses; on-street diagonal parking	8th Street, Main Street

Table 1 below describes specific street contexts within the Hays street network. These are different from traditional street categories because they relate to character, land use, and actual function as well as width and traffic volume. Map 2 illustrates how these street contexts relate to Hays street system. The width and traffic characteristics each street type will generate different treatments to adapt them for bicycle transportation. Of these, streets that most effectively satisfy the six measures of success identified in the Introduction – integrity, directness, safety, comfort, experience, and feasibility – are streets with relatively low traffic volumes, high continuity, and adequate width for mixed traffic.



Map 2:
Street Contexts

- Continuous Local
- Neighborhood Collector
- Neighborhood Parkway
- Civic Avenue
- Local Arterial
- Major Arterial
- Downtown Main Street
- One-Way Pairs

North

Other Network Opportunities (Map 3)

In addition to its low-volume continuous streets, Hays provides other opportunities that can help to build a system that satisfies the six performance criteria. These features can accommodate facilities physically separated from travel lanes such as separated pathways adjacent to streets, multi-use trails, or street modifications. They include:

• **Potential complete streets and road diets.** These are streets (often local arterials) that could be converted to a different lane configuration. For example, 13th Street and Hall Street north of 27th both have four-lane sections with traffic volumes well within the capacity of a three-lane street section. Most traffic engineers agree that a three-lane street with a separated left-turn lane is preferable to a four-lane street without left-turn facilities for both operations and safety. A reduction of these streets from four to three lanes will provide adequate space for bicycle lanes/shoulders.

• **Major open spaces or institutional uses with long continuous street frontages, preferably at least 1/4 mile.** These include parks, cemeteries, school campuses, golf courses, roadways with limited access and wide right-of-ways, and large public uses. Off-street paths parallel to streets can be located along these relatively uninterrupted frontages.

• **Parks and campuses capable of accommodating trails.** These uses and site plans enable trails to cross through their interiors without compromising their use. Examples are Municipal and Frontier Park, and the Sports Complex.

• **Linear corridors that accommodate significant new trail facilities that serve transportation purposes and/or fill gaps in the existing system.** Examples are:

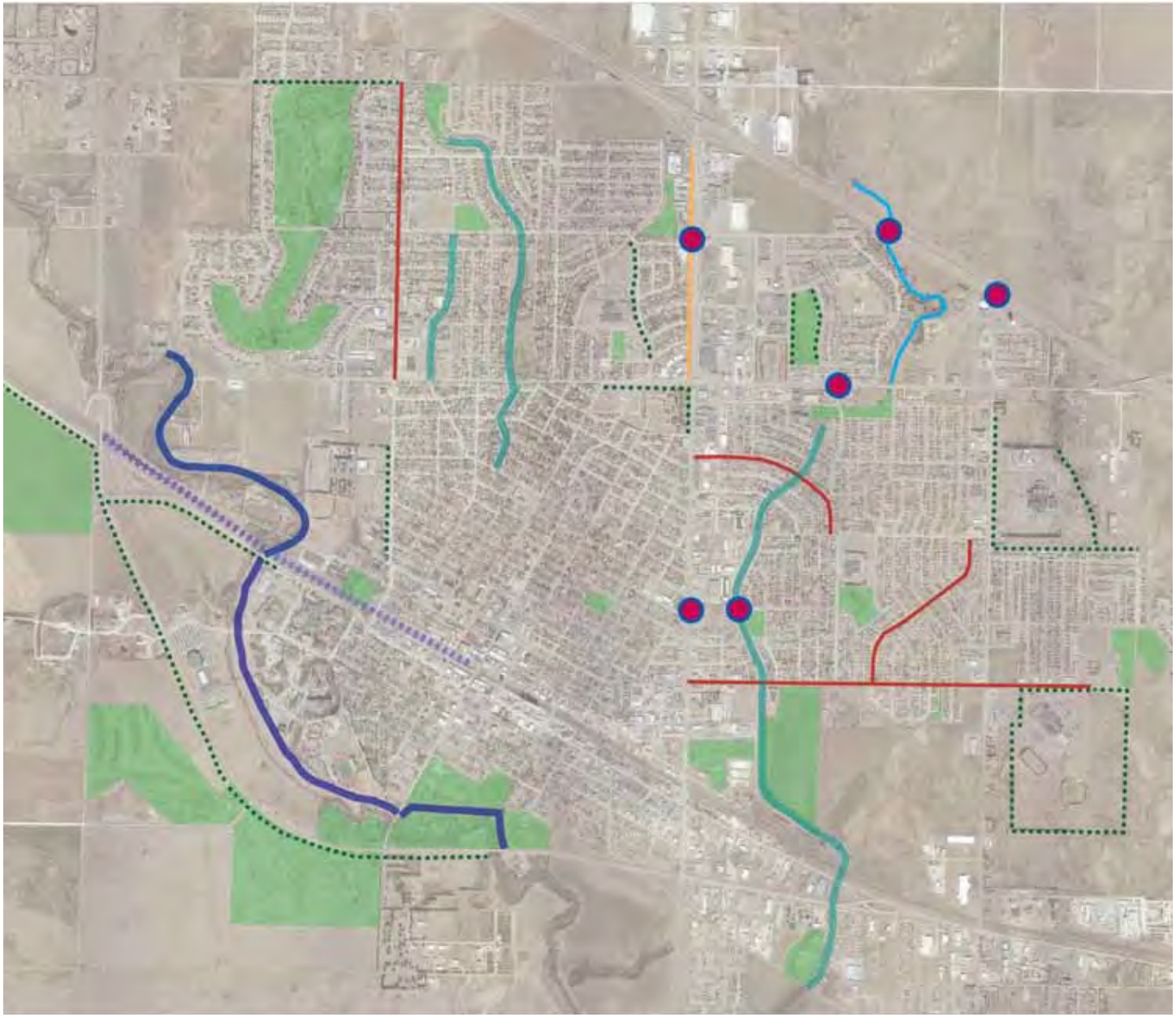
- Drainageways and watercourses with banks and sufficient adjacent public or common land to accommodate pathways. The city's parkways are highly adaptable as bikeway and pedestrian facilities.

- Levees along watercourses, most notably Big Creek.

- Railroad corridors, where possibilities for rail with trail development exist.

- Green spaces that are proposed in the comprehensive plan, such as the possible repurposing of the west frontage road along Vine Street between 27th and Interstate 70.

- New grade separations or drainageway crossings of I-70.



Map 3: Network Opportunities

- Big Creek Levee
- Secondary Waterway
- Parkways
- Uninterrupted Edges
- Lane Reconfigurations
- Roadway Repurposing
- Railroad/Road Corridors
- Connectivity Improvement
- Parks

CHAPTER 2

THE BIKEWAY NETWORK PRINCIPLES AND CONCEPT

This chapter starts with the principles that govern the design of the Bike Hays bikeway network. It uses these principles and the structure of destinations, contexts, and opportunities presented in Chapter One to generate the overall system concept.

The introductory section identified six guiding requirements for an effective bicycle network, adapted from work completed by the Netherlands Centre for Research and Contract Standardization in Civil and Traffic Engineering:

Integrity: The ability of a system to link starting points continuously to destinations, and to be easily and clearly understand 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 opposition.

These six requirements 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. Tables 2 through 7 describe performance criteria to guide implementation of the network over time and evaluate its effectiveness.

Attributes of the Network

Based on this development of the six requirements presented in the tables, the Hays system design follows the following major attributes:

Destination-Based. The Hays network serves important destinations in the community. Since the majority of bicycle trips are recreational, the system design began with servicing and connecting the city's parks and recreational facilities. It then expanded to address other important destinations appropriate for non-motorized transportation, including schools, the university, downtown, and retail destinations. More than a grid of bicycle-friendly streets or recreational trails, Bike Hays is intended to be a transportation system that takes people to specific places.

Transit Model. The Hays system considers a grid of destination-based routes analogous to a road or transit system. This idea guides bicyclists to destinations with minimum consultation of support materials and emphasizes the interconnection of routes. Thus, cyclists heading to a specific destination will know the combination of designated routes that take them where they want to go.

Incremental Integrity. 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 it were the ultimate stage of completion.

Evolution. 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 cliche, the perfect should not be the enemy of the good. For example, much of the path along Big Creek's levee is suitable for the majority of users with relatively inexpensive upgrades short of full pavement. Similarly, comprehensive plan recommendations for North Vine and Downtown will result in major street and pathway improvements, but inexpensive, interim solutions can create a better cycling environment in the short-term. Rather than trying to accumulate funds to pave that trail, we should build an initial network that

uses what we have and provides a foundation for future improvements.

Conflict Avoidance. Few important actions are completely without controversy, but successful development of a bicycle transportation system should avoid unnecessary discord and impact on neighborhoods. For example, when parking in neighborhoods or desirable street operation should not be sacrificed to accommodate bike lanes. In many cases, however, bike lanes can help reduce other problems, such as speeding on streets that have too much lane capacity. On local streets, shared routes and signs that

Table 2: ***Development of the INTEGRITY requirement.***

Performance Factor	Measures	Performance Standard
Comprehensiveness	Number of connected destinations on system	Major destination types, including parks, the Sports Complex schools, FHSU, the Technical College, the hospital, Downtown, and major retail concentrations should be served by the ultimate network. 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 must not be dropped at a terminus without route or directional information. Even at incremental levels, route endings must make functional sense. Transitions between facility types must 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 or beyond their capacities. 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 must 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 MUTCD. Use of the Clearview font is recommended.
Route choice	Number of alternative routes of approximately equal distance	Ultimate system provides most users with a minimum of two alternatives of approximately equal distance. Minimum distance between alternative routes should be about 500 feet
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.

do not disturb the neighborhood routine can provide an adequate facility that focuses on the positive and minimizes divisive conflicts.

Use of Existing Facilities. Existing features like the Big Creek levee path, the access under I-70 along North Vine, the hospital's health walk system, and the planned sidepath along 41st Street Trails are integral to a bikeway system and should not be taken for granted.

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.

Table 3: ***Development of the DIRECTNESS requirement.***

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-quarter to 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. Through portion of routes should permit operation in a 15 to 20 mph range.
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. Detour ratio (distance between two points/shortest possible distance) should not exceed 1.2 over long distances and 1.4 over short distances.
Delays	Amount of time spent not moving per mile	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. Target design should limit maximum delays to about 30 seconds per mile over long distances and 45 seconds per mile over short distances.
Intersections	Bicycle direction through intersections	Bicyclists should be able to continue through intersections as vehicles. Situations that force cyclists to become pedestrians in order to negotiate intersections should be avoided.

Table 4: ***Development of the SAFETY requirement.***

Performance Factor	Measures	Performance Standard
Reduced number and fear of crash incidents	Number of incidents Reactions/perceptions of users	Bikeways system users should feel that the system protects their physical safety, as measured by both use of routes and survey instruments. A particular area of concern in Hays are close frontage roads along arterials (Vine, 27th, Canterbury)
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. 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 cyclists and motorists. Trail and pathway geometries should avoid sharp turns and alignments that hide cyclists operating in opposing directions. 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 As a rule, sidepaths should 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.

Table 5: ***Development of the COMFORT requirement.***

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.
Hills	Number and length of hills and inclines Maximum grades on component for both long and short distances	Hills and grades are generally not a factor within Hays. Grades are most significant at separations over or under roads and railroads. As a general rule, routes should avoid more than one incline over 5% for each mile of travel Maximum average design grades should not exceed 7% over a hill not to exceed 400 feet in length; or 5% over the course of a mile. When street width restricts bike lanes to one side of the street only, facilities should generally be placed on the upgrade side. 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 DIRECTNESS standards can be reasonably complied with. The network should avoid mixed traffic situations when average daily traffic (ADT) exceeds 5,000 vehicles per day when alternatives exist. Alternatives can include bike lanes, separations, or alternative right-of-way.
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.

Table 6: ***Development of the EXPERIENCE requirement.***

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. Routes should provide access to commercial and personal support services, such as food service, convenience stores, and restrooms.
Landscape	Location and extent of parks or maintained open space	Network should maximize exposure of 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.
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.

Table 6: ***Development of the FEASIBILITY requirement.***

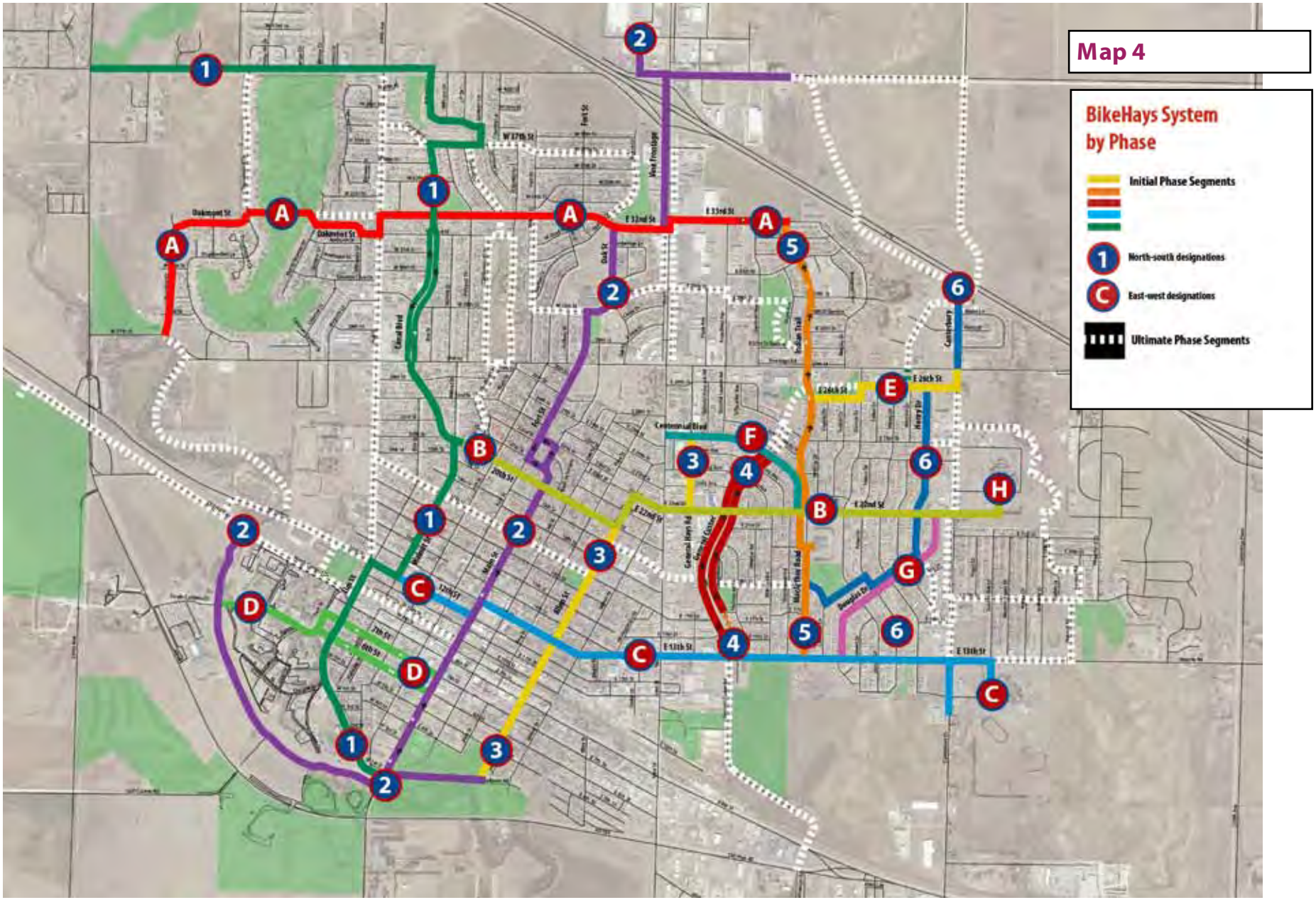
Performance Factor	Measures	Performance Standard
Cost effectiveness	Route cost Maximum use of low-cost components Population/destination density	The network should generate maximum benefit at minimum cost. Where possible, selected routes should favor segments that can be adapted to bicycle use with economical 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 bicycle 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 assent. 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.

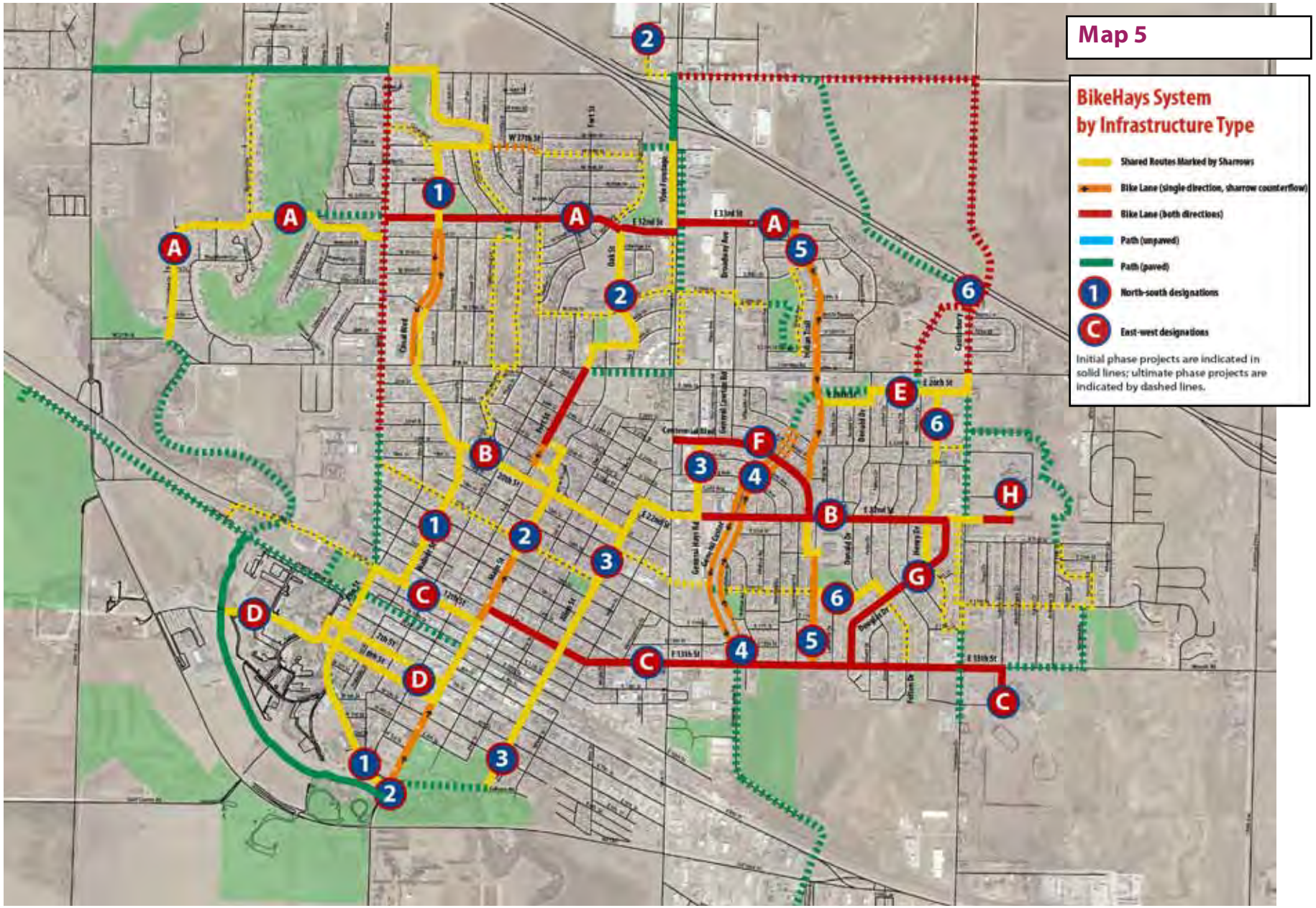
The Hays Bikeway System

Figures 4 and 5 displays the proposed Bike Hays system, based on the requirements and principles described previously in this chapter. The proposed system includes:

- **An Initial Phase.** This first phase proposes route segments identified by associated color and number, requiring an identification system that would be adapted to the city environment. Some shorter segments are identified for phasing and cost calculation purposes. For the most part, the initial phase utilizes existing streets and pathways, using pavement markings, lane diets, and graphics to identify them as part of a citywide network.
- **Later Phases.** These segments would be added to the initial system, and include both additional street segments and multi-use trails. They extend the initial phase into new areas, including a major east-west link to the Sports Complex; paving of the Big Creek Trail; and other on- and off-street system expansions. Big Creek Trail paving should be advanced if funds are available. It also includes pedestrian and bicycle facilities proposed as parts of capital projects for Downtown, North Vine, and the transportation system by the comprehensive plan.

Figure 4 displays the overall bikeway system, indicating both the initial and ultimate phases. Initial segments are numbered (for north-south routes) and lettered (for east-west routes) and identified by color. Later phases are designated by white dashed lines. Figure 5 shows the type of infrastructure improvement proposed for each segment in the system. The design guidelines elements for each of these segments and their contexts are presented in Chapter Three.

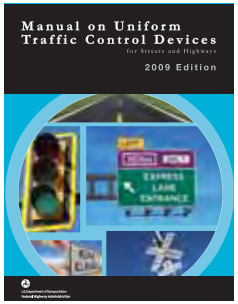

Map 4
BikeHays System by Phase
Initial Phase Segments
North-south designations
East-west designations
Ultimate Phase Segments


Map 5
BikeHays System by Infrastructure Type
Shared Routes Marked by Sharrows
Bike Lane (single direction, sharrow counterflow)
Bike Lane (both directions)
Path (unpaved)
Path (paved)
North-south designations
East-west designations
Initial phase projects are indicated in solid lines; ultimate phase projects are indicated by dashed lines.

CHAPTER 3

INFRASTRUCTURE DESIGN GUIDELINES

This chapter presents the infrastructure of the BikeHays network, including facility types and design guidelines appropriate to the city's various street types. These facility types form the building blocks of the network, and become the individual design components of the system's routes.



Sources. Sources that establish detailed standards for the design of bicycle facilities include the recent Urban Bikeway Design Guide (National Association of City Transportation Officials, 2011), the Manual of Uniform Traffic Control Devices (Federal Highway Administration, 2009), and the draft AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities (American Association of State Highway and Transportation Officials, 2010). Designers of facilities should use these primary sources. The guidelines and standards included in this plan are intended to provide guidance that augments these authoritative standards to specific situations within a Hays bikeways network.

The complete BikeHays network will be realized on the ground by a variety of features: pavement markings, signs, capital projects like paths and trails, and supporting improvements. Each of these is designed to increase the comfort and safety of cyclists traveling along the system, and to encourage citizens of Hays to consider using bicycles for at least some of their routine trips. These concepts are adapted to the characteristics of the city's streets as described in Chapter One. Figure Five in the previous chapter shows the type of infrastructure used for each segment of the system, while this chapter presents guidelines for their design. It is important to note that individual segments may still require specific design adaptations of these guidelines.

Facility Types

In general, the Hays network will use the following types of facilities:

Shared streets, in which bicyclists and motor vehicles operate in common right-of-way. These streets usually have relatively low volumes and adequate continuity to be useful parts of the system. In most cases, they have on-street parking, but in many cases are wide enough to accommodate motorists and bicyclists comfortably.

Bike lanes, in which bicyclists share the street right-of-way but operate within marked lanes reserved for their use. Bike lanes always provide for one-way movement, in most cases moving in the same direction as motor vehicles. Bicycle lanes are appropriate on streets that can comfortably accommodate bicyclists, but have higher traffic volumes than shared streets; provide adequate width in their current channels for both motor vehicles and bicycles; or as part of new street construction projects that integrate pedestrians, bicycles, and transit into their design (complete streets). Where streets are not wide enough for bike lanes on both sides, the system proposes bike lanes on one side of the street, with a shared lane on the opposite side.

Sidepaths. Sidepaths are bicycle paths located within a street right of way but fully separated from travel lanes. These facilities are popular in Europe and are frequently used in the United States, but have been controversial, largely because of potential bicycle-motor vehicle conflicts at intersections of streets and driveways. These facilities are especially useful along the street frontages of major campuses, parks, open spaces, and limited entry developments with long distances and few interruptions. A sidepath is planned as part of the 41st Street improvement project between Hall Street and US 183.

Cycle tracks, defined one- or two-way paths within street channels buffered from moving traffic by parked cars or separated by buffers, have gained popularity in many cities.

Multi-use trails. Currently, trails in Hays are limited to the existing unpaved path along Big Creek. Trails following waterways, levees, railroads, campuses, and utility lines are part of the longer range BikeHays network.

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Facility Types with Hays Applications

1 Shared street with sharrow, Omaha, NE
2 Bike lane on existing street, Boston, MA
3 Complete street conversion, Green Bay, WI
4 Sidepath, Lawrence, KS
5 Cycle track, Cambridge, MA
6 **Paved** Multi-use trail, Shunga Trail, Topeka
7 Multi-use trail, Lake Shawnee Trail, Topeka

Local Shared Streets

Shared, low-volume streets will make up the majority of on-street mileage in the Hays bikeway system. On these streets, bicycles and motor vehicles operate within the same area.

Shared streets will be marked by shared lane markings, or sharrows, a pavement marking now recognized within the Manual of Uniform Traffic Control Devices (MUTCD). Sharrows, made up of a bicycle symbol and a directional chevron, fill three primary functions:

- They provide route continuity for cyclists. The sharrow helps assure riders that they are on the bikeway system and moving along a street that is intended for bicycle use..
- Along with other signage, they increase motorist awareness of bicycles on the street.
- Properly placed, they help bicyclists position themselves safely on a street away from the "door zone" of adjacent parked cars.

Application to Street Contexts in Hays

Characteristics of streets in the Hays system that adapt to shared use include:

- *Low traffic volumes.* Streets with average daily traffic (ADT) below 2,000 vpd are most appropriate for shared use. As volumes increase, the number of potential cyclists comfortable riding in the shared street environment will decrease.

- *Relatively low speeds.* The MUTCD recommends that sharrows not be placed on roadways with speed limits over 35 mph. A better maximum speed limit for streets with sharrows for Hays is 25-30 mph.

- *On-street parking.* Low-volume streets in Hays do not restrct on-street parallel parking. The sharrow is useful in helping bicyclists position themselves away from the hazards of opening car doors.

- *Inadequate space for bike lanes.* Bike lanes, providing reserved space in the street channel for bicyclists, are often desirable, but many streets in Hays are not wide enough to accommodate bike lanes, travel lanes, and on-street parking. Providing all of these features typically requires a 44-46 feet minimum curb to curb width.

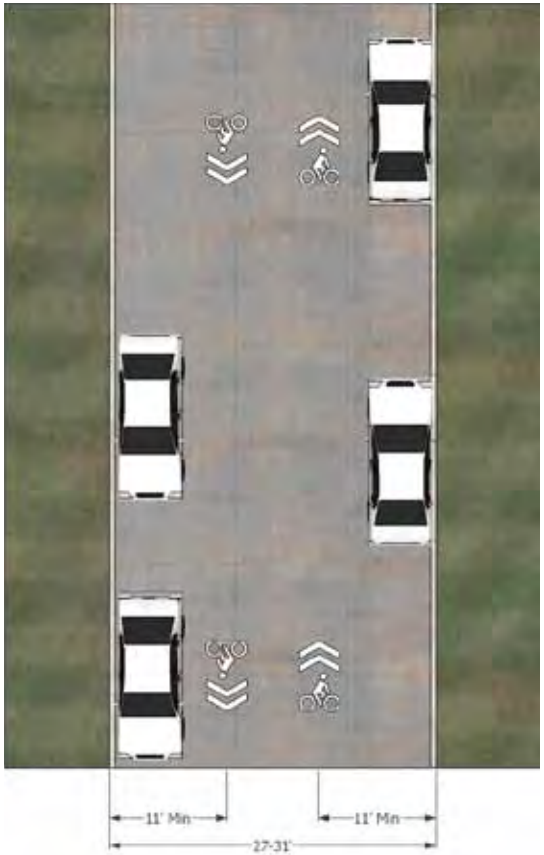
These conditions are typically found in the following street types:

- Continuous local streets
- Continuous neighborhood collectors
- Neighborhood parkways

Sharrows may be used on streets with somewhat higher volumes and speeds up to 35 mph where necessary to provide system continuity or to fill short gaps in the network. However, these routes will not be comfortable for all riders.

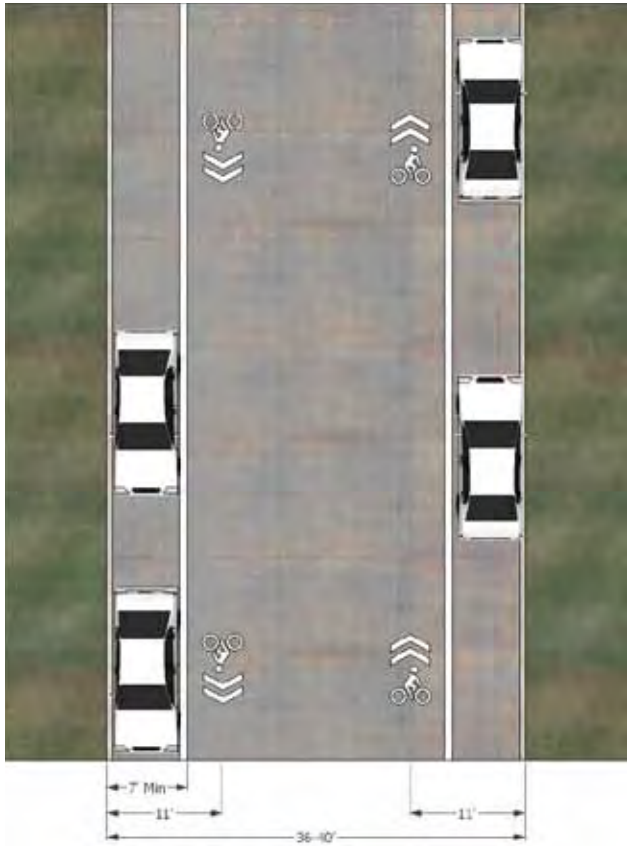
Design Contexts

In Hays, shared streets will typically range from 25 to 40 feet wide, with parallel parking on both sides.



TYPE 1

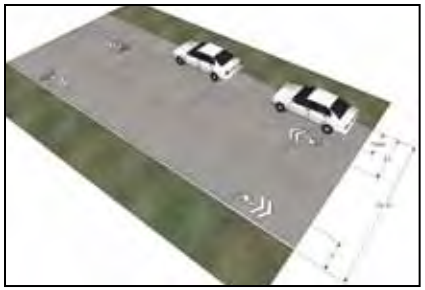
Local or neighborhood collector shared street in older parts of Hays south of 22nd Street. Street channels typically range from 24 to 30 feet. Sharrows (a standard marking using a bicycle symbol and chevron) are painted a minimum of 11 feet on center from the face of the curb. This keeps cyclists safely away from the door swing of parked cars.



TYPE 2

Local or neighborhood collector shared street in parts of Hays with wider streets. In these areas, pavement markings in Hays' wide streets can both improve bicycle visibility and slow traffic to appropriate speeds by seeming to narrow the street. THis is done by painting a line to define the parking lane, typically 7 to 8 feet from the face of the curb, and using a sharrow painted at 11 feet minimum from the face of the curb.

Table 7: ***Design Guidelines for Shared Route Markings***



Design Condition	Pavement Marking and Signage	Typical Street Type	Comments
Two-sided parking, 25-31 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of the curb.	Continuous local, continuous neighborhood collector, neighborhood parkway without median	
One-sided parking, 25-29 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of curb on the parking side, minimum of 3 feet from face of curb on the no parking side	Continuous local, continuous neighborhood collector, neighborhood parkway	
One-sided parking, 29-32 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of curb on the parking side, minimum of 3 feet from face of curb on the no parking side. Painted white line to define parking lane, with outside edge 8 feet from face of curb	Neighborhood collector, neighborhood parkway, neighborhood avenue	White line should be used when the remainder of the street channel is at least 21 feet wide. Parking line helps define parking area and aids in bicyclists positioning themselves safely away from parked cars. In addition, when curbside parking is lightly utilized, the parking lane can serve as an informal bike lane for some cyclists.
Two-sided parking, 36-40 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of curb on the parking side, minimum of 3 feet from face of curb on the no parking side. Painted white line to define parking lanes, with outside edge 8 feet from face of curb.	Neighborhood avenue	White line should be used when the remainder of the street channel is at least 21 feet wide. Parking line helps define parking area and aids in bicyclists positioning themselves safely away from parked cars. In addition, when curbside parking is lightly utilized, the parking lane can serve as an informal bike lane for some cyclists.

Bike Lanes

Bike lanes provide reserved (but not always exclusive) space for bicyclists operating within the street channel. Because they delineate a specific area for bicyclists, bike lanes provide an on-street environment both safer and more comfortable for cyclists on higher volume and/or higher speed roads than shared streets.

In Hays, bike lanes are proposed in four situations:

- *Retrofits of existing streets.* These streets are wide enough to accommodate bike lanes without affecting the existing number of lanes. Broadway from 27th to 33rd is an example of such a street. In some cases, width and parking conditions require a hybrid solution: a bike lane in one direction, with a shared lane on the opposite side. The bike lane should be placed in the direction where bicyclists are most likely to delay motor vehicles. Main Street is an example.

- *"Lane diets."* These are typically older four lane streets that can serve their traffic volumes more safely if converted to three lanes with a left-turn lane. This then provides enough space for bike lanes on strategic corridors. Examples are 13th Street and Hall Street north of 27th Street.

- *Parkways.* These streets are usually dual streets with a drainageway in the median. Examples include Canal Boulevard or General Custer Road.

- *New streets or street widenings.* These major investments are proposed by the comprehensive plan to meet future traffic demands or create new corridors. These would be developed as multi-modal or "complete streets," designed to accommodate all modes of travel. Examples are continuations of Canterbury Drive across and north of I-70 or 41st Street east to a Canterbury extension.

Application to Street Contexts in Hays

Characteristics of streets in the Hays system that adapt to bike lanes include:

- *Higher traffic volumes.* Bike lanes become more necessary as volumes increase, applying to streets with average daily traffic above 2,000-4,000 vehicles per day. These higher volumes require greater degrees of separation to maintain comfort for a maximum number of cyclists.

- *Medium speeds.* Speed differentials are generally more important than traffic volume in determining the application of bike lanes. However, lanes are most appropriately utilized on streets with typical speeds between 30 and 45 miles per hour. Above 45 mph, margins for error and, consequently, user comfort and safety decline.

- *On-street parking.* Some candidate streets for bike lanes also provide on-street parking. Adequate space must be provided to avoid hazards from opening car doors. Bike lanes should be avoided behind head-in diagonal parking stalls unless separated by a buffer of at least five feet.

These conditions are typically found in the following Hays street types:

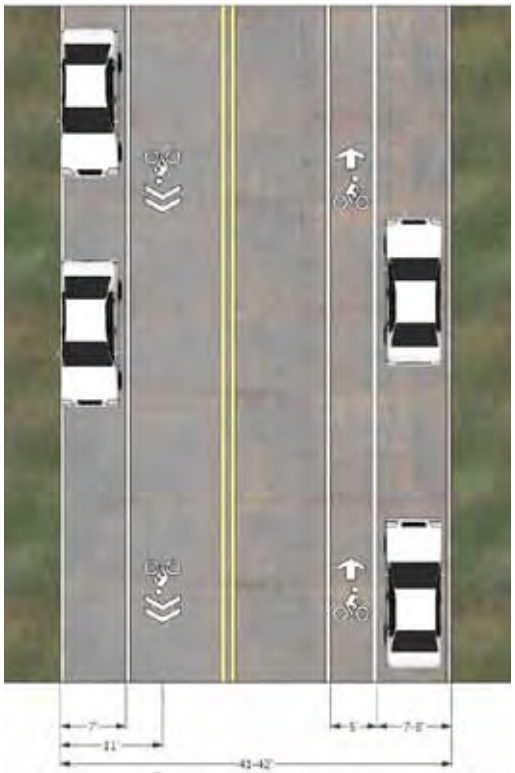
- Civic avenues (Main Street)
- Collectors
- Local arterial
- Major arterial

Overall Design Guidelines

In the Hays system, streets with bike lanes may vary in width from about 40-42 (for one side bike lanes) to 60 feet. General design principles include the following:

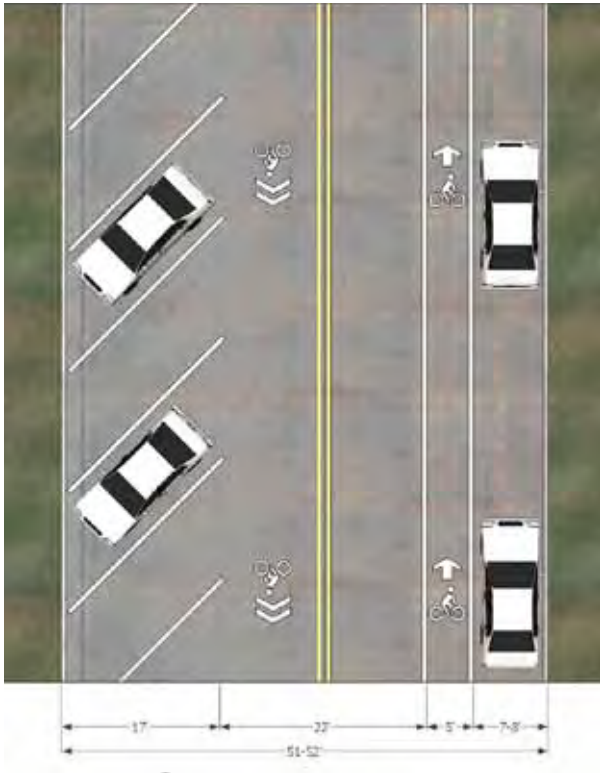
- Bike lanes must always operate in a single direction, flowing with traffic.

- Bike lanes will typically be provided on both sides of two-way streets. In situations where bike lanes are needed but right-of-way only accommodates a single directional lane, a sharrow should be used in the opposite direction. The bike lane should be provided in the direction most likely to slow or create conflicts with other traffic, such as an uphill grade.



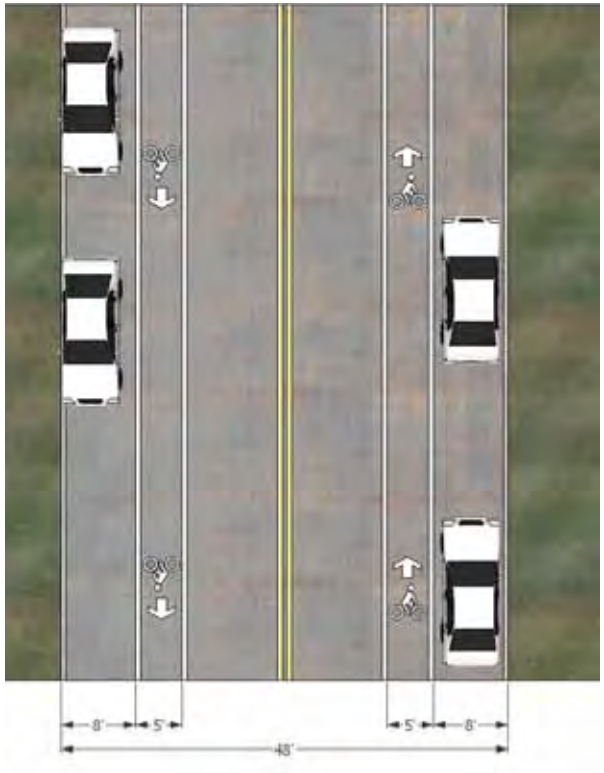
TYPE 3

Single direction bike lane with parallel parking and opposing shared lane. Street channels require a minimum of 42 feet from face of curbs with two-sided parking. Minimum width drops to about 35 feet with single-sided parking. The bike lane should be placed on the side of the street where cyclists in a shared lane would be most likely to delay traffic (such as an uphill or rising grade).



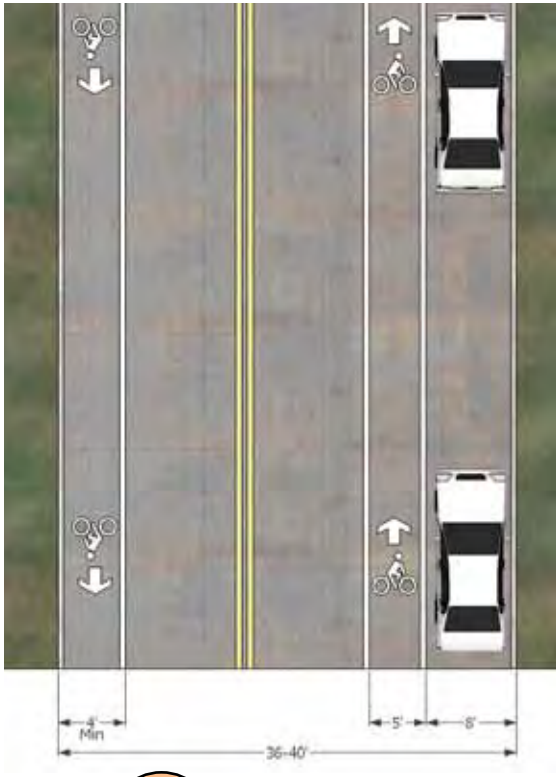
TYPE 4

Single direction bike lane with opposing shared lane and diagonal parking. This is a variation of Type 3, with diagonal parking on one side, a condition found on parts of Main Street and 10th Street. Street channel requires a minimum of about 52 feet from face of curbs. The bike lane should be placed on the side of the street with parallel parking if conventional head-in diagonal parking is used.



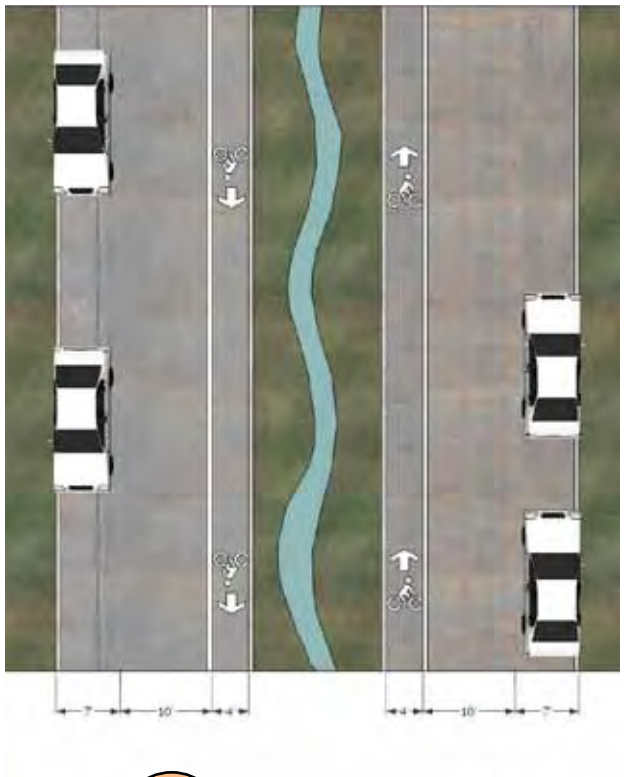
TYPE 5

Two direction bike lanes with two-sided parallel parking. Desirable minimum curb to curb width is 48 feet, although this can be reduced to 46 feet by narrowing the parking lane.



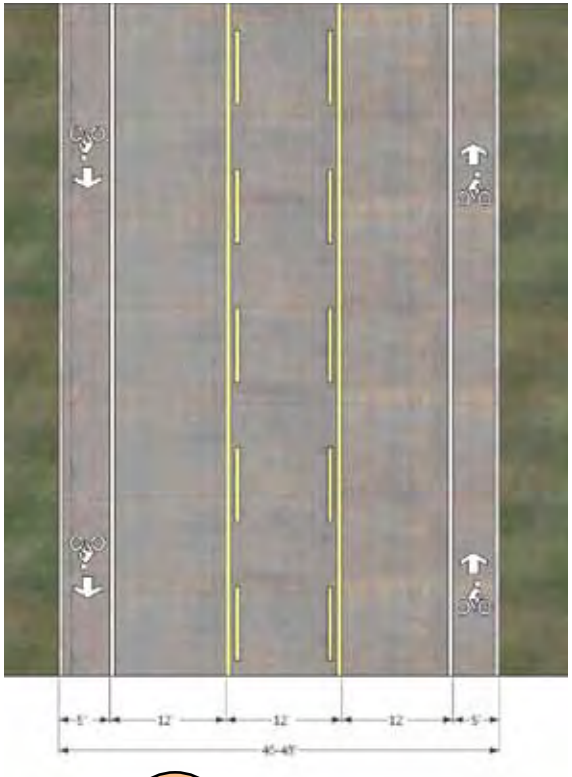
TYPE 6

Two direction bike lanes with one-sided parallel parking. Desirable minimum curb to curb width is 40 feet, although this can be reduced to 38 feet by narrowing the parking lane and bike lane on the side of the street without parking.



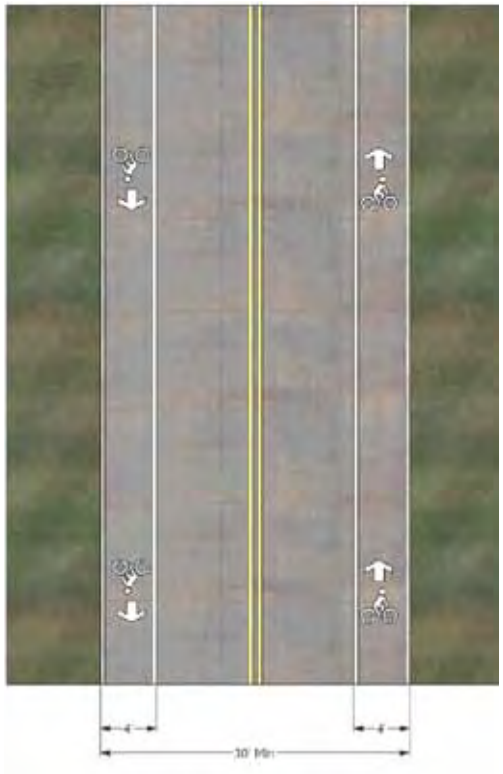
TYPE 7

Parkway with dual single-lane street channels and one-sided parking. Drainageways are located in median, with bike lane on the left side of the one-way roadway and adjacent to the median. Minimum width of roadway is 22 feet on each side. Because of low traffic, moving cars can encroach slightly on the bike lane. Left side location eliminates door zone hazards,



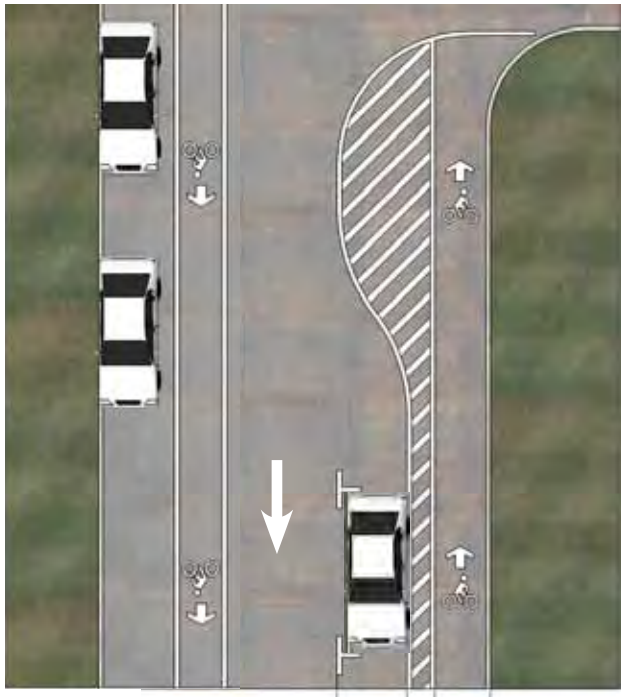
TYPE 8

Four to three lane arterial road diet. Required minimum width is 46 feet. Arterials do not permit parking.



TYPE 9

Two direction bike lanes with no parking. Minimum curb to curb width is 32-34 feet. This situation does not occur on the proposed Hays system, but could be used for new roads or on rural sections.



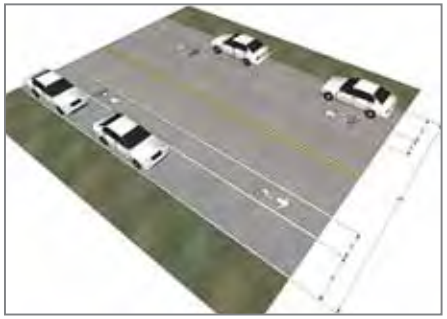
TYPE 10

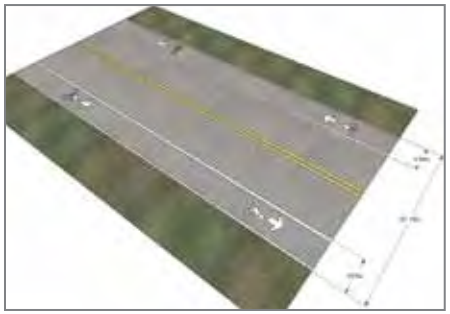
Two direction bike lanes with counterflow buffered cycle track. This design is unique to Fort Street between 22nd and 27th Streets, with a single southbound traffic lane and parking on both sides of the street. The concept features a buffered counterflow bike lane along the east curb, with parking in the direction of travel permitted between the buffer and the southbound travel lane.

Canal Boulevard. Hays' drainageway parkways are especially adaptable to innovative bikeway development.

Buffered cycle track. This two-way cycle track in Brooklyn is somewhat more complicated to use than the one-way counterflow lane proposed in Fort Street, but illustrates the concept.

Table 8: ***Design Guidelines for Shared Bike Lane Markings***





Design Condition	Bike Lane, Parking Lane, and Total Street Width	Typical Street Type	Comments
Two-Way Traffic , two-sided parking	Standard of 8 foot parking lanes with 5 foot bike lanes. In constrained settings, a 12 foot combined parking/bike lane may be considered. Total minimum street width (face to face of curb: 46-48 feet for two-lane plus 11 feet for each additional travel lane.	Civic avenues, local arterial	Supporting information should advise cyclists to ride in the left-hand part of the bike lane. Four foot bike lanes are acceptable in constrained situations with a minimum 8 foot parking lane.
Two-Way Traffic, one-sided parking	Standard of 8 foot parking lanes with 5 foot bike lane on parking side. In constrained settings, a 12 foot combined parking/bike lane may be considered. Four foot bike lane is minimum on the non-parking side, excluding gutter pans. Total minimum street width (face to face of curb: 39 feet for two-lane plus 11 feet for each additional travel lane.	Local arterial	Supporting information should advise cyclists to ride in the left-hand part of the bike lane. Four foot bike lanes are acceptable in constrained situations with a minimum 8 foot parking lane or on side of the street without parking.
Two-Way Traffic, no parking	Four-foot minimum bike lanes, excluding gutter pan. On major streets with higher volume and speed, bike lane width should increase to 5- to 7-feet, depending on street character and speed limits. Total minimum street width (face to face of curb: 30-32 feet for two-lane plus 11 feet for each additional travel lane.	Local arterial	

General Notes:
1. Typical recommended placement of standard bike lane pavement markings is at the entrance and departure from each intersection.
2. Standard bike lane sign (R3-17) may be placed with an AHEAD plaque at the approach to the lane and with an END plaque at the terminus of the lane. Pavement markings should be used more frequently than signs and marking locations should be coincident where possible.

Intersection Design

Intersection design is important to the safe operation of on-street facilities. Consistent practices should address conflicts between turning traffic and bicyclists proceeding straight ahead. In urban bicycling situations, bicyclists are advised to position themselves in the right-hand third of the lane that serves their destination. While this maximizes safety, many cyclists tend to move to the extreme right of an intersection, placing them in a position to be hit by turning motor vehicles.

Intersection solutions for on-street bicycle facilities include:

- Typical pavement markings.
- Right-Turn Pockets
- Bike Boxes for Left Turns

Typical Intersection Markings

Figures on the opposite page illustrate typical pavement markings in various situations including intersections. Problems have emerged with bike lane installations that maintain solid lines up to the intersection. This encourages some cyclists to consider the bike lane to be inviolate, and opens them to the possibility of being hit by right-turning traffic. In response, current practice is to replace the solid white line with a dashed line, suggesting that the lane alignment should not be rigidly followed. This also encourages cyclists to behave like other traffic by leaving the right-hand bike lane to make left turns.

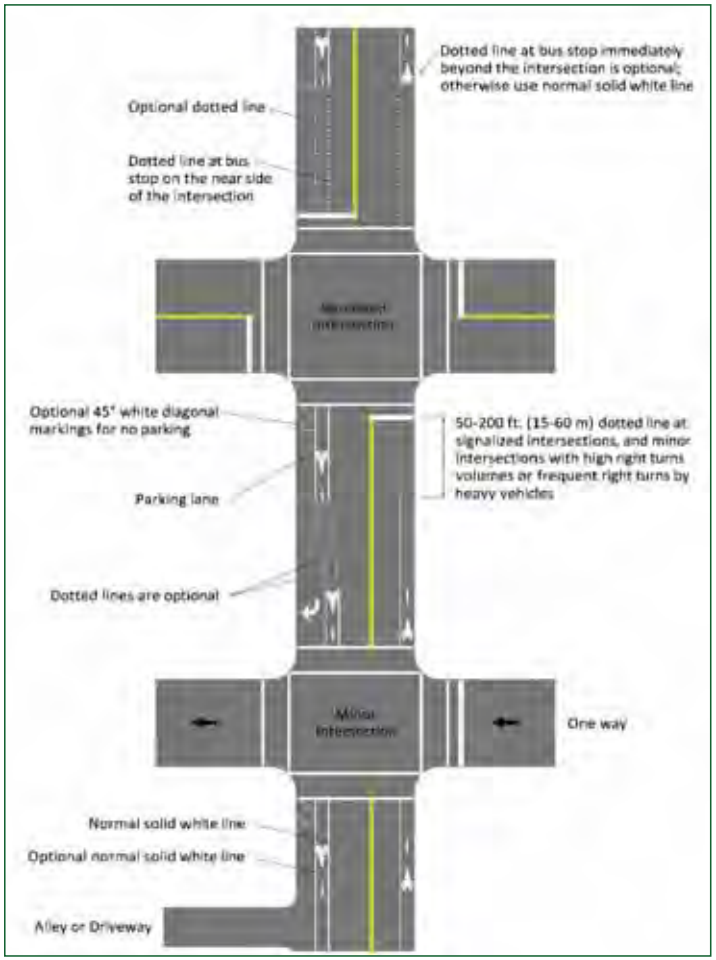
Right-Turn Pockets

Some major intersections include right-turn only lanes to allow right turns on red signals or otherwise separate right turning movements from the direct flow of traffic. This creates a potential issue for bicyclists who are used to positioning themselves "as far to the right as practicable" in the language of many state laws, again exposing themselves to collision with right-turning motor vehicles. Recommended pavement markings position the bicyclists continuing straight ahead to the left of the RTO lane, providing a dashed stripe through the conflict zone. The solid stripe resumes on the other side of this conflict zone. Many cities are coloring the surface of this zone to increase motorist awareness of a potential collision hazard, A standard sign, advising motorists to yield to bikes on a direct route (R4-4) should also be installed.

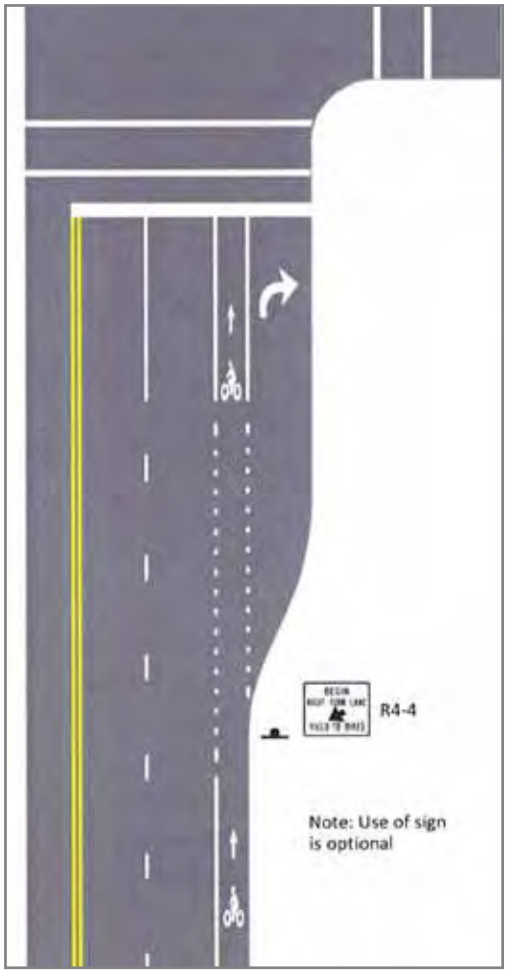
Bicycle Boxes for Left Turns

Bicycle boxes are used at signalized intersections to extend a bike lane to the front of a traffic queue. The box sets the stop bar for motor vehicles behind the stopped bicycles. They provide clear visibility for bicyclists, minimize the problem of cyclists hugging the right-hand curb, and expedite left-turning bicycle movements. The boxes are defined by stripes and may be colored for greater visibility. Recommended depth of the box is 14 feet from the edge of the crosswalk.

Recommended Lane Markings at Typical Intersections



Source: AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities, February, 2010 Draft



Bicycle box on Commonwealth Avenue in Boston. Bike lanes here are on the left side of the street channel, adjacent to the median.

Sidepaths

Sidepaths are paths separated from the stream of traffic but within the right-of-way of a street or road. They are popular among roadway designers, but are controversial among bike facility designers and urban bicyclists. They present significant challenges at intersections but allow cyclists to operate comfortably on direct major routes. Hays is developing a sidepath as part of its 41st Street project and the current widened sidewalk on North Vine under I-70 demonstrates both the uses and problems with this kind of facility.

Objections to the use of cycle tracks or sidepaths (these terms will be used interchangeably here) in this country are based on conflicts with dominant motor vehicle traffic and include:

- Hazardous intersections. On two-way paths, motorists do not expect, and often do not see, bicyclists in the counterflow direction. Right-turning motorists in many cases ignore path users moving straight ahead, creating the possibility of a crash. This always places path users on the defensive.
- Right-of-way ambiguities at driveways and intersections. Usually, cyclists on a sidepath along a major street are forced to yield to intersecting traffic. Cyclists traveling on streets, on the other hand, have the same right of way rights as motorists.
- Path blockages. Cross traffic on driveways and intersecting streets frequently blocks the sidepath by stopping across it.

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. Sidepath images were also rated highly for level of comfort by participants in the Hays Bikeways Survey. Many cyclists justifiably fear rear-end (or overtaking)crashes or distracted drivers wandering into even a well-designed bicycle lane. Sidepaths accommodate pedestrians and other wheeled users who cannot use streets. Also, auto-era development replaced the traditional grid of local streets with cul-de-sacs and short curvilinear streets, causing through connections to depend solely on the arterial system. Sidepaths along major streets provide continuity where other alternatives, including trails or parallel local streets, are not available.

These facilities are an important part of the national bicycle system of the Netherlands, one of the world's premier cycling countries, and work because of careful design and motorist respect and acceptance of bicyclists. While research on American sidepath safety is scarce, a recent Harvard University study based on the Montreal system compared crash rates on sidepaths to on-street facilities. It suggested that sidepaths had higher crash rates at intersections and lower rates along their main line, producing about the same overall crash rates as on-street facilities. Since crashes at speed in mid-block areas have a higher probability of fatality than lower speed crashes at intersections, the study indicated that these facilities should not be excluded from urban bicycle systems in this country.

Application to the Hays System

- Conventional multi-use sidepaths, typically wide paths parallel to arterial streets, should in most cases complement rather than replace on-road facilities if on-road facilities are feasible. Their primary purpose is to provide continuity where alternatives that meet the six performance requirements do not exist.
- Complete streets should include both on-street facilities and paths for pedestrians and bicyclists who are uncomfortable with riding even in protected, on-street bike lanes. Innovative concepts, like one-way cycle tracks on new or existing streets, can combine the safety benefits of off-road riding between intersections and vehicular cycling through intersections.
- The objective of sidepath design guidelines should be to make these facilities as safe as possible, specifically by addressing their greatest weakness: road and driveway intersections.
- Sidepaths are safest when driveway and cross-street interruptions are fewest. Therefore, they work best along arterial streets that have long stretches of relatively uninterrupted frontage, like parks, campuses,

and cemeteries.

Design Guidelines for Cycle Tracks/Sidepaths

Pathway Standards

Cycle tracks and sidepaths may be developed as two- or one-way facilities. Most US applications of off-road sidepaths are two-way facilities, adhering to a standard ten-foot width, typical of other multi-use trails. A one-way cycle track combined with a sidewalk should separate territory allocated to bicyclists and pedestrians, and include directional markings for bicyclists. These territories can be defined by paint or changes in pavement color. Minimum width for a one-way cycle track is four feet (five feet recommended) with an adjacent pedestrian path of similar width. Structure and materials for sidepaths should follow standards for multi-use trails on separated right-of-way.

Pathway Setbacks

Research conducted for the Florida Department of Transportation indicates that, to maximize safety, separation of the sidepath from a roadway should increase as road speeds increase. The Florida data suggest that at lower adjacent road speeds, a smaller separation produces crash rates lower than those of the adjacent road, while that threshold is reached at greater separations for high speed facilities. AASHTO 2010 recommends a minimum separation of five feet without a physical barrier. Table 9 displays recommended separations for sidepaths based on the Florida findings.

Access Management

Access management makes sidepaths safer. There is no one clear standard for frequency of access points. Reasonable guidance is provided by the Idaho Department of Transportation, recommending a maximum of eight crossings per mile, with a preferred maximum of five crossings per mile. This access management policy should apply to the primarily arterial streets proposed for these three corridors.

Sidepath Concepts and Adjacent Roadway Character

As mentioned earlier, two-way sidepaths, in common use in American road design as "bike paths," set up an unexpected counterflow direction that creates the possibility of crashes. Florida DOT research indicates that two-way sidepaths appear safer along 2- and 3-lane roadways and less safe along multi-lane roads with 2 or more lanes in each direction. In addition to the higher speeds typical of wider roads, this phenomenon can be explained by:

- The field of vision of motorists opposite the sidepath. On wider roadways, motorists cannot see or are less aware of a sidepath on the opposite side, creating a particular crash hazard between path users and left-turning traffic.

- Motorists exiting intersecting driveways or streets are looking for oncoming traffic at a shallower angle because of the greater street width, directing attention away from the already unexpected sidepath traffic to their right.

Table 9: ***Separation for Sidepaths from Street Channel***

Adjacent Road Speed Limit (mph)	Recommended Sidepath Separation (feet)
35	5-8
45	12-14
55	20-24

Sidepath (cycle track) sections. Sidepath width and construction standards are similar to those for multi-use trails. Top: Two-way sidepath along an arterial, a typical accommodation on contemporary streets. Above: One-way cycle track concept separates pedestrian from bicycle traffic. Bicycles move in the direction of traffic.

Sidepaths and Cycle Tracks. Top: Two-way sidepath typical of US multi-modal projects, US 40 in Lawrence. Middle: Broadway in Boulder, CO, defining pedestrian and bicycle domains along a roadside trail. Lower: One-way cycle track and pedestrian path in Amsterdam.

The previously discussed Harvard study on the Montreal system also suggests that sidepaths are safer than on-street operation between intersections, but more hazardous at street crossings. The one-way cycle track, in combination with bicycle lanes or shoulders on the adjacent road, addresses these issues. Before reaching a major intersection, the cycle track is directed to and merges into the bicycle lane which, at major intersections, is located to the left of a right-turn only (RTO) lane. Inexperienced bicyclists have the option of becoming pedestrians and using the crosswalk. Thus, one-way sidepath concept combines the relative mid-block security of the sidepath to many users with the safer options of behaving like other vehicles or as pedestrians at street intersections.

The one-way sidepath should be considered:

- Along multi-lane corridors with local street accesses.
- When a sidepath is recommended but, for various reasons, access cannot be closely managed.

Design of In-line Crossings at Driveways and Streets

Cycle tracks/sidepaths and multi-use trails share design characteristics at intersections. Guidelines for multi-use trails are presented later in this section. However, roadside facilities have special problems not experienced by the largely grade-separated trail system. Recommendations for the special conditions presented by sidepath crossings are presented here.

Ramp Design

- Curb/intersection cuts or ramps must be logical and in the direct travel line of bicyclists. We suggest avoiding the common practice of placing the ramp on a diagonal at the corner, tending to direct users into the middle of the intersection rather than to a crossing.
- A design that places a curb in the direct travel line of bicyclists is hazardous. The intersection area must be free of obstructions, such as poles for traffic signal mast arms or lighting standards.

Separation Distance

The separation of the trail crossing from the edge of the roadway is a troublesome issue. Some sidepath designs put users in serious jeopardy by placement that either provides poor visibility or inadequate reaction time. Based on specifications in Finland and the Netherlands, where sidepaths are prevalent, the Florida DOT's path intersection design manual proposes three discreet and mutually exclusive separation distance categories:

- 1-2 meters
- 5-10 meters
- more than 30 meters

These distances are based on the interaction of five variables: motor vehicle turning speed, stacking distance, driver and/or pathway user awareness, and chance of pathway right-of-way priority. These categories are designed to prevent awkward conditions that may impair visibility and not give either the trail user or motorist opportunity to respond. Figure 4.11 summarizes the relative performance of each placement for these variables.

Defining Crossings

- All crossings across streets and major driveways should be clearly defined. Street intersection markings should utilize standard zebra or ladder markings incorporated at mid-block crossings and other major intersections. Colored concrete or asphalt surface treatments may also be used. A simpler dashed crosswalk boundary may be used as a convention at driveway crossings.
- At intersections controlled by stop signs or signals, stop

One-Way Sidepath Concept. A system of paired one-way sidepaths can minimize some of the operating hazards of two-way paths in certain settings. The one-way sidepath concept can be used both on streets both without (top) and with bike lanes. Without bike lanes, the cycle track is the street's bicycle facility, but becomes a bike lane as it enters the intersections. If bike lanes are provided along the street, the cycle track merges into the bike lane. Left: Merger from street to one-way cycle track at Vassar Street cycle track on the MIT campus in Cambridge.

Poor Sidepath Intersection Design. Top: Ramps are narrow and located off line from a bicyclists normal path, creating a potential hazard. Above: The base of a signal mast arm obstructs the logical path through the ramp.

bars should be provided for motor vehicles ahead of the crosswalk to discourage motorists from obstructing the path. Surface triangles that indicate a motorist yield may be used in place of stop bars. Unfortunately, many American motorists do not understand this marking.

Signage

Use warning signs along roads with sidepaths similar to advisories for parallel railroad tracks. This provides motorists with a background awareness of the parallel sidepath.

Right-of-Way Assignment

Ideally, pathway users paralleling a street with right-of-way priority should share that priority. However, sidepath users must be advised to ride defensively, and assume that they will often be forced to yield the right-of-way.

Overly frequent stop signs will cause many path users to ignore the traffic control entirely. The Florida manual states that path users may be intolerant to delay, wish to maintain momentum, or have limited traffic knowledge. When stop signs are installed on a path at extremely low volume intersections or even driveways, path users tend to disregard them. The wheeled user cyclist or skater is, in effect, being taught this dangerous behavior by these "crying wolf" signs since he or she thinks there is little chance of cross traffic.

Intersection Geometrics

In addition to crossing visibility and access management techniques, the 2010 AASHTO draft advises the following design measures to address intersection and driveway crossing safety:

- Intersection and driveway design to reduce speed and heighten driver awareness of path users through tighter corner radii, avoidance of high-speed free flow movements, median refuge islands, and good sight lines.
- Design measures to reduce pathway user speed at intersection approaches, being certain that designs do

Table 10: ***Separation for Sidepaths from Street at Intersections***

Parameter	1-2m 0-6.56 feet	5-10m 16.4-32.8 feet	over 30m over 98.4 feet
Motor vehicle turning speed	Lowest	Higher	Highest
Motor vehicle stacking space	None	Yes, better at higher separation	Yes
Driver awareness of path user	Higher	Lower	High or Low
Path user awareness of driver	Higher	Lower	Highest
Chance of pathway ROW priority	Higher	Lower	Lowest

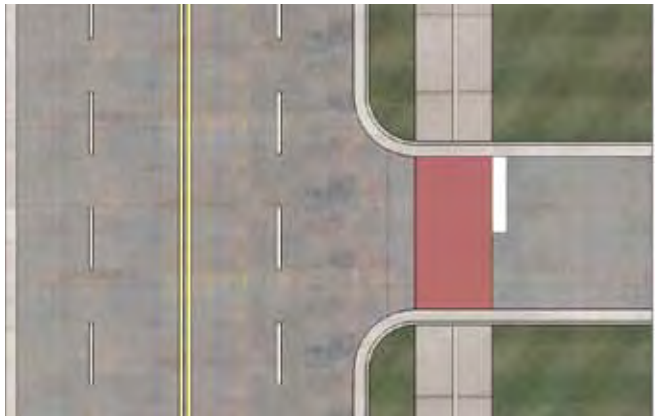
Source: *Intersection Design Manual, Florida Department of Transportation*

not create hazards.

- Calming traffic speeds on the adjacent roadway.
- Designs that encourage good cyclist access between roadway and sidepaths at intersections.
- Keep approaches to sidepaths clear of obstructions, including stopped motor vehicles, through stopbars and yield markings.

Signal Cycles

- Avoid permissive left turns on busy parallel roads and sidepath crossings. Use a protected left-turn cycle with a sidepath-oriented bicycle/pedestrian signal, giving a red signal to the sidepath user when left turns are permitted.
- Prohibit right turns on red at intersections with a major sidepath crossing.



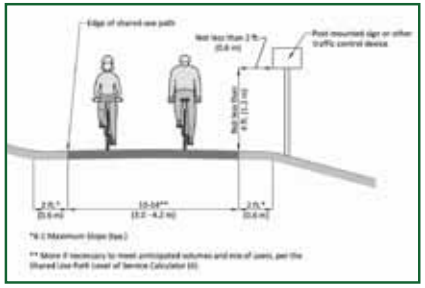
Crossing Definition. Sidepath/cycle track crossings should be defined for maximum visibility. Colored or textured surfaces can be effective in these situations. A clear stop bar should also be used with advisory signage, to discourage motorists from blocking the track.

Sidepath Advisory Sign. Variation of the MUTCD's Railroad Advance Warning Sign, modified as a sidepath advisory. This sign should be used on both sides of a road with sidepaths. This installation is on Speer Boulevard in Denver, advising of the parallel Cherry Creek Trail. Florida DOT advises a similar sign.

Crossing Definition Treatments. From left: StreetPrint, an imprint and coloring applied to heated asphalt paving on the New Berlin Trail near Waukesha, Wisconsin.; Colored concrete on Military Avenue in Green Bay.

Multi-Use Trails

Multi-use trails are not in common use in Hays today but are part of the recommended long-range network. Trail-related projects include improvements to the Big Creek Trail and development of new trails with demonstrable transportation benefits.



The BikeHays system will ultimately use multi-use trails on separated rights-of-way. Anticipated trail projects fit within three categories:

- Improvements to existing trails, most notably the Big Creek Trail. This trail can serve many needs with minor improvements, but should eventually be both extended and paved.
- New trail segments to connect on-street routes . These relatively short, strategic links tie the system together.

Individual trail projects are discussed in detail in the route by route analysis in the following chapter.

Design Guidelines for Multi-Use Trails

ADA/AASHTO Compliance

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."

Materials

Table 11 reviews attributes of various trail surface materials. Asphalt provides an excellent surface when new and is somewhat less expensive than concrete. Concrete provides a more durable, longer-lived surface, particularly in climates with freeze-thaw cycles, and can be replaced panel by panel if necessary. Without prescribing specific regional standards, AASHTO 2010 recommends a six inch minimum depth, including both surface and base courses, over a compacted subgrade. A stable sub-base is especially important to the durability of both materials. This is especially important around drainageways, where stream banks tend to slough off and produce serious cracking and deterioration. Expansion joints on concrete trails should be saw-cut to provide room for movement.

Trail Width and Clearances

- The accepted minimum width for two-way trails is 10 feet. Eight feet may be adequate for secondary segments in areas with severe right-of-way limits. However, eight feet width does not safely accommodate passing of or by users who require greater width than narrow profile road bicycles, including in-line skaters, bicyclists with child trailers, and recumbents.
- A two-foot minimum shoulder (3-5 feet is more desirable) with a maximum 6:1 cross-slope should be provided as a recovery zone adjacent to trails.
- Signs or other traffic control or information devices should be at least two feet from the edge of the trail surface. The bottom edge of any sign should be at least 4 feet from the grade of the trail surface.
- A soft surfaced two-foot extension to a paved trail can improve conditions for walkers and runners because

of its resilience and lower impact.

- Minimum vertical clearance for trails is 8 feet; 10 feet is recommended unless clearance is limited. When conditions, like the height of a culvert or bottom of a bridge structure, further limits clearance, cyclists must be advised to walk bicycles.

Grades and Grade Changes

Recommended maximum grades for multi-use trails are 5% for any distance, 8.3% for distances up to 200 feet, and 10% for distances up to 30 feet (bicycles only).

- Grades over 5% must include landings and handrails compliant with the Americans with Disabilities Act.
- Ramps, bridges, and landings adjacent to abrupt grade changes must include 42-inch handrails, designed to meet AASHTO recommendations. Ramp surfaces should be slip-resistant.
- When underpasses require slopes over 5%, consider an alternate accessible route with reduced grades if possible, even if this route requires a grade crossing.
- Warning signs for trail users should be used on grades approaching 5% and greater.
- AASHTO 2010 recommends avoiding grades less than 0.5% because of ponding problems.

Subsurface and Drainage

- Typically 4 to 8-inch compacted, smooth, and level. Individual conditions may require special design.
- Trail cross-section should provide adequate cross-drainage and minimize debris deposited by runoff. Typically, this involves a cross slope between 1% and 2%.

Table 11: ***Attributes of Trail Surfaces***

Surface	Advantages	Disadvantages
Soil Cement	Natural materials, more durable than soil, low cost, relatively smooth surface	Uneven wear, erodible, difficulty in achieving correct mix.
Granular Stone	Natural material, firm and smooth surface, moderate cost, multiple use	Erodible in storms, needs regular maintenance to maintain surface, discourages on-line skaters and some wheeled users
Asphalt	Hard surface, smooth with low resistance, stable, low maintenance when properly installed, multiple use	Relatively high installation cost, requires periodic resurfacing, freeze/thaw vulnerability, petroleum based material, construction access and impact
Concrete	Hardest surface, easy to form, lowest maintenance, best cold weather surface, freeze-thaw resistance	Highest installation and repair cost, construction access and impact
Native Soil	Natural material, very low cost, low maintenance, easy for volunteers to build and maintain	Dusty, ruts, limited use, unsightly if not maintained, not accessible
Wood Chips	Natural material, good walking surface, moderate cost	Decomposes when wet, requires regular maintenance and replenishment, not accessible
Recycled Materials	Good use of materials, surface can be adequate	High cost, uncertain performance

- When trails are adjacent to or cut into a bank, design should catch drainage on the uphill side of the trail to prevent slope erosion and deposits of mud or dirt across the trail.

Intersection Design

- Design speed of 20 mph, with horizontal and vertical geometrics and stopping sight distances consistent with AASHTO 2010 standards, as published.
- In most cases, trail traffic will be subordinate to motor vehicles on intersecting roads. Figure 4.15 illustrates crossing treatments at mid-block intersections.
- Align or widen trail at railroad intersections to permit

perpendicular crossing of tracks.

Crosswalk Delineation

- The crossing surface should clearly delineate the trail right-of-way.
- Trail crossings should be delineated with standard pavement markings, such as the "ladder" or "zebra" patterns. Another option is providing a contrasting surface that clearly defines the trail domain. These may include the use of stamped concrete, colored concrete, or pavement marking or patterning products such as StreetPrint or others.
- At midblock crossings of multi-lane roads, refuge medians should be used to reduce the distance that trail users must negotiate at one time.

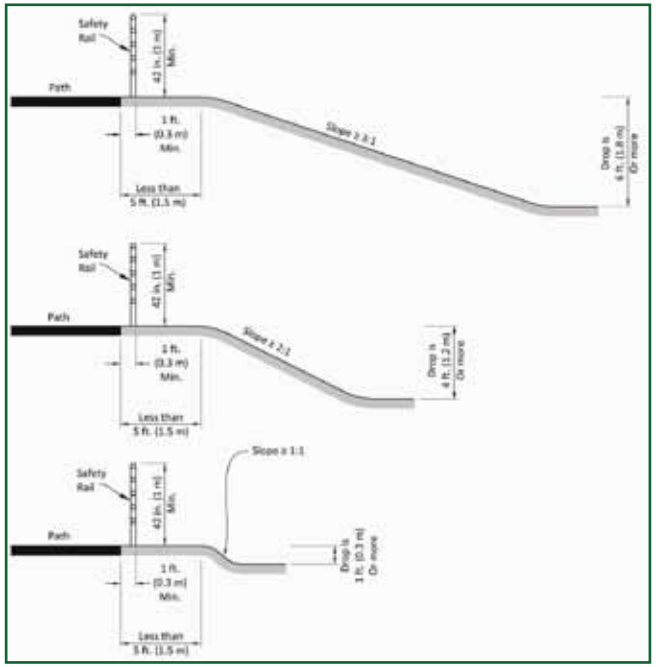
<u>Curb Cuts and Trail Access Points</u>

- Avoid the use of bollards or obstacles at grade-level intersections unless operations prove they are needed. If necessary, use entrances with a median separating directional movements in place of bollards. Medians should be placed about 25 feet in from the edge of the roadway to permit space for cyclists to clear the intersection before slowing.
- When bollards or gateway barriers are used, provide a minimum opening of five feet, adequate to permit adequate clearance for all bicycles. Avoid poorly marked cross barriers that can create hazards for entering bicyclists, particularly in conditions of darkness.
- At midblock crossings of multi-lane roads, refuge medians should be used to reduce the distance that trail users must negotiate at one time.
- The bottom of the curb cut should match the gutter grade and have a minimal lip or bump at the seam. Truncated domes should be used to alert visually impaired users to the street crossing.
- The bottom width of the curb cut should be full width of the intersecting trail.

Signage

- Provide regulatory and warning signs consistent with the 2009 Edition of the Manual of Uniform Traffic Control Devices (MUTCD).
- Standard trail crossings signs, typically a bicycle in a diamond, should always be used to alert motorists of

Railings and Trail Separations from Adjacent Slopes



Source: *AASHTO 2010*

the trail crossing. See Figure 7.3 for suggested sign placement.

Traffic Control

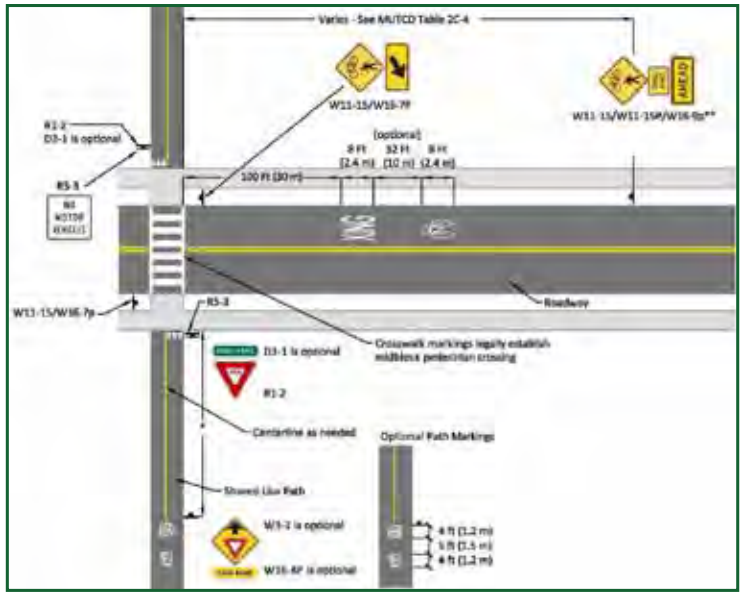
- Right-of-way should be clearly established. Ordinarily, the trail will be stopped with right-of-way preference given defensively to the motorist.
- Controls for pedestrian signals should be easily accessible to trail users and should not require cyclists to dismount or move out of their normal path.
- New crossing technologies such as the hybrid beacon apply well to trail crossings.

Design for Maintenance

- Provide adequate turning radii and trailhead access to maintenance and emergency vehicles.

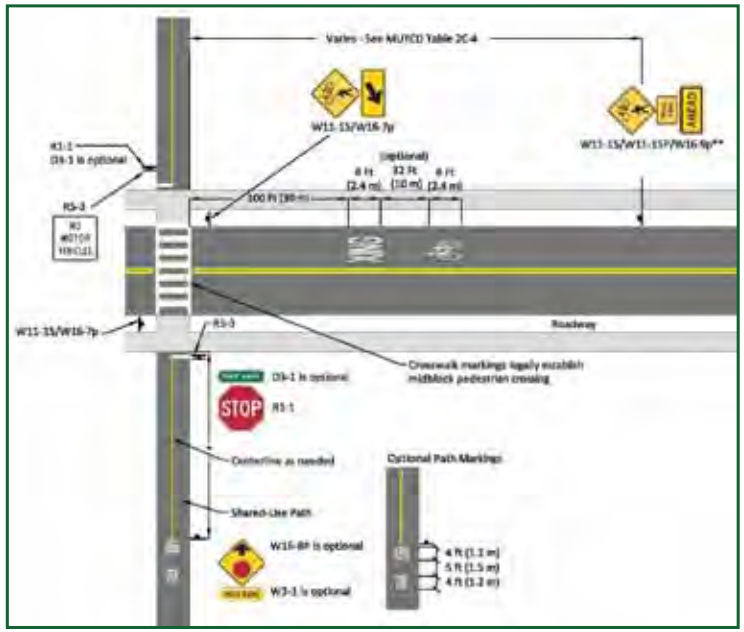
Information and Support Facilities

- Establish a consistent informational sign system that includes a BikeHays logo, an identifying trail name, trail maps at regular intervals, mileage markers for reference and locating emergency situations, directional signage to destinations, and safety rules and advisories.
- Provide periodic minor rest stops, including benches, shaded areas, picnic areas, and informational signing. Ensure reasonable access to water, restrooms, and shelter.



* Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge but not less than 50 feet (15m).

**W11 series sign is required, supplemental plaques are optional

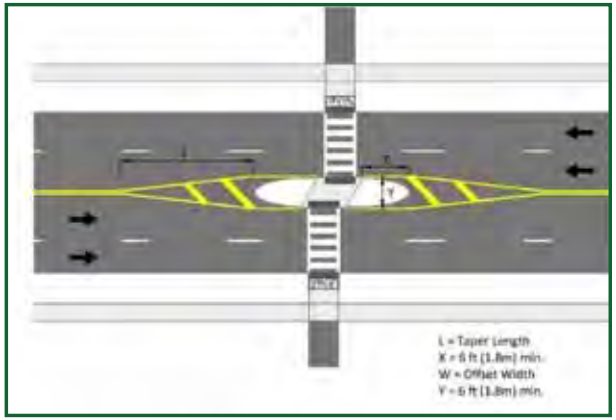


* Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge but not less than 50 feet (15m).

**W11 series sign is required, supplemental plaques are optional

Intersection Conditions for Midblock Trail/Road Intersections: Yield and Stop Controlled
Source: *AASHTO 2010*

Trail Crossing Features



Midblock Refuge Medians. A crossing median provides refuge to trail users at mid-block crossings, reducing the distance that pedestrians and cyclists are exposed to traffic.

Contemporary trail crossing. This crossing of a major arterial near Waukesha, Wisconsin includes a refuge median, defined crosswalk, effective warning signage, and the consultant's bike.

Hybrid Beacon. This signal type, pioneered in Tucson, functions somewhat like school bus warning signals. It is dark when not in use. When actuated by a pedestrian, a flashing and then solid yellow light warns motorists to slow; a solid red light paired with a walk signal stops traffic and gives the right-of-way to the pedestrian. Users report a high degree of motorist compliance and a positive effect on pedestrian safety.

CHAPTER 4 IMPLEMENTATION

This chapter establishes an implementation program based on executing an initial 20 mile bikeway system for Hays. It includes a general description of the initial components and opinions of probable cost.

Priorities and Implementation

The proposed Hays bikeways network will be implemented in phases, and will almost certainly evolve over time. In Chapter Two, this plan presented an initial phase to guide development during the next five years, and later phases that complete an overall bicycle transportation system. The initial phase was based on the following priority criteria:

- **Response to demands.** The initial system should address existing demand patterns, and serve destinations that are valuable to users and appropriate endpoints for bicycle transportation.
- **Route integrity.** High priority routes and projects should provide continuity between valid endpoints such as parks and major activity centers.
- **Extensions of existing facilities.** Projects that make use of and extend the reach of key existing facilities such as the Big Creek Trail, should have a significant priority.
- **Gaps.** Small projects that fill gaps in current facilities or tie relatively remote neighborhoods to the overall system can be especially useful at early stages n the system's development.
- **Opportunities.** The implementation sequence should take advantage of opportunities such as street projects such as the 41st Street project or the resurfacing of 33rd Street programmed for 2012.
- **Relative ease of development.** It is important that the a useful system be established relatively quickly and at comparatively low cost. Routes that require major capital cost or controversy should be deferred to later phases, when precedents are established and the network becomes part of the Hays urban landscape.
- **Ability to serve the entire city.** The initial system should serve all areas of Hays, and work effectively to connect them together.

Funding and Sequencing

In late 2012, the Commission allocated approximately $280,000 toward implementation of the initial phase of the Bike Hays network and an additional $20,000 for signage and marketing. This major step requires a sequencing plan that produces a sound initial project that will both evolve into full implementation of the initial system and a match that can be used toward subsequent grant awards.

The following section considers the cost, physical character, and sequencing of segments that together make up the initial system described in Chapter Two. It includes:

- A locator map for each of these identified components.
- A brief description of the character of these components and the types of facilities that they include.
- A table breaking these components (or routes) into individual segments with lengths, infrastructure types, and opinions of probable cost.

Cost opinions are based on the following estimates, displayed in Table 12. Infrastructure types refer to those presented in Chapter Three.

Within these tables, sequencing and funding is divided into a Phase 1a and Phase 1b. Phase 1a establishes a basic system that can be completed with the available 2013 funding of $280,000. Key criteria of this system include:

- A priority on routes that incorporate bike lanes. Bike lanes provide a facility that will be most comfortable

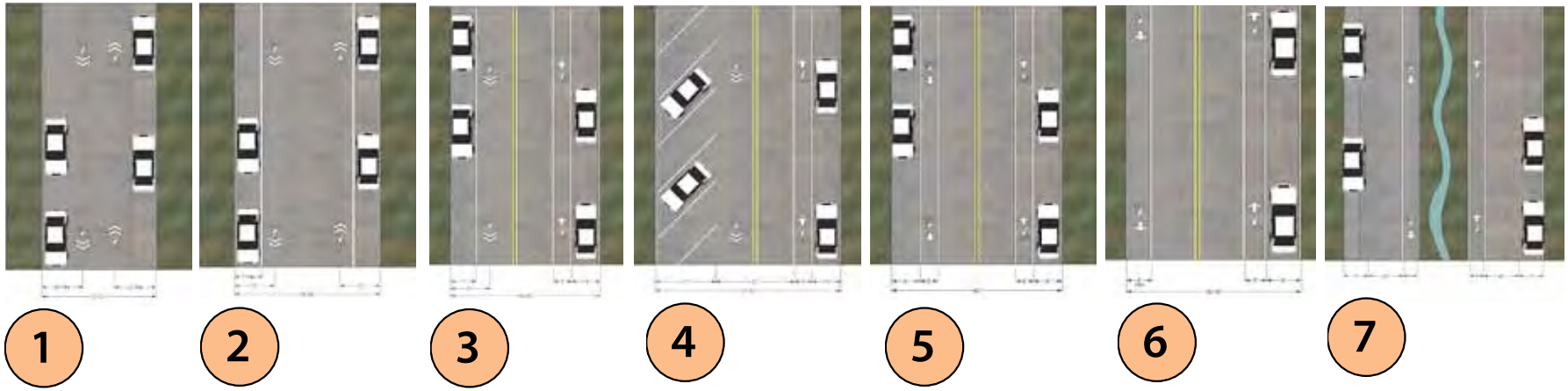
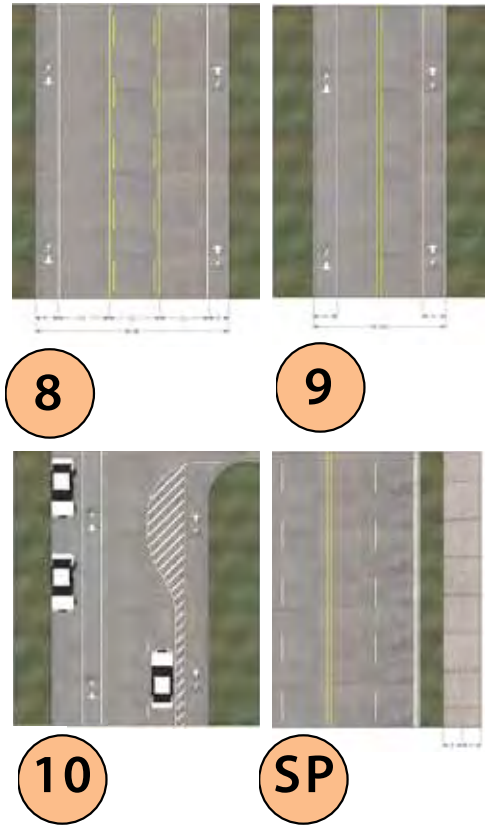


Table 12: *Estimated Cost per Mile by Facility Type*

Facility Type	Description	Cost/Unit
1	Sharrows	$9,000/mile
2	Sharrows with striped parking lane	$12,000/mile
3	Single-direction bike lane with sharrows and striped parking lane	$16,500/mile
4	Single-direction bike lane with sharrows and diagonal parking	$20,000/mile
5	Two-direction bike lanes with two-side parallel parking	$20,000/mile
6	Two-direction bike lanes with one-side parallel parking	$18,000/mile
7	Parkway with dual single-lane street channels and one-sided parking	$15,000/mile
8	Four to three-lane road diet with two-side bike lanes	$60,000/mile
9	Two-side bike lanes or shoulders with no parking	$18,000/mile
10	Two-side bike lanes with buffered cycle track	$22,000/mile
SP	Sidepath: 10 foot concrete	$150,000/mile
MUP	Multi-use Pathway: 10 foot concrete	$250,000/mile

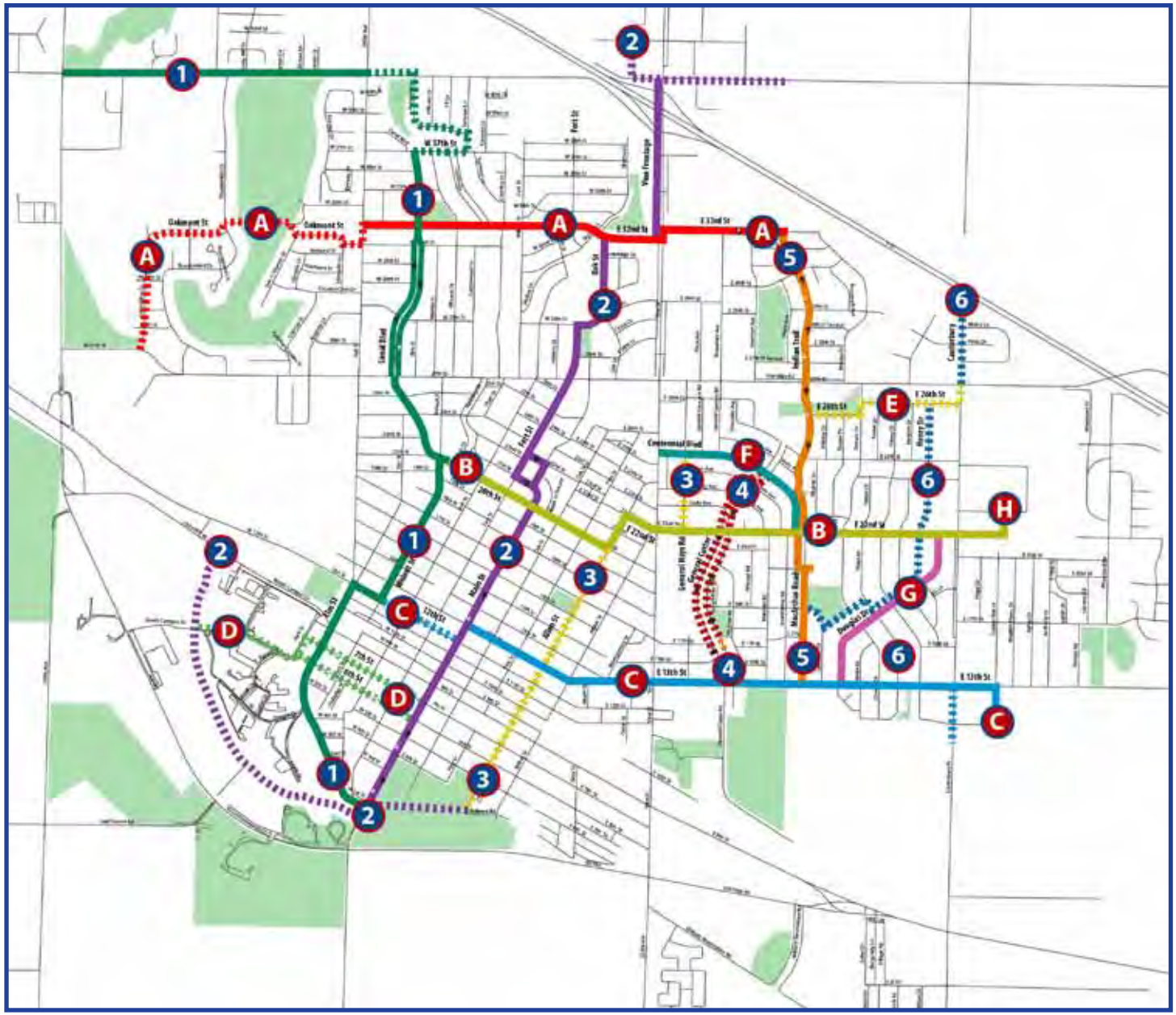


for the greatest number of potential users.

- Routes that together form a system that satisfies the Integrity performance standard, connecting all parts of Hays that avoids discontinuities.

Phase 1b emphasizes shared routes and bike lanes that complete the initial system concept and support the phase 1a network. It also includes upgrading the Big Creek Trail between Main Street and Old Highway 40 on the southwest side of Hays.

The phasing concept assumes that the 41st Street improvement project includes funding of a sidepath between the US 183 Bypass and Hall Street. Therefore, this sidepath project is not included in the Bike Hays funding plan.

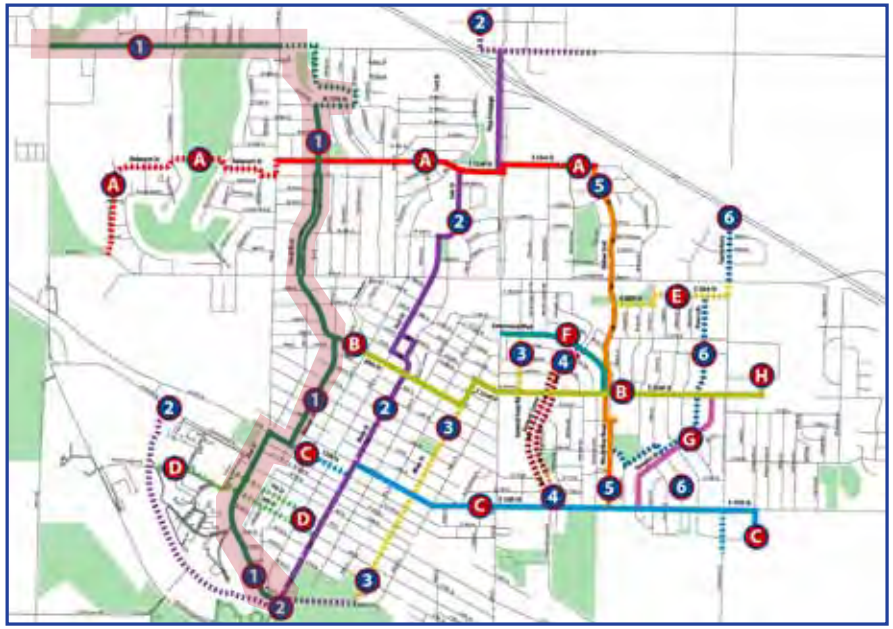


Map 6

Initial BikeHays System: Sequencing

- Phase 1a Segments
- Phase 1b Segments
- 1 North-south designations
- C East-west designations

1 WESTSIDE

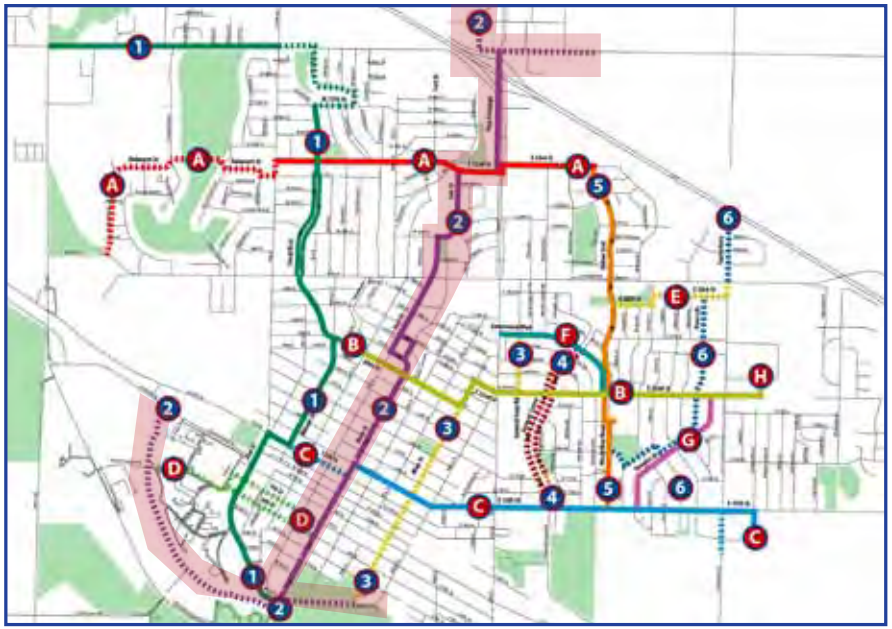


This major north-south route on the west side of Hays incorporates a planned sidepath along 41st Street as part of a street improvement project. The route uses Canal Boulevard and Walnut Street to link the FHSU campus to the 27th and Hall business district and the northwest part of the city. With the exception of the 41st Street sidepath and a future path through Rolling Hills Park, it involves low cost adaptations of existing streets. Related long-term projects may include a lane diet along Hall Street, providing a three-lane facility with a left-turn lane and bike lanes.

Phase 1a segments are highlighted in table.

	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
1	41st Street, US 183 to Hall	1.00	Sidepath	$150,000	NA		Current street project
	41st Street, Hall to Autumn	0.16	Type 1: sharrows	9,000		$1,440	
	Autumn/Summer Dr, 41st to 37th	0.39	Type 2: sharrows/parking lanes	12,000		4,680	
	37th, Summer to Canal	0.17	Type 2: sharrows/parking lanes	12,000		2,040	
	Canal Blvd, 37-33	0.28	Type 2: sharrows/parking lanes	12,000	$3,360		
	Canal Blvd, 33-27	0.56	Type 7: blvd, left side bike lanes	15,000	8,400		Includes both street channels.
	Canal Blvd, 27-20	0.32	Type 2: sharrows/parking lanes	12,000	3,840		
	Walnut, 20-17	0.2	Type 2: sharrows/parking lanes	12,000	2,400		
	Walnut, 17-12	0.32	Type 1: sharrows	9,000	2,880		
	12th, Walnut-Elm	0.1	Type 2: sharrows/parking lanes	12,000	1,200		
	Elm, 12-Main	0.85	Type 1: sharrows	9,000	7,650		
	Total	4.35			$29,730	$8,160	

2 MAIN

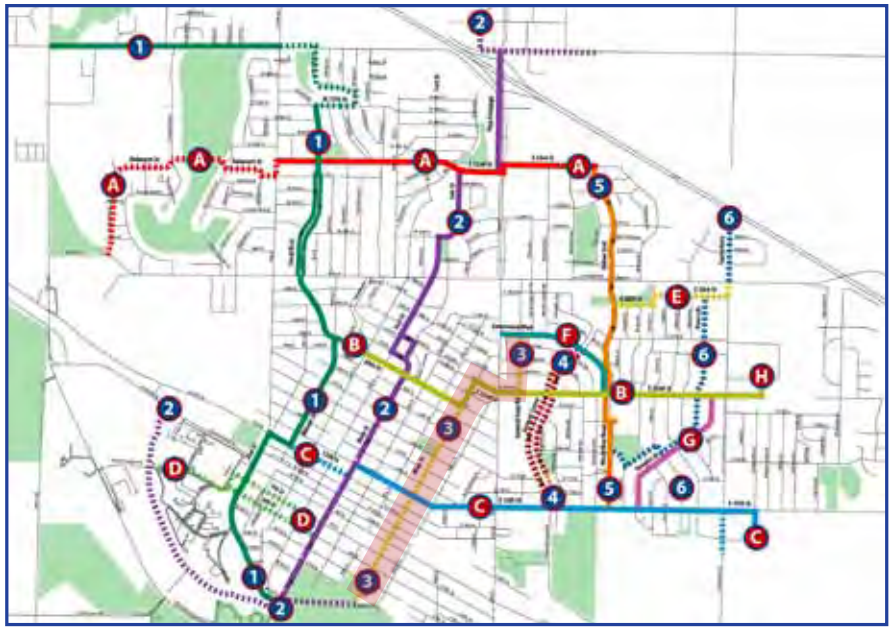


This component connects the north and south parts of central Hays, largely adapting the Main and Fort Street corridors to connect Municipal Park, the Big Creek Trail with Downtown, Wilson Pool, Felton Middle School, and the developing commercial area north of I-70. Bike lanes are used on portions of Main and Fort Streets wide enough to accommodate them. The route crosses 27th Street at the Fort Street intersection and introduces a counterflow northbound bike lane to take advantage of this crossing. The route includes a paving the Big Creek Trail to 8th Street in Phase 1b. It will be further improved with implementation of the North Vine access concept proposed by the comprehensive plan.

Phase 1a segments are highlighted in table.

	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
2	Vine Street, 37-Mopar	0.24	Existing sidepath under I-70		NA		
	Vine Frontage, 37-32	0.28	Type 1: sharrows	$9,000		$2,520	Explore access to Skyline Dr. as an alternative to Vine St frontage
	Oak/28th/Fort, 32-27	0.59	Type 2: sharrows/parking lanes	12,000	$7,080		
	Fort, 27-22	0.28	Type 10: two-side bike lanes, with counterflow buffered cycle track	22,000	6,160		NB counterflow bike lane
	21 and 22, Main to Fort	0.20	Type 1: sharrows	9,000	1,800		Single direction sharrows, with NB route on 22nd, SB on 21st
	Main, 22-16	0.42	Type 1: sharrow	9,000	3,780		
	Main, 16-13	0.2	Type 4: one side bike lane, diagonal parking	20,000	4,000		
	Main, 13-6	0.36	Type 1: sharrow	9,000	3,240		
	Main, 6-Trail	0.33	Type 3: one side bike lane	16,500	5,445		
	Big Creek Trail, Main-8	1.50	Paved multi-use pathway	250,000		375,000	
	Total	4.40			$31,505	$377,520	

3 ALLEN

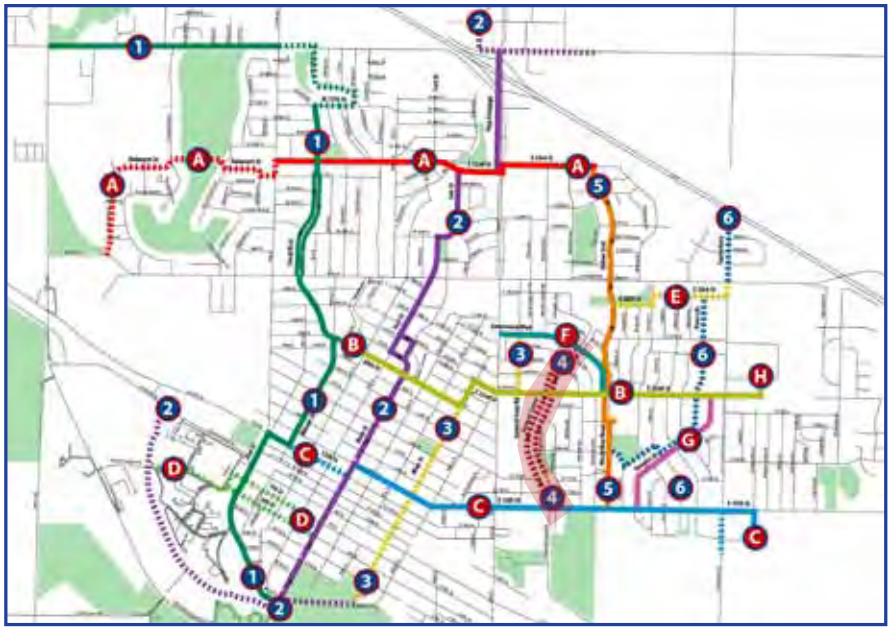


This relatively short connection provides a short route from the east side of Hays to Downtown and Municipal Park via Allen Street. The route crosses Vine Street at the signalized 22nd Street intersection, coinciding with the east-west crosstown Line B. It will eventually link to an improved Big Creek Trail, serving westside community features.

Phase 1a segments are highlighted in table.

	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/ Mile	Phase 1a Cost	Phase 1b Cost	Comments
3	General Hays, Centennial to 22nd	0.25	Type 2: sharrows, parking lanes	$12,000		$3,000	
	Allen, 20 to Ballpark Road	1.14	Type 1: sharrows	9,000		10,260	
	Total	1.39				$13,260	

4 GENERAL CUSTER

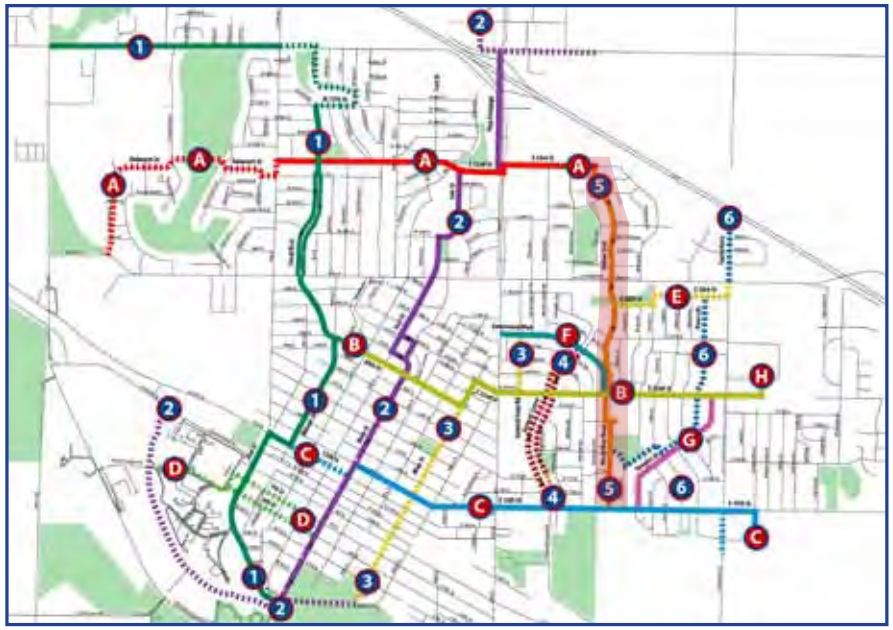


This important eastside connection parallels Vine Street along the General Custer parkway corridor. It serves Hickok and Polly Parks and is part of a system that connects to North Vine and the Mall area. Facilities along this corridor make extensive use of bike lanes. A future connection of 19th Street across Vine would also increase the utility of this route, easily linking the west side to east side parks and attractions, as would a pedestrian bridge across Chetolah Creek between 22nd and 13th Street. These improvements are not included in the phase one projects, however.

Phase 1a segments are highlighted in table.

	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/ Mile	Phase 1a Cost	Phase 1b Cost	Comments
4	General Custer, Centennial-13th	1.58	Type 7: blvd, left side bike lanes	$15,000		$23,700	Includes both street channels. NB is unpaved between 13th and 17th.
	Total	1.58				$23,700	

5 INDIAN TRAIL

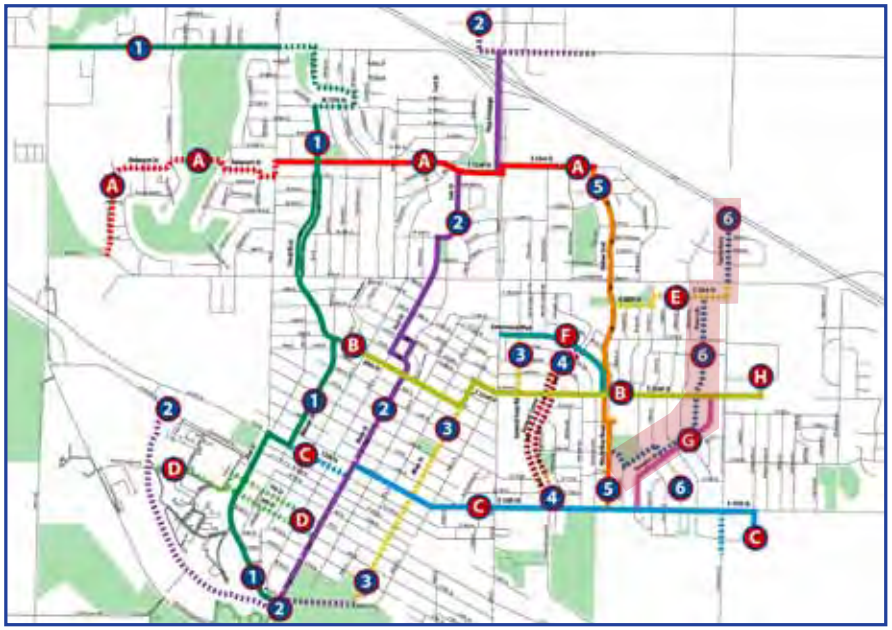


This key route uses Indian Trail as a connection through the center of the east side of town, serving Roosevelt School and Sunrise Park. It continues south along MacArthur to the proposed 13th Street crosstown bikeway (Line C). Indian Trail crosses 27th Street at a four-way stop, helping to connect the north and south sides of Hays safely.

Phase 1a segments are highlighted in table.

	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/ Mile	Phase 1a Cost	Phase 1b Cost	Comments
5	Indian Trail, 33 to Centennial	1.00	Type 3: one side bike lane	$16,500	$16,500	NA	
	Alley, Centennial to 20	0.11	Use alley as is	$-	$-		
	20, Alley to MacArthur	0.05	Type 1: sharrow	9,000	450		
	MacArthur, 20 to 13	0.35	Type 3: one side bike lane	16,500	5,775		
	Total	1.51			$22,725	NA	

6 HENRY DRIVE



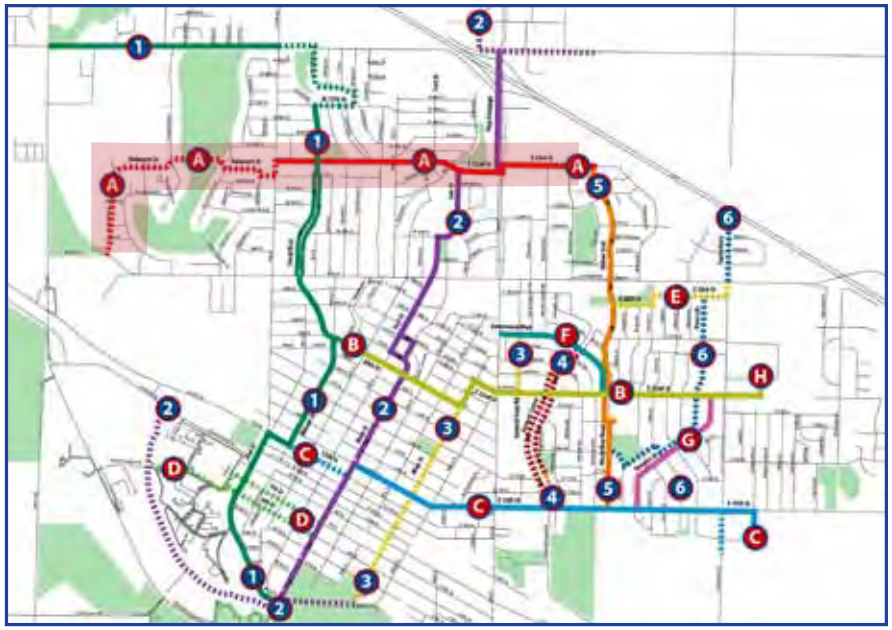
This line provides a north-south connection on the east side of Hays, generally parallel to Canterbury Drive. It begins at the Sternberg Museum and follows Henry Drive, one block west of Canterbury and providing access to mediacl offices and the hospital along that corridor. The line uses the Douglas Drive route (Line G) and other streets to connect to Sunrise park and Felten Middle School.

Phase 1a segments are highlighted in table.

	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/ Mile	Phase 1a Cost	Phase 1b Cost	Comments
6	Canterbury, Museum-27th	0.28	Type 5, 2-side bike lanes	$20,000	NA	$5,600	
	Canterbury, 27-26	0.1	Type 1, sharrows	9,000		900	
	Henry, 26-Douglas	0.60	Type 2, sharrows/parking lanes	12,000		7,200	
	Felten/Lawrence/19th, Douglas TO MacArthur	0.33	Type 2, sharrows/parking lanes	12,000		4,000	
	Total	1.43			NA	$17,700	

A

33RD/ CROSSTOWN

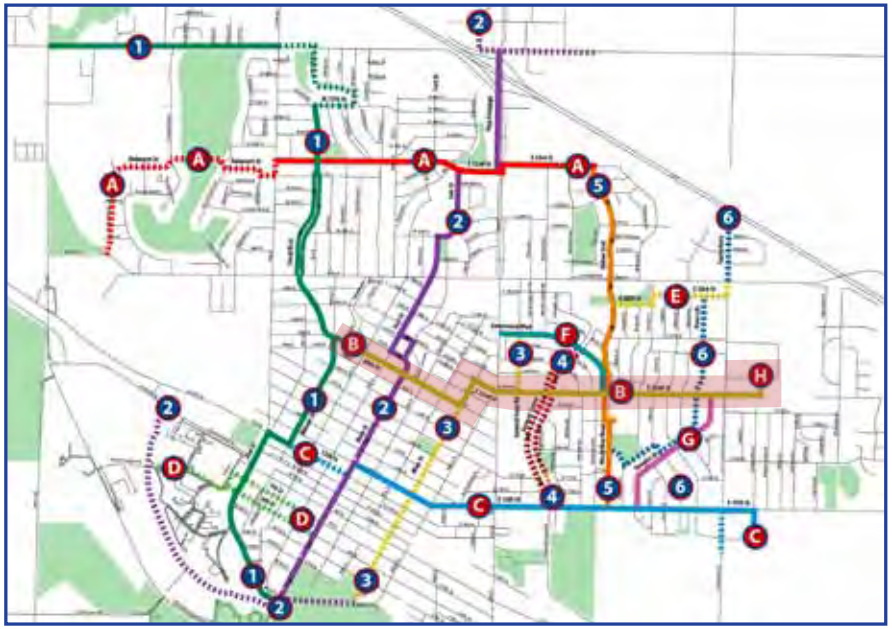


This important east-west line uses 33rd Street across the city, crossing Vine at a major commercial intersection near the Mall. Realignment of this intersection is proposed in the comprehensive plan. At its west end, the route would intersect a completed Big Creek Trail at 27th Street. Bike lanes are scheduled to be installed along parts of 33rd Street as part of a resurfacing project during 2012. The cost of this segment is included in the table below.

Phase 1a segments are highlighted in table.

Route	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
A	Columbine, 27th to Oakmont	0.23	Type 1, sharrows	$9,000		$2,070	
	Oakmont/Greenbrier, Columbine to Hall	0.93	Type 2, sharrows/parking lanes	12,000		11,160	
	33, Hall to Vine	1.00	Type 5a, 2-side bike lanes	20,000	$20,000		
	Vine St Crossing Modifications	1.00		40,000	10,000	30,000	
	33, Vine-Indian Trail	0.40	Type 5a, 2-side bike lanes	20,000	8,000		
	Total	3.56			$38,000	$43,230	

B 22ND CROSSTOWN



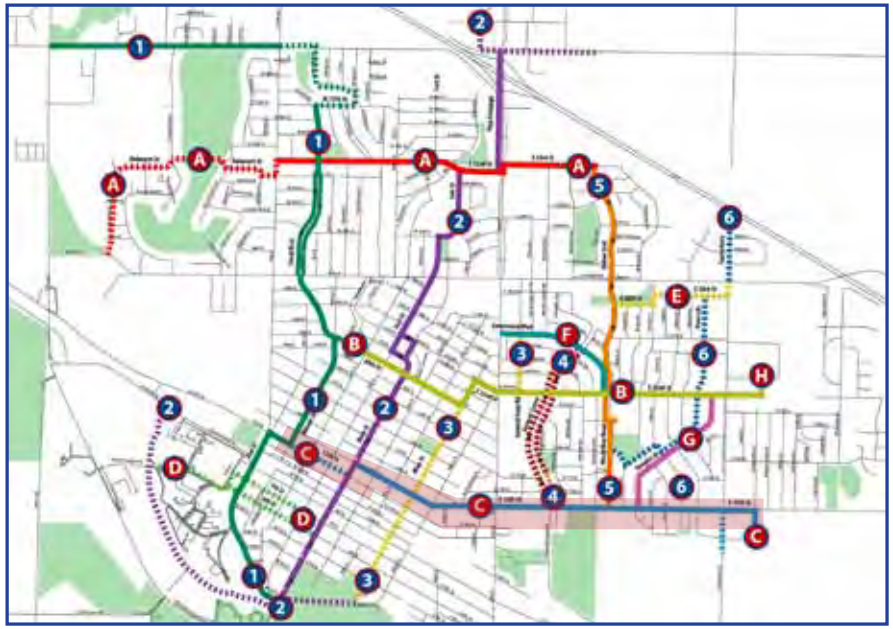
This line provides a major crosstown bike route across central Hays. The route uses 20th Street to link Canal Boulevard and Allen Street, and continues along 22nd Street to connect the medical center with the central part of the city. In this concept, 22nd Street is slightly modified and restriped to include bike lanes. The route connects seven north-south routes and serves a central role in the initial citywide network.

Phase 1a segments are highlighted in table.

Route	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
B	20th, Walnut-Main	0.35	Type 2, sharrows/parking lanes	$12,000	$4,200	NA	
	20th, Main-Allen	0.30	Type 1, sharrows	9,000	2,700		
	Allen, 20-22	0.12	Type 1, sharrows	9,000	1,800		
	22nd, Allen-Vine	0.10	Type 2, sharrows/parking lanes	12,000	1,200		
	22nd, Vine to Douglas	0.97	Type 9, 2-side bike lanes	18,000	17,460	NA	
	22nd, Douglas to Canterbury	0.10	Type 1, sharrow	9,000	$900		
	22nd, Canterbury to Hospital Entrance	0.18	Type 8, 3-lane with bike lanes	30,000	5,400		Restripe to 12' lanes with bike lanes
	Total	2.12			$32,940	NA	

C

13TH/ SOUTHSIDE



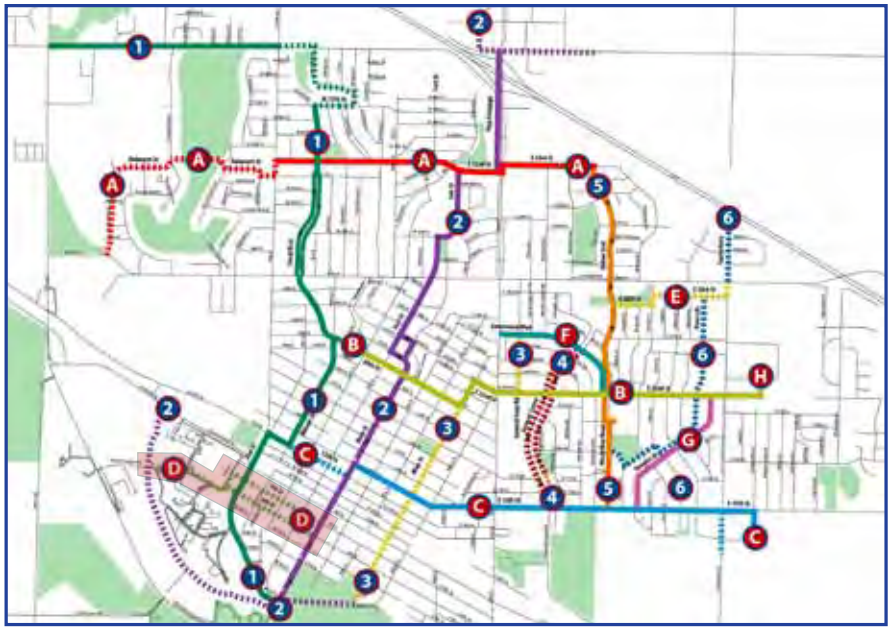
This important east-west line links the south side of Hays using 12th and 13th Streets, and serves the campus area, Downtown, and the high school. A major infrastructure element is a lane reconfiguration of 13th Street, including a reduction from four lanes to a three lane section, including a center left-turn lane. This configuration appears adequate to handle average daily traffic, provides safer left-turn movements, and provides room for bike lanes on this important corridor.

Phase 1a segments are highlighted in table.

Route	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
A	12th, Elm-Main	0.38	Type 2, sharrows/parking lanes	$12,000		$4,560	
	13th, Main-Milner	0.38	Type 5 bike lanes	20,000	$7,600		
	13th, Milner to Golden Belt	1.42	Type 8, 4 to 3-lane road diet with 2-side bike lanes	60,000	85,200		
	Canterbury, 13-Recreation Center	0.20	Sidepath	150,000	30,000	30,000	
	Total	2.18			$92,800	$34,560	

D

6/7TH



This short connector connects the campus residential area to Downtown with a shared route on the 6th and 7th Street one-way pair. Sharrows are used on the one-way streets, with bike traffic traveling in the same direction as motor vehicles.

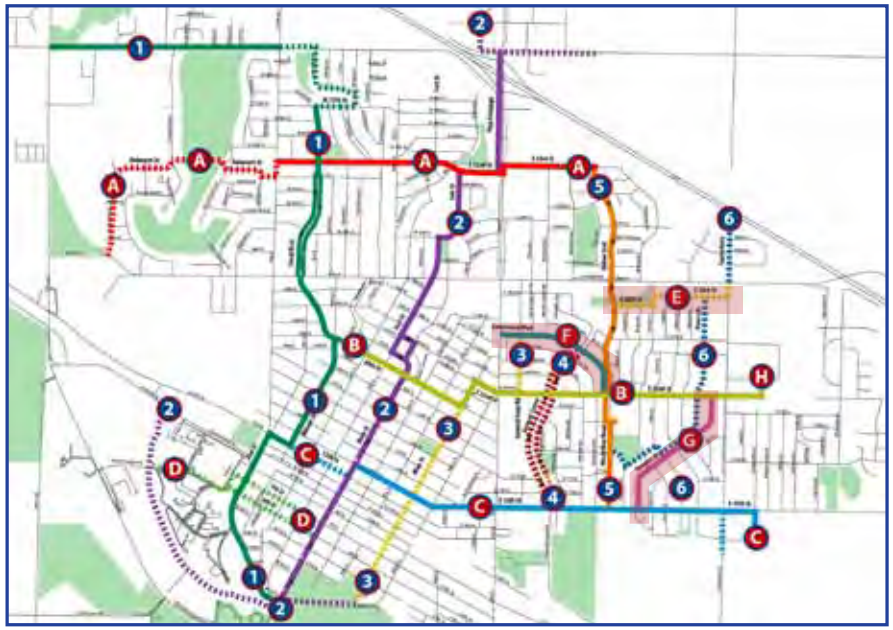
Phase 1a segments are highlighted in table.

Route	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
D	South Campus Drive/Park, US 183 to 7th	0.66	Type 1, sharrow	$9,000	NA	$5,940	
	7th, Park-Main	0.45	Type 1, sharrow	$9,000		$4,050	One-way WB
	6th, Park-Main	0.45	Type 1, sharrow	$9,000		$4,050	One-way EB
		1.56			NA	$14,040	

E

F

G



These three short system components connect major north-south routes and take advantage of wide streets like Douglas Drive to provide bike lanes in strategic locations. They provide access from major parts of the initial network to the hospital, Vine Street commercial, and the 13th Street corridor.

Phase 1a segments are highlighted in table.

Route	Segment	Length (Miles)	Bikeway Facility Treatment	Cost/Mile	Phase 1a Cost	Phase 1b Cost	Comments
E	26th, Indian Trail-Canterbury	0.55	Type 2, sharrows/parking lanes	$12,000		$6,600	
F	Centennial, Vine-22	0.61	Type 5, 2-side bike lanes	$20,000	$12,200		
G	Douglas Dr, 22-13	0.65	Type 5, 2-side bike lanes	$20,000	$13,000		
	Total	1.81			$25,200	$6,600	

Recap of Pilot System by Component

Route	Name	Length (Miles)	Total Cost	Phase 1a Cost	Phase 1b Cost
1	Westside	4.35	37,890	29,730	8,160
2	Main/Big Creek	4.40	414,325	31,505	377,520
3	Allen	1.39	13,260	–	13,260
4	General Custer	1.58	23,700	–	23,700
5	Indian Trail	1.51	22,275	22,725	–
6	Henry Drive	1.31	17,700	–	17,700
A	33rd/Crosstown	3.56	81,230	38,000	43,230
B	22nd/Crosstown	2.12	32,940	32,940	–
C	13th/Southside	2.38	127,360	92,800	34,560
D	6th/7th	1.56	14,040	–	14,040
E	26th	0.55	6,600	–	6,600
F	Centennial	0.61	12,200	12,200	–
G	Douglas	0.65	13,000	13,000	–
Total	**Complete Initial System**	**25.97**	**$811,670**	**$272,900**	**$538,770**

North Vine parkway concept (right). The initial system uses the existing sidepath under I-70 and the Vine Street frontage to extend the Main route (Line 2) to the north side of the Interstate. The parkway/rearage road concept of the comprehensive plan would replace the frontage road with a multi-use pathway. In the interim, Skyline Drive could also provide an alternative to safety issues posed by the frontage road. Use of Skyline would require a path connection west from Vine Street.

Probable Initial System Cost

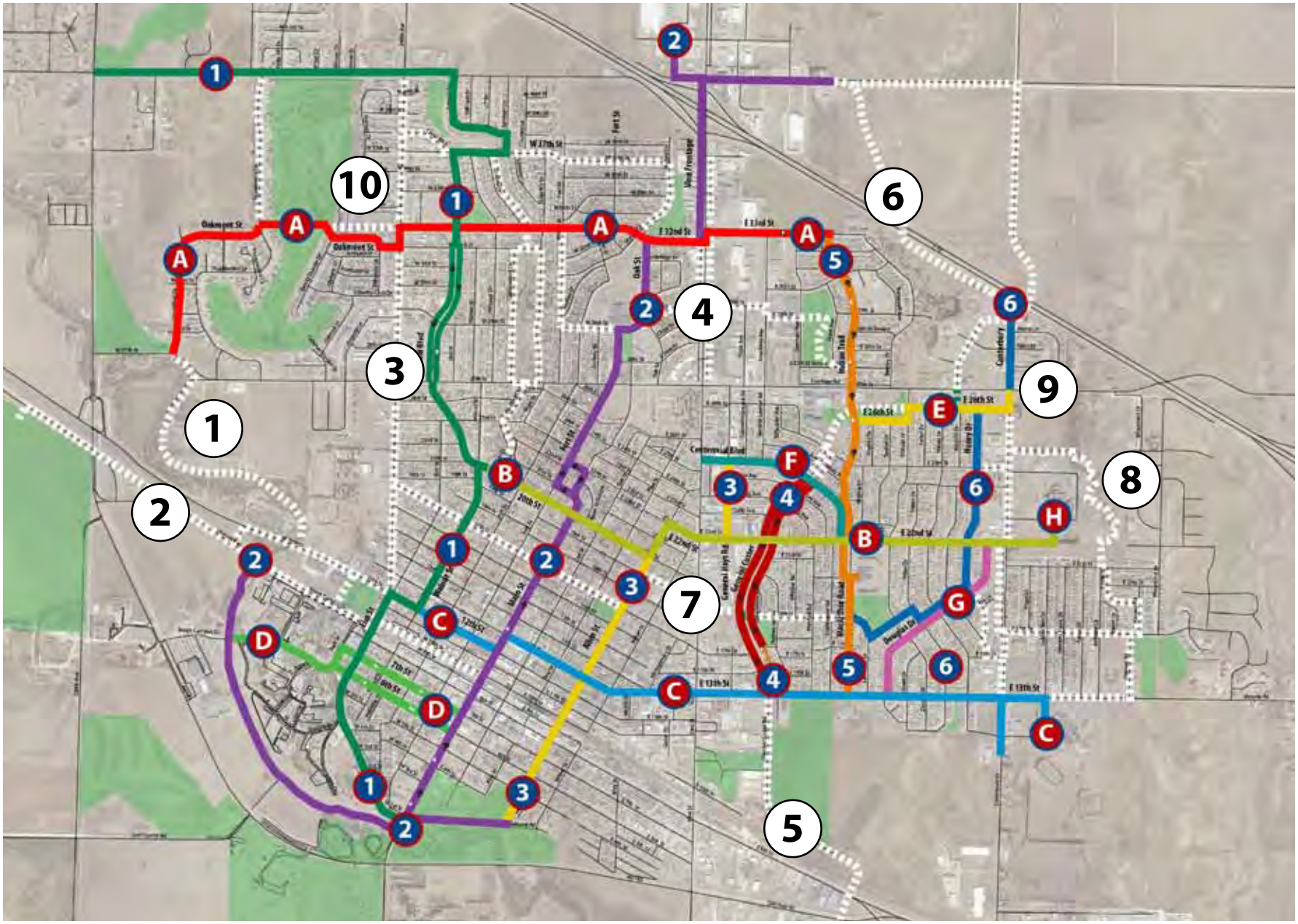
The table at left recaps the costs of the entire, nearly 25 mile initial system. The table includes paving of the existing Big Creek Trail between Main and 8th Street to an 8 to 10 foot width as possible. Street adaptation costs are about $432,000, with initial trail development estimated at an additional $400,000, for a total cost of about $832,000. Implementation of the initial system may occur over a three year period.

The Ultimate BikeHays Network

The ultimate Bike Hays system would be extended largely through additional on-street routes, but also includes a number of substantial future investments. Highlights of the long-range system include the following:

- Paving and extension of the Big Creek Trail between 12th Street and 27th Street. (1)
- A Sports Complex Pathway, connecting the Fort Hays State campus with the Bickle-Schmidt Complex using the north edge of campus and a path along Old US 40. This path would tie into both the 6th and 7th Street route and the bike/pedestrian corridor proposed as part of the campus to downtown development area in the comprehensive plan. (2)
- A four- to three-lane road diet with bike lanes on Hall Street between the 27th and Hall business district and 41st Street. (3)
- The Vine Street parkway between 27th and 41st, proposed in the comprehensive plan. (4)
- A General Custer Trail along Chetolah Creek, from 13th Street under the railroad and US 40 to the Stramel Ball Parks and Reservation Road. (5)
- A Sternberg Trail, from the museum under I-70 to 41st Street. (6)
- Extension of 18th Street across Vine with a new intersection, and a pedestrian/bicycle bridge across Chetolah Creek. (7)
- A Medical Center Trail, upgrading the wellness path through the hospital campus, and integrating it into residential neighborhoods on the eastern edge of town. (8)
- Canterbury Trail, incorporating a path or bicycle lanes along Canterbury Drive that includes the edge of the medical center campus and would extend across I-70 on a future overpass to 41st Street. This route would then continue along 41st Street to North Vine. (9)
- Connection along an easement continuing the alignment of 33rd Street west to Greenbrier. (10)

Future planning should also monitor overall development trends and adapt the BikeHays program into emerging neighborhoods and destinations. For example, paved shoulders on the US 183 Bypass also accommodate bicyclists and may be integrated into westside growth. The Commerce Parkway corridor also may emerge as a desirable destination for bicycle commuters and future development.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CHAPTER 5

SUPPORT SYSTEMS

While previous chapters have focused on the design and character of a BikeHays network, infrastructure by itself does not create an excellent bicycle transportation program. To guide communities, the League of American Bicyclists through its Bicycle Friendly Communities (BFC) program, establishes five components of program design that are used to determine whether a city should be awarded BFC status – the 5 E's of Engineering, Education, Encouragement, Enforcement, and Evaluation. This program applies to communities of all sizes, and many cities the size of Hays have received this status. Indeed, as the home of a notable manufacturer of quality recumbent bicycles, a major university campus, and an active bicycling community, Hays is ideally positioned to be a Bicycle Friendly Community.

According to the LAB, the evaluative elements of the 5E's are:

ENGINEERING evaluating what is on the ground and has been built to promote cycling in the community. Areas of evaluation include:

- Existence and content of a bicycle master plan.
- Accommodation of cyclists on public roads.
- Presence of both well-designed bike lanes and multi-use paths in the community.
- Availability of secure bike parking.
- Condition and connectivity of both the off-road and on-road network.

EDUCATION determining the amount of education available for both cyclists and motorists. Education includes:

- Community programs teaching cyclists of all ages how to ride safely in any area from multi-use paths to congested city streets.
- Education for motorists on how to share the road safely with cyclists.
- Availability of cycling education for adults and children.
- Number of League Cycling Instructors in the community,
- Distribution of safety information is distributed to both cyclists and motorists in the community such as bike maps, tip sheets, and as a part of driver's education manuals and courses.

ENCOURAGEMENT concentrating on promotion and encouragement of bicycling. Areas of evaluation include:

- Programming such as Bike Month and Bike to Work Week events.
- Community bike maps and route finding signage.
- Community bike rides and commuter incentive programs.
- Safe Routes to School programs.
- Promotion of cycling or a cycling culture through off-road facilities, BMX parks, velodromes, and road and mountain bicycling clubs.

ENFORCEMENT addressing connections between the cycling and law enforcement communities, addressing:

- Liaisons between the law enforcement and cycling communities.
- Presence of bicycle divisions of the law enforcement or public safety communities
- Targeted enforcement to encourage cyclists and motorists to share the road safely
- Existence of bicycling related laws such as those requiring helmet or the use of sidepaths.

EVALUATION & PLANNING, considering programs in place to evaluate current programs and plan for the future, including:

- Measuring the amount of cycling taking place in the community
- Tabulation of crash and fatality rates, and ways that the community works to improve these numbers.

- Presence, updating, and implementation of a bicycle plan, and next steps for improvement.

The previous four chapters of this plan address the Engineering aspect of bicycle programming. But the "soft" systems, namely the other four E's, are critical to taking full advantage of infrastructure investments, improving the effectiveness and safety of bicyclist, and making Hays a truly bicycle friendly community. The following discussion provides recommendations for the support systems for bicycling in the city, organized around the LAB's five categories of bicycle friendliness.

Education

Increase the number of league certified instructors (LCI's) in Hays. The League of American bicyclists BikeEd program is recognized a the standard for bicycle safety education, and includes a variety of courses that serve young cyclists, recreational riders, and everyone up to road-hardened commuters. Successful operation of the program is dependent on one critical factor, however - local presence of instructors. Therefore, a critical part of the program is training of instructors through the League Certification process. In this process, cyclists complete both prerequisite courses and a three-day course conducted by a specially trained instructor. Successful completion and passing written and on-road evaluations qualifies individuals as League Certified Instructors (LCI), who are then authorized to provide training to other cyclists. In addition to a cadre of instructors, a successful training program requires marketing and placement to match instructors with demand from schools, corporations, and other organizations. This can most appropriately be done through an advocacy or active living organization with staff to organize the education effort.

Integrate bicycle rules of the road into drivers education programs. Most drivers are unaware of the rights and responsibilities of vulnerable users such as bicyclists (as well as motorcyclists and pedestrians. These factors should be included in drivers education programs for new motorists and decertification testing. In addition, a significant unit on bicycle, pedestrian, and motorcycle laws and behaviors should be included in defensive driving classes for drives who have received citations for moving traffic violations. This often reaches motorists who may be most likely to drive inattentively or aggressively, and may be most likely to endanger cyclists.

Work with major employers to conduct on-site education programs. As part of efforts to encourage better employee health through greater active transportation, major employers often are willing to host BikeEd programs. Outreach and partnerships with companies to offer programs on-site can increase participation in bicycling, and assist employers with establishing an ethos based on healthy living.

Develop and implement bicycle education programs for kids. Young bicyclists perceive the riding environment differently from adults, and obviously have neither the visual perspective nor experiences of older riders. Schools and safety groups often offer "bike rodeos" which may or may not address the skills of riding even on local streets. The LAB's BikeEd program has a specific track that addresses these issues ad skills, and they should be incorporated into these more frequently offered safety events.

Publish and post on-line an engaging and brief guide to safe bicycling. Information on safe urban cycling should be both ubiquitous and appealing to different audiences, including both motors and bicyclists. Poor safety practices are both dangerous and bad for public relations, creating the possibility of backlash against cyclists. New York's Biking Rules program, an on-line guide to practice and law, developed by the advocacy organization Transportation Alternatives, and a brief city DOT publication on safe rid-

Biking Rules. Excerpts from a streetcode to promote responsible urban cycling, developed by New York City's Transportation Alternatives advocacy organization.

ing are excellent examples. Chicago has published a safety booklet specifically targeted toward young cyclists. Hays should develop similar guides, which also successfully avoid portraying bicycling as a hazardous activity.

Encouragement

Expand participation in bicycle transportation through programs that engage corporations in competitions and fun, such as corporate commuter challenges. These programs track participation by numb of trips and miles traveled during a multiple-month period, and give awards to winners at an event at the end of the period. Companies may be classified by size, so that competition is among similarly sized organizations. These challenge programs are successful by encouraging bicycle transportation within companies and in many case produce a bicycle culture as companies compete against each other.

Institute a bike month celebration. Bike month events typically occur during May, and can involve a variety of activities, including short rides led by the mayor or other public officials, clinics on subjects such as riding technique and bicycle repair, special tour events, screenings of bicycle-related movies, and other programs.

Organize special rides that are within the capabilities of a broad range of riders and encourage family participation. On memorial day weekend, the Active Transportation Alliance's Bike the Drive closes Chicago's Lake Shore Drive for exclusive bicycle use for three hours on Sunday morning for cyclists to enjoy. In Madison, seven miles of downtown streets are closed to motor traffic for exclusive use by bicycles and pedestrians in a free event that attracts thousands. Many community rides and benefits have different lengths and routes to appeal to all ages. These events build interest, and make cycling comfortable and attractive to more people. Hays has scheduled similar events in the past to demonstrate the possibilities of bicycle transportation. Cyclovia programs that close a major street or streets in a part of the city have become very popular around the country as a community festival.

Implement a bicycle ambassador program in middle and high schools. Ambassadors are students with a special interest in bicycling who share that interest with their peers. Many cities also have adult ambassador programs, whose goal to to provide safety education and market the many positive aspects of bicycling in the city.

Encourage Hays' businesses and employers to participate in the League of American Bicyclists Bicycle Friendly Business (BFB) program. The program recognizes businesses that encourage their employees to use bicycles for transportation through efforts such as providing secure bicycle parking, sponsoring company rides, offering economic incentives, establishing internal bicycling events and bicycle interest groups, and supporting community bicycle initiatives.

Achieve Bicycle Friendly Community status within three to five years. In addition to recognition as a good bicycling environment, many observers also consider Bicycle Friendly Community status to be an indicator of overall community quality. As such, it is a significant community marketing tool, and reinforces substantial efforts in balanced transportation development.

Engineering (Facilities)

Institute a bicycle parking program, installing facilities at strategic locations across the city. Bicycle parking is a low cost but significant physical improvement that both encourages cycling, provides greater security, and keeps bikes from damaging trees or street furniture, or obstructing pedestrians. The parking program includes several elements:

- **Identifying key locations for facilities.**

- **Standardizing on bike parking equipment that is durable, relatively inexpensive, and unobtrusive.** Many of the bike racks in use today, including the so-called "schoolyard" rack and waves are inefficient, take up a great deal of space, and, in the case of the former, can actually damage bikes. Better in most cases are less obtrusive designs such as the inverted U, hitching post, or the new "theta" design that recently won a bicycle parking design competition for New York City.

- **Develop a funding mechanism and incentive program for bicycle parking installations.** Bike parking on private property may be funded with the assistance of special events. For example, Omaha's Eastern Nebraska Trails Network holds an annual Corporate Challenge ride, which in 2011 attracted a record 4,200 cyclists. A portion of the proceeds are used to purchase inverted U's, some of which are offered to targeted private businesses at reduced cost.

- **Amend zoning ordinances to require a specific amount of bicycle parking for high demand business types.**

Develop and install a unified bikeway network graphic system. While signs and sign clutter should always be minimized, a carefully designed identification and directional graphics system can greatly increase users' comfort and ease of navigating the street system. The graphic system may have individual features, but should generally follow the guidelines of the Manual of Uniform Traffic Control Devices (MUTCD). Types of signs in the system include:

- Route identifier, including a system logo and the number and name of the route. These signs reassure users that they are on the right path and is keyed to numbered routes.

- Intersection signs, indicating the intersection of two or more routes.

- Destination way finders, indicating the direction, distance, and time (using a standard speed, typically 9 miles per hour), to destinations along the route.

- Directional changes, signaling turns along a route.

The graphic system should be modular to provide maximum flexibility and efficiency in fabrication. Signs should also use reflective material for night visibility. The Clearview font is recommended as a standard for text.

Enforcement

Involve a Police Department representative on the advisory committee, bike education efforts, and other aspects of the bicycle transportation program. Police participation adds a critical perspective to facility and safety program planning and implementation.

Enforce bicycle laws for both motorists and bicyclists. All users of the road have responsibilities to each other. Effective enforcement begins with police officers being completely familiar with legal rights and responsibilities of cyclists. But bicyclists must not have free passes to disobey traffic laws, and irresponsible riders often create backlash against all. Enforcement for all users leads to better, safer behavior and greater predictability and cooperation by all.

At the state level, Kansas has made two major statutory steps to become more friendly to bicyclists: a 3-foot separation requirement for motorists passing bicycles, and a Dead Red law, permitting bicyclists and motorcyclists to go through red signals that do not detect their presence.

Encouragement through Events. The largest group bike ride in the country is Bike New York's Five Borough Bike Tour, with 32,000 riders. But much more modest rides also provide fun and support for riders of all abilities.

Evaluation and Planning

Institute an evaluation system that compiles bicycle traffic counts and crash information, and monitors mode split data through the American Community Survey and user surveys. Good evaluation information measures the effectiveness of the program and informs adjustments and improvements. The bicycle/pedestrian coordinator is ultimately responsible for developing and implementing this evaluative program.

Complete periodic surveys of system users, monitoring customer satisfaction and recommendations. The very high response to the survey in chapter two indicates a large and committed constituency that is a great source of information and input. In addition to being an excellent measure of user satisfaction and recommendations for improvement, surveys keep the bicycle community actively engaged in the process of improving bicycle transportation in Hays.

Bicycle Parking. Inverted U's at the University of Nebraska at Omaha, enhanced with the school's mascot.

Bikeways System Graphics. Clockwise from bottom: Destination sign, route intersection sign, and route identifier.

Hays