Trail Design:
planning for trails and shared-use paths

Overview

Trails are increasingly being used as a vital component to the bicycle and pedestrian network and are seen as an asset to the community. Traditionally, trails in communities were primarily for recreational purposes. Now they are providing needed connections between communities and a safe place to ride. This module will look at the variety of trail types and what components are necessary for a successful trail project.

Learning Objective:

- Identify and compare trail types
- Design process for trail planning
- Evaluate the benefits and need for different trail characteristics

Suggested Use

_x_Professional Development _x_Graduate Level _x_Undergraduate

Time Required

__Less than 1 hour __ 1 hour _x_2-3 hours __Half-day Workshop __Full-day Workshop

Instructions

1. Announce purposes and give brief overview of the day
2. Give lecture
3. Break for discussion and questions
4. Summarize lecture and discussion
5. Assignment
6. Circulate evaluations

Lecture

1. Trail Types
    a. Greenways
    b. Community Trails
    c. Urban Trails
    d. Rails to Trails
2. Trail Characteristics & Amenities
3. Successful Trail Projects
4. Feasibility & Master Planning
5. Planning Process

Assignments and Activities

1. Evaluate Existing Trail Plans

2. Existing Conditions Report
3. Trail User Count Report

Suggested Readings

Federal Highway Administration University Course on Bicycle and Pedestrian Transportation (2006), Chapter 19: http://www.fhwa.dot.gov/publications/research/safety/pedbike/05085/chapt19.cfm

Rails to Trails Conservancy, "Plan, Design, Build: Turning Trail Vision into Reality." http://www.railstotrails.org/ourWork/trailBuilding/toolbox/informationSummaries/plandesignbuild.html

Bicycling Info, "Shared Use Paths Design Details." http://www.bicyclinginfo.org/engineering/paths-details.cfm.

"Promoting and Developing a Trail Network Across Suburban, Rural, and Urban Communities," Michele G. Schasberger MA, Carol S. Hussa BA, Michael F. Polgar PhD, Julie A. McMonagle MS, Sharon J. Burke BA and Andrew J. Gegaris Jr MS. (2009).

"Planning for multi-purpose greenways in Concord, North Carolina." Ashley Conine, Wei-Ning Xiang, Jeff Young and David Whitley (2003).

Related Modules

- Context of Other Movements
- Bicycle Facility Design
- Master Planning

Trail design is increasingly seen by communities as not only an asset, but a vital part of the transportation infrastructure. Today, they are seen as more than simply recreational facilities. This module was made with the assistance of Alta Planning and Design.

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Overview

1. Trail Types
   - Greenways
   - Community Trails
   - Urban Trails
   - Rails to Trails
2. Trail Characteristics & Amenities
3. Successful Trail Projects
4. Feasibility & Master Planning
5. Planning Process

We'll go over the types of trail types, characteristics of trails, examples of successful projects and how to create a feasible master plan as part of a larger planning process.

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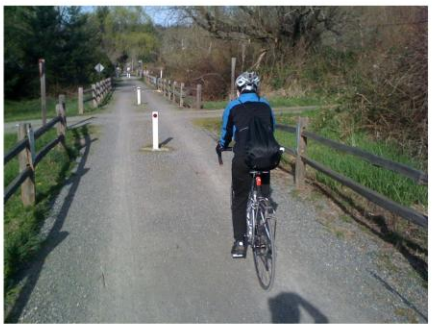
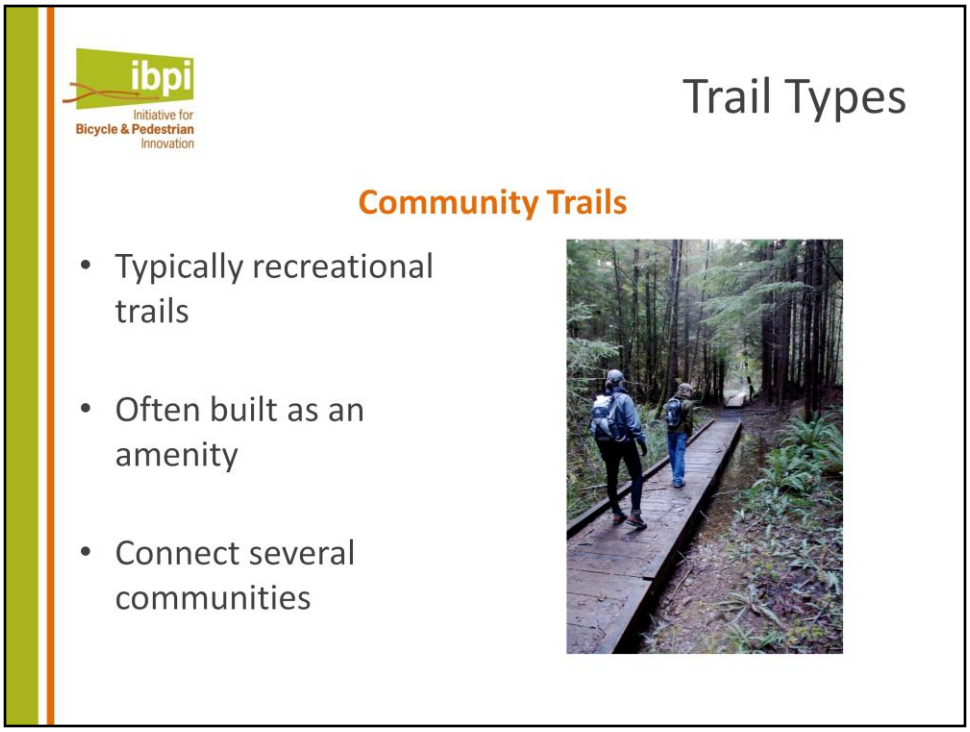
Trail Types

Greenways

- Tend to be linear
- Multi-purpose
- Maintain or increase vegetation



- The term Greenway comes from the "green" in green belt_ the "way" in parkway implying a recreational or pedestrian use rather than a typical street corridor
- emphasis on introducing or maintaining vegetation, in a location where such vegetation is otherwise lacking.
- They also tend to be linear with a mostly contiguous pathway, allowing urban commuting via bicycle or foot.
- Multi-purpose; often considered linear parks
- Is usually redeveloped, but can also be newly developed



Community trails are typically seen as recreational trails, oftentimes being built as an amenity for master-planned communities.

These community trails may connect several communities by way of the path, they can be incorporated into a wider trail network to add value to both the master planned communities and network users.

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Trail Types

Urban Trails

- "Shared Use Pathway"
- Utilitarian & recreational trips
- Part of larger network

- Urban trails and shared use pathways – as name implies, located in urbanized areas
- May be used for utilitarian trips as well as recreation
- May be part of bicycle and pedestrian transportation network

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Trail Types

Rails to Trails

- Network of trails from abandoned rail lines
- Gentle grading, transverse communities
- "Rail With Trail" public path running parallel

Former rail lines are ideal locations for trails as they have already been graded to gentle slopes, wide pathways, and are no longer being used. Often they are resurfaced to remove rails and make more appropriate for cyclists and pedestrians.

Similar program is a "rail with trail" which is parallel to active rail lines, often they can care share easements

The mission of the Rails to Trails Conservancy is to create a nationwide network of trails from former rail lines and connecting corridors to build healthier places for healthier people.

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Characteristics & Amenities

Surfaces

Width

Trail users per hour in each direction	Trail width (feet)			
	8	12	16	20
25	B	B	A	A
50	D	B	A	A
75	D	B	B	A
100	D	B	B	A
150	E	C	B	B
200	F	D	C	B
250	F	D	C	C
300	F	E	D	C
400	F	F	E	E
500	F	F	F	F

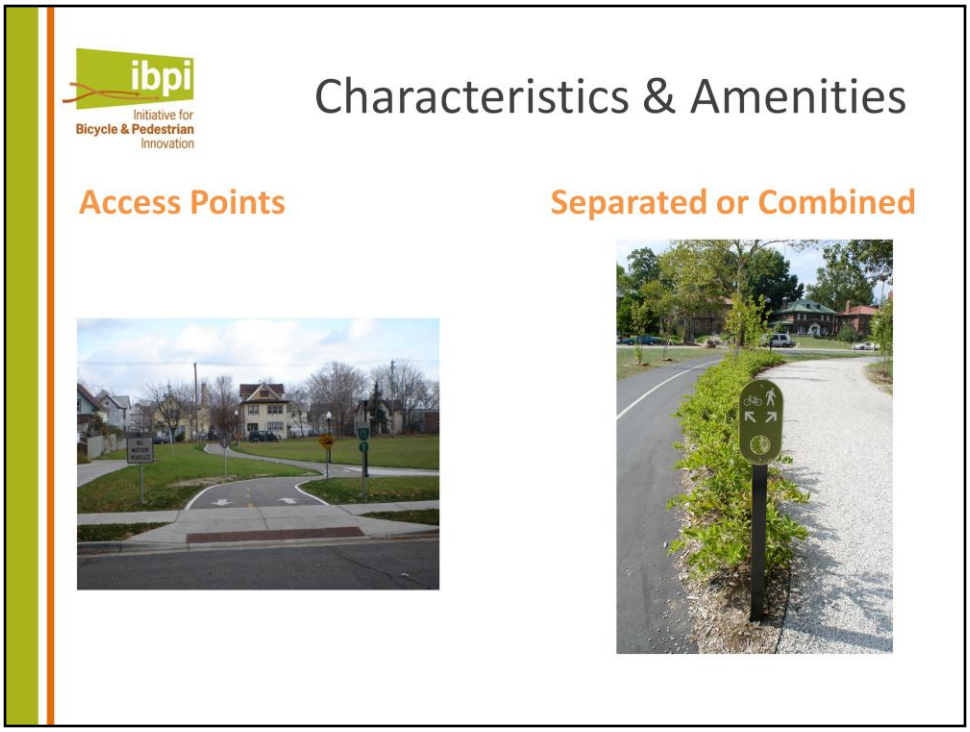
Characteristics of trails can vary widely depending on the location.

Surfaces of trails vary depending on need, usage, climate, and budget. Maintenance should be considered when determining the appropriate surface for a facility. Paved, dirt, or gravel trails are often utilized. Each type has advantages and disadvantages and so should be designed with the end user in mind. Paved trails allow cyclists to travel at faster speeds, but are more expensive to install. Softer surfaces such as dirt and gravel are less expensive to install but are more expensive to maintain and not usable by all types of bicycles.

Width of a trail depends on the usage and the amount of space that is available for a right of way. 8’ is the minimum recommended width for facilities that are expected to have low traffic at all times and there are good sightlines. 12’ is recommended for trails with substantial use by multiple modes, this should also have 2’ of graded area (step off) next to the pathway. The Federal Highway Administration uses the above table as a rule of thumb for the width of trail based on Level Of Service graded rating (A-F). These estimates have limitations and only represent the bicyclist viewpoint. (*Evaluation of Safety, Design, and Operation of Shared-Use Paths: Final Report: http://www.fhwa.dot.gov/publications/research/safety/05139/index.cfm)*

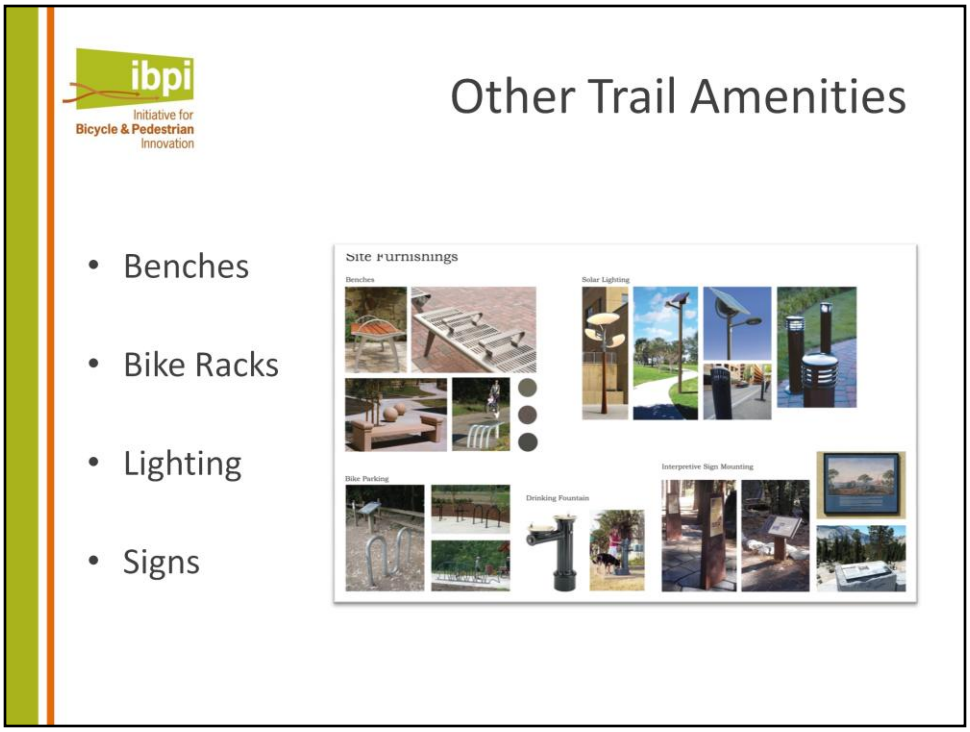
Signs and Wayfinding are essential, especially on shared use paths. Signs should point out crossings, destinations, and potential conflict areas.

Pavement markings can support the signage and provide guidance for multiple users. They can help reduce conflicts between modes and enforce trailway regulations.

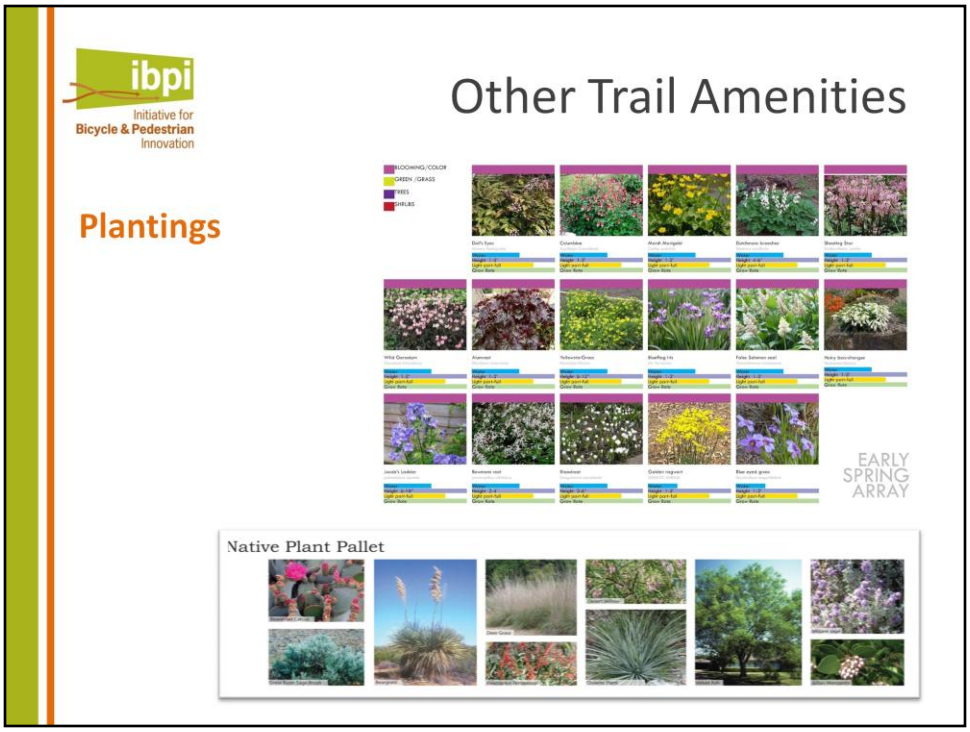


Access points should be available at major destinations and provide connections to the trail network. These access points should be clearly marked to reduce conflict. Siting good access points in relation to destinations and users is an important part of trail planning.

Separated or combined trails between pedestrians and bicyclists depends on the anticipated traffic from users, and may make a difference in the type of facility surfaces, widths, and amenities. A separated trail may be more expensive, but will reduce conflicts between the types of users and their variable speeds. This may be especially important to cyclists who are using the trail for commute purposes, and not simply recreation. Often this is not feasible due to the amount of right of way available.



Trails amenities add value to the system enhance user experience. Amenities often include benches, interpretive signage, lighting, and facilities such as bike racks.



Landscaping along the trail can add to the aesthetics of the place, and appeal to the users. This provides another opportunity to include native landscaping and be a benefit to the local ecosystem.

Interpretive signs are another way to enrich the user experience and can be included to enhance educational opportunities and provide cultural, historical, or environmental information on the area.

Successful trail projects should include an opportunity to gather community feedback and build ownership, keep safety in mind for all users, provide a plan for management, and plan for connections to other destinations and easy access to the trail.

Trails should also respect neighboring property owners and work with them on creating a project that they can enjoy and will add value to their neighborhood.

Access points– If you can't get to it, no one will use it. In urban areas, patrons of a trail may be integrated into the broader transportation system, especially for bicyclists.

Successful Trail Projects

- Conduct a safety audit of the trail
- Work with local law enforcement
- Listen to the community
- Utilize crime prevention through environmental design (CPTED)

Safety considerations are essential to a trail project. There are many opportunities to incorporate the input from potential users, local law enforcement, and those familiar with the area. This feedback can inform a plan to prevent crime along the trail.

A safety audit can provide information on potential hazards, including the trail surface, lighting, vegetation or conflict points with other trail users or at crossings, that need to be addressed.

Successful Trail Projects

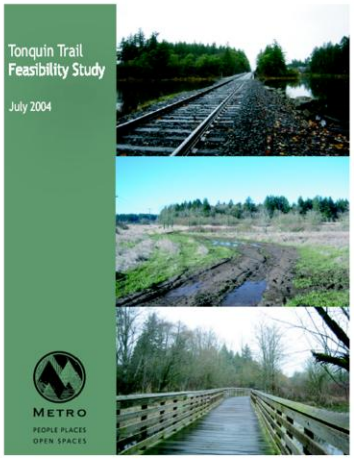
Develop a Security Plan to Evaluate:

- Sight distance
- Vegetation
- Lighting
- Fencing
- Access
- Call boxes
- Intersections / Driveways
- Signage
- "Hiding place" removal
- Graffiti / nuisance removal

This security plan should evaluate how elements such as sight distance, vegetation, and access can impact the security of users. This evaluation will help develop a mitigation plan.

Feasibility & Master Planning

1. Establishing Goals & Objectives
2. Data Collection
3. Identifying Issues
4. Developing Evaluation Criteria
5. Determine & Evaluate Alignments
6. Develop Designs & Cost Estimates



Planning and designing trails is somewhat different than other bicycle and pedestrian systems for several reasons:

- Not part of public street right of way
- Often need to acquire land
- Flexibility to design to demand and user needs
- But other constraints not encountered in typical street:
    - Ownership
    - Topography
    - Environmental concerns and requirements

Planning process needs to take these into account

Creating a Master plan or study for a trail should follow this basic outline. We'll discuss these steps individually.

Goals and objectives for the trail should be based on client and community needs

This discussion will help inform evaluation criteria and determine the user groups and types of trails.

This step should also look at how the trail will be used. Assess Trail Demand through tools such as:

- State Comprehensive Outdoor Recreation Plan (SCORP)
- Compare ratio of existing trail miles to user population along corridor and compare to National Recreation and Park Association (NRPA) suggestion of 1 mile trail per 2,000 people
- Obtain user information from other nearby trails
- Check any surveys or data available on your community
- Generate data using FHWA's Guidebook on Methods to Estimate Non-Motorized Travel

2. Data Collection

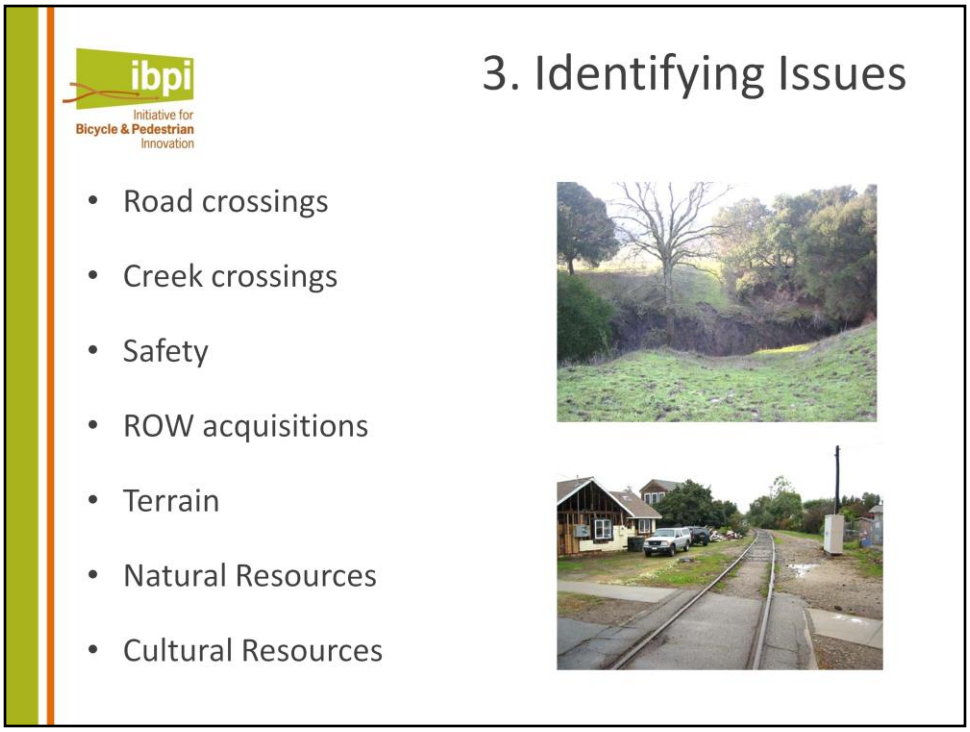
- Existing Planning Documents
- Relevant Demographic Info
- Field Work
- Site Data (Topography, Ownership etc.)

Data collection will look what has already been planned and how this trail will fit into the community.

Demographic info: relates to potential users and their needs

Field work provides information on existing conditions-both natural and human made—that will affect trail design and alignment.

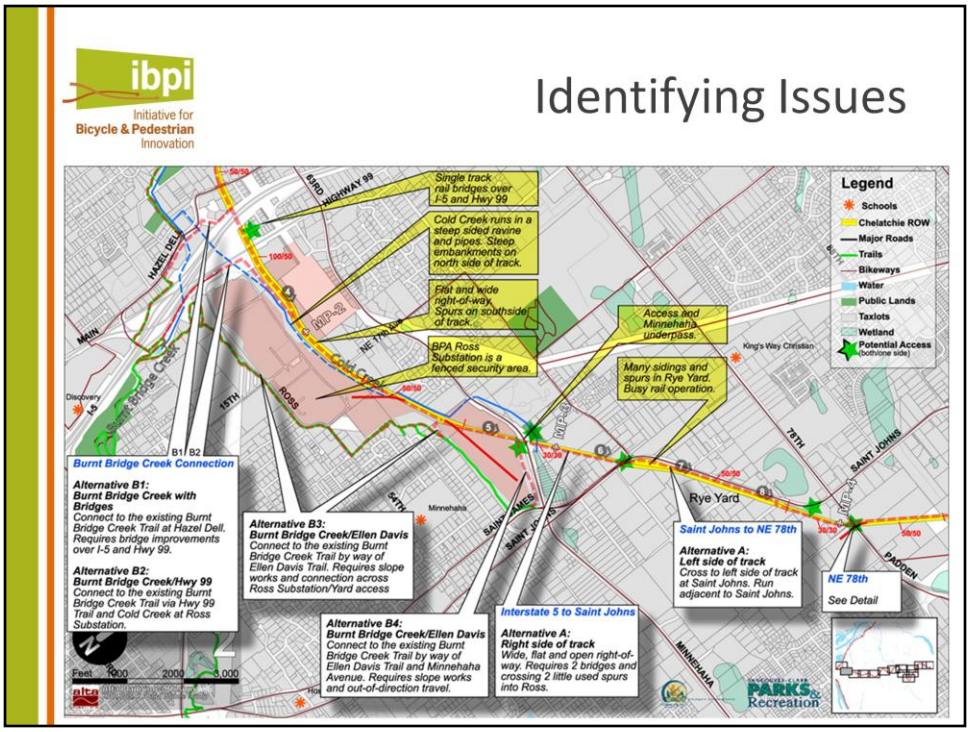
Site data: Ownership, utilities and other similar data also affect alignment options, costs, and identify project partners.



Based on the data collected, the plan can then move into identifying issues, needs and concerns along the proposed area for the trail. This could be:

- Road crossings
- Creek crossings
- Safety issues
- Right of way acquisitions (we'll talk about more next)
- Terrain
- Natural Resources
- Cultural Resources

Note that crossing roads and designing safe and appropriate crossings is one of the most essential components of a successful trail project.

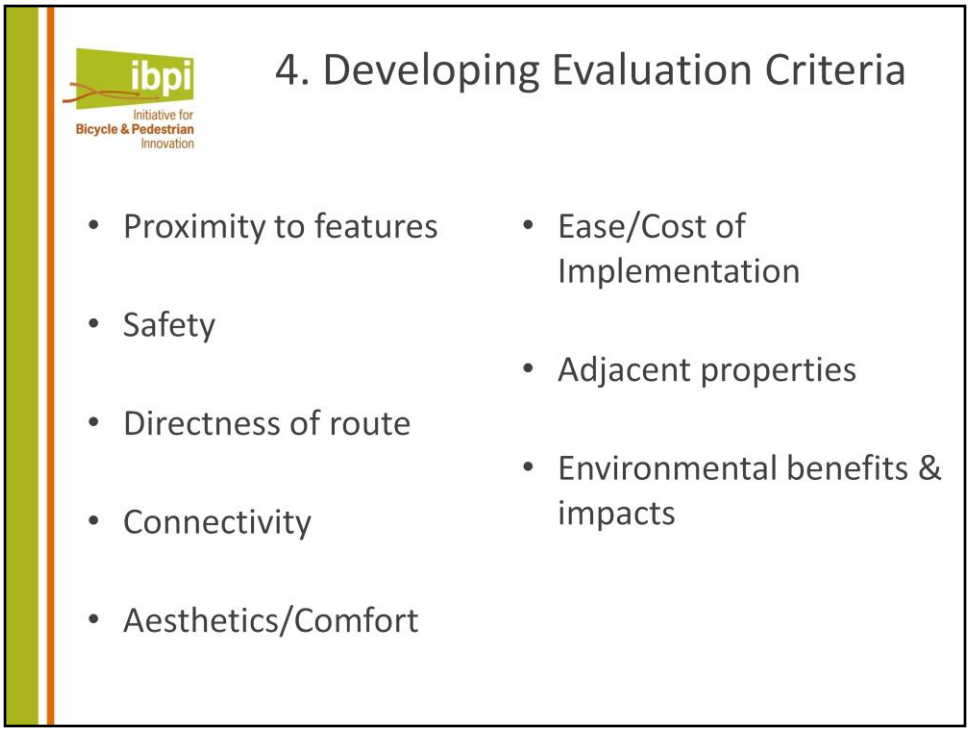


When you have identified issues, an opportunity and constraints map like this from Alta Planning can help illustrate the issues you are coming up against and where there should be amenities and access points.

Securing Right of Way

- Negotiating with property owners
- Utilities – Power lines, sewer easements, irrigation canals
- Railroads

Securing the right of way can be a challenge for trail projects. May involve negotiating with property owners for the ROW, or trails could be incorporated along utility lines or railway corridors. This also requires negotiation, legal arrangements and costs.



Before evaluating alternatives to the plan, there should be some thought put into what would make a successful trail project by developing evaluation criteria.

The evaluation criteria could include a number of factors such as these.

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5.Determine and Evaluate Alignments

- List advantages & disadvantages of each
- Cost of each option

SECTION A

A-01 Loop around Bowman Reservoir

Key Issues
- Culturally and historically significant
- Two owners: BLM and Muddy Valley Irrigation Co.
- Non-motorized access only
- Isolation

Character
- Undulating topography on north side
- Reservoir holds irrigation water

Connection: Jump Backs OHV area, Open space, neighborhoods to the south.

Crossings: None

Bowman Reservoir, looking southeast

A-02 Bowman Road between Moapa Valley (MV) Blvd. and Bowman Reservoir

Key Issues
- Historic access to Bowman Reservoir
- Speed at MV Blvd. is 55 mph.

Character
- Road slopes up from MV Blvd. to Reservoir
- 60' R-O-W, 25 mph speed limit
- Pavement in poor condition

Connection: Bowman Reservoir and MV Blvd.

Crossings: 6 residential driveways and MV Blvd.

Bowman Road. lookine west

A-03 MV Blvd. between Bowman Road and A & W Farm Rd.; A & W Farm Rd. from MV Blvd. to Muddy River

Key Issues
- Crossing of major irrigation ditch
- Moderate to steep slope at interface between valley floor and Wells Siding

Character
- 100' NDOT R-O-W on MV Blvd & 55 mph
- 50' R-O-W on A & W Farm Rd.
- Undeveloped land with dedicated R-O-W
- Some agricultural land in production

Connections: Bowman Reservoir, Wells Siding, Muddy River

Crossings: Future unnamed street, major irrigation ditch

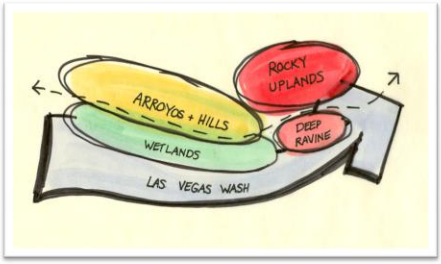
A & W Farm Rd. alignment, looking west

These different alignments can now be evaluated based on those criteria discussed. Each should list advantages, disadvantages, and costs for each.

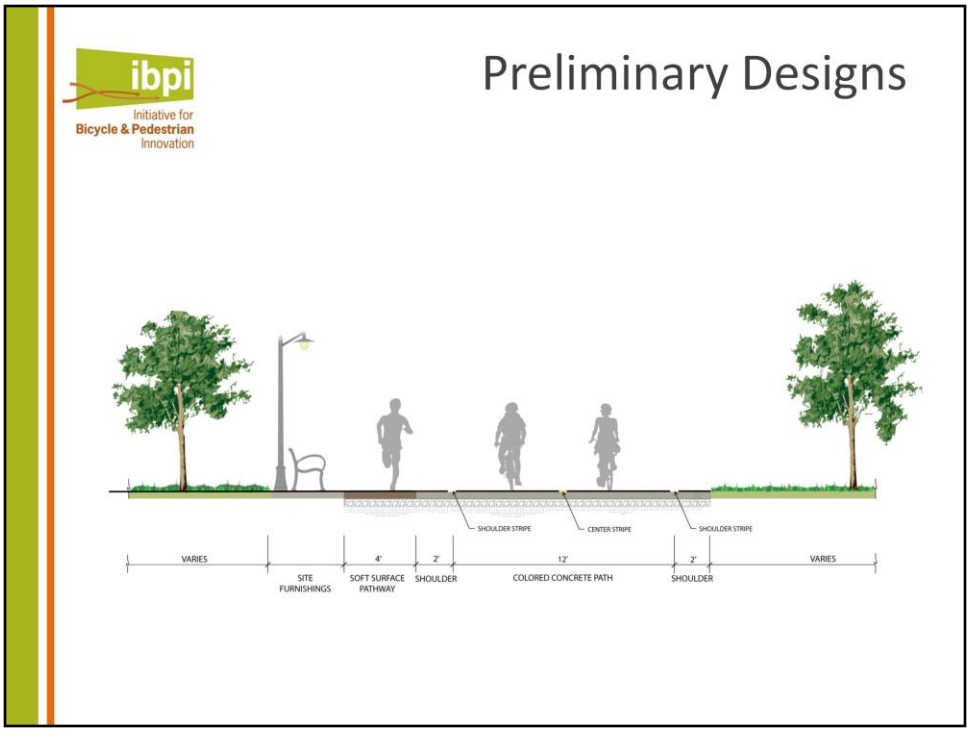
6. Develop Preliminary Designs

Conceptual Design

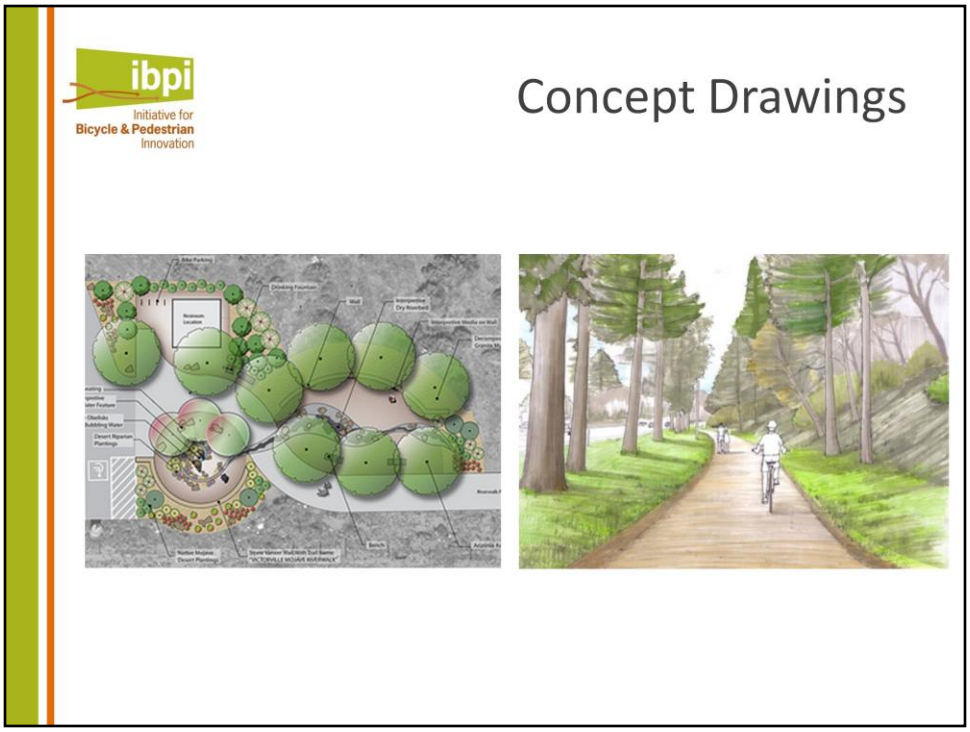
- The early design phase
- Illustration of design ideas using sketches, renderings, photo simulation



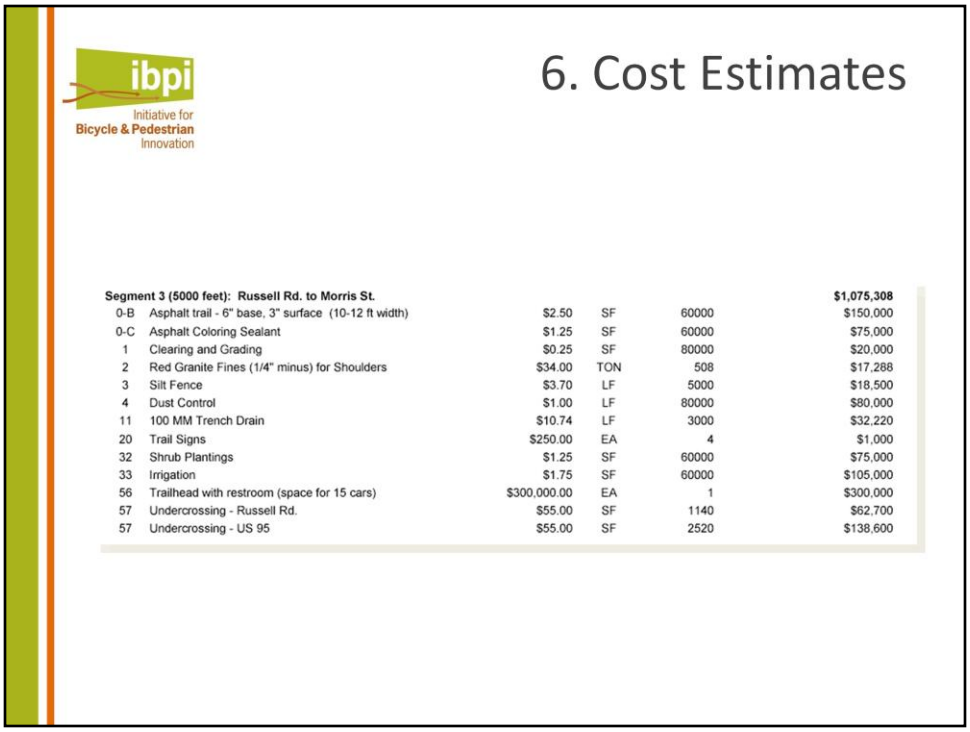
A conceptual design will help inform the plan design.



Preliminary designs can then be developed for the trail. This can include amenities, surface types, and width.



The concept drawings help the community envision the look and feel of the proposed design.



Segment 3 (5000 feet): Russell Rd. to Morris St.					**$1,075,308**
0-B	Asphalt trail - 6" base, 3" surface (10-12 ft width)	$2.50	SF	60000	$150,000
0-C	Asphalt Coloring Sealant	$1.25	SF	60000	$75,000
1	Clearing and Grading	$0.25	SF	80000	$20,000
2	Red Granite Fines (1/4" minus) for Shoulders	$34.00	TON	508	$17,288
3	Silt Fence	$3.70	LF	5000	$18,500
4	Dust Control	$1.00	LF	80000	$80,000
11	100 MM Trench Drain	$10.74	LF	3000	$32,220
20	Trail Signs	$250.00	EA	4	$1,000
32	Shrub Plantings	$1.25	SF	60000	$75,000
33	Irrigation	$1.75	SF	60000	$105,000
56	Trailhead with restroom (space for 15 cars)	$300,000.00	EA	1	$300,000
57	Undercrossing - Russell Rd.	$55.00	SF	1140	$62,700
57	Undercrossing - US 95	$55.00	SF	2520	$138,600

Estimates of the trail project cost should be laid out for evaluation. These estimates should also include considerations for a maintenance plan.

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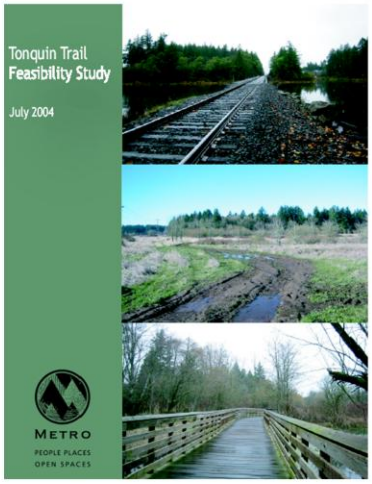
Final Document



All of this will lead to a final plan, ready to be implemented.

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Discussion

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Trail Design:
Planning for Trails and Shared-Use Pathways

Thanks to Steve Durrant, ASLA, Principal,Alta Planning + for contributing significant content to this presentation

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   - Greenways
   - Community Trails
   - Urban Trails
   - Rails to Trails
2. Trail Characteristics & Amenities
3. Successful Trail Projects
4. Feasibility & Master Planning
5. Planning Process

Trail Types

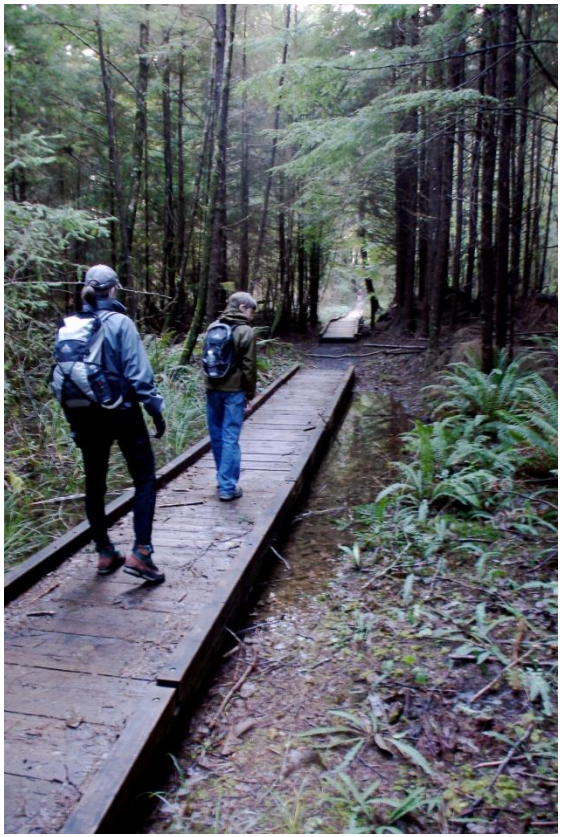
Greenways

- Tend to be linear
- Multi-purpose
- Maintain or increase vegetation

Trail Types

Community Trails

- Typically recreational trails
- Often built as an amenity
- Connect several communities



Trail Types

Urban Trails

- "Shared Use Pathway"
- Utilitarian & recreational trips
- Part of larger network

Trail Types

Rails to Trails

- Network of trails from abandoned rail lines
- Gentle grading, transverse communities
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Characteristics & Amenities

Surfaces

Width

Trail users per hour in each direction	Trail width (feet)			
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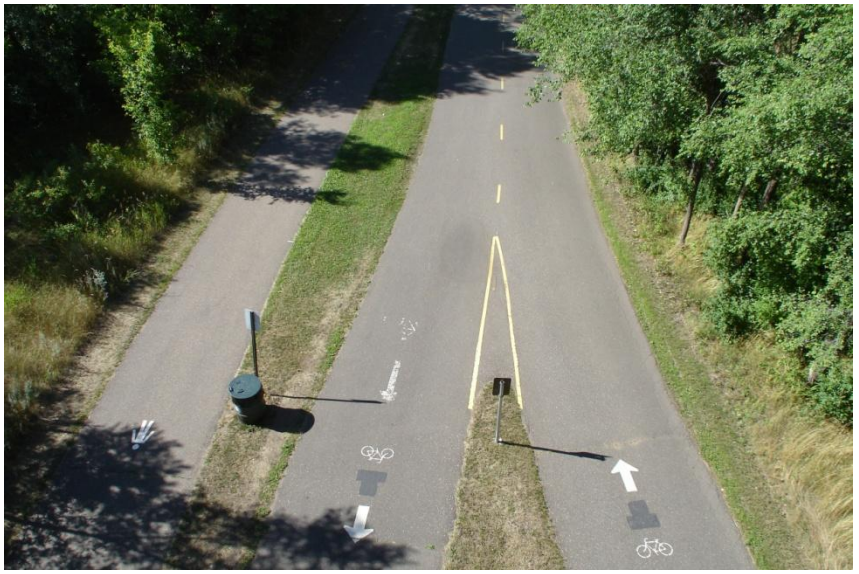
400	F	F	E	E
500	F	F	F	F

Characteristics & Amenities

Signs & Wayfinding

Pavement Markings



Characteristics & Amenities

Access Points

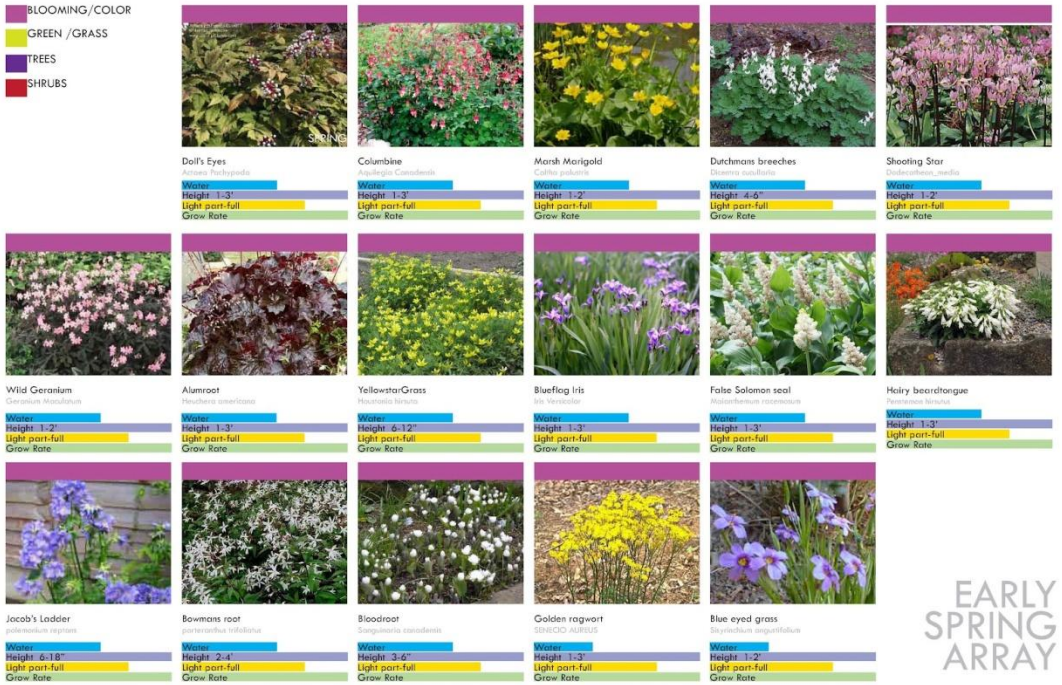
Separated or Combined

Other Trail Amenities

- Benches
- Bike Racks
- Lighting
- Signs

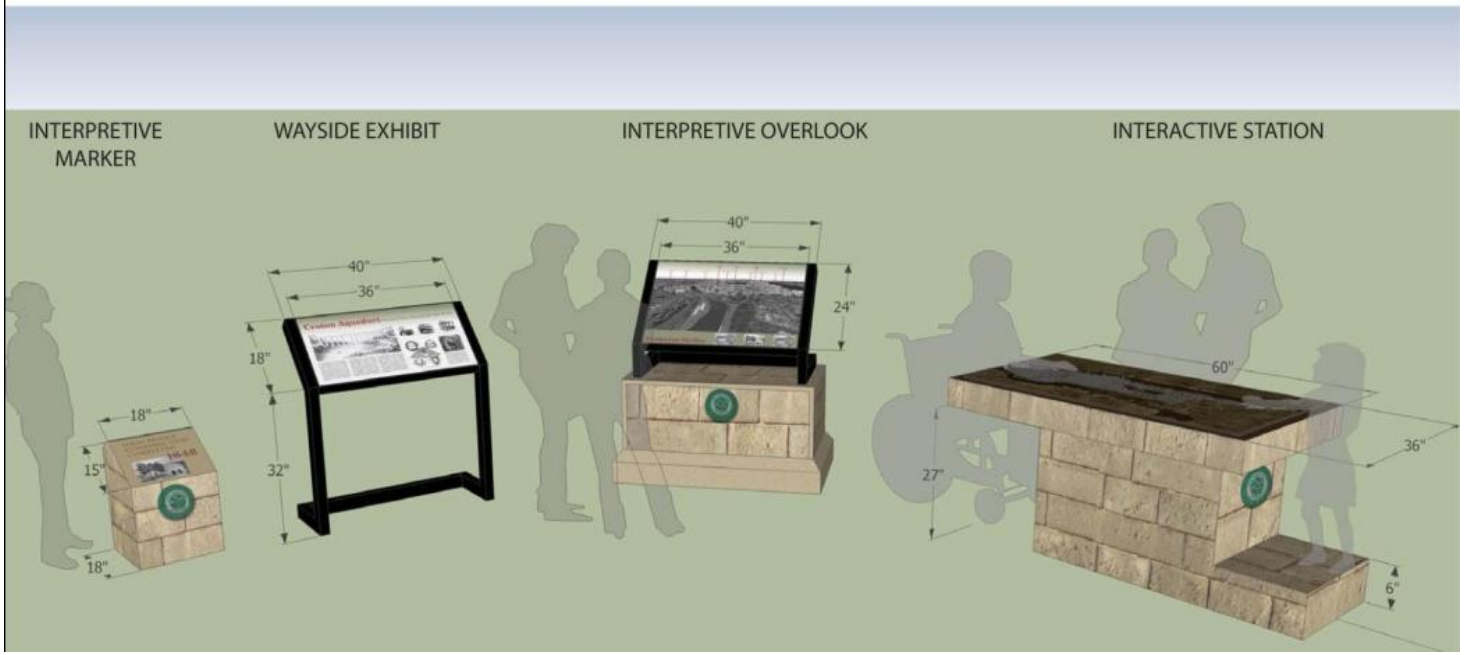
Other Trail Amenities

Plantings



Other Trail Amenities

Interpretive Sites



Successful Trail Projects

1. Community ownership
2. Respect property owners
3. Safety
4. Management
5. Connections & access

Successful Trail Projects

- Conduct a safety audit of the trail
- Work with local law enforcement
- Listen to the community
- Utilize crime prevention through environmental design (CPTED)

TRAIL WATCH

Successful Trail Projects

Develop a Security Plan to Evaluate:

- Sight distance
- Vegetation
- Lighting
- Fencing
- Access
- Call boxes
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- Signage
- “Hiding place” removal
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Feasibility & Master Planning

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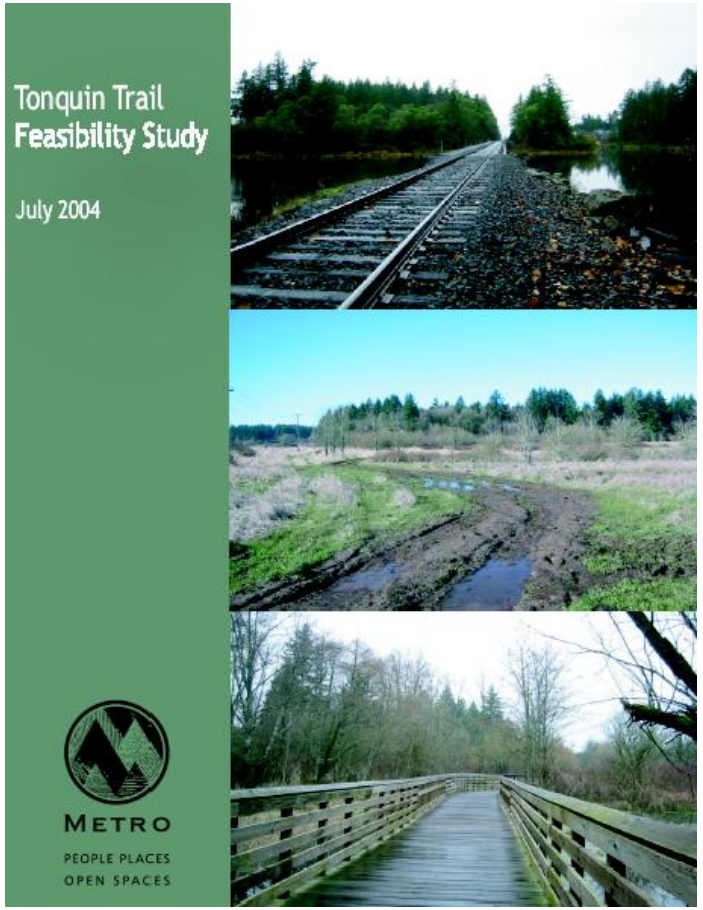


1. Establishing Goals and Objectives

- Based on client and community needs
- Will help inform evaluation criteria
  - Primary user groups
  - Trail demand

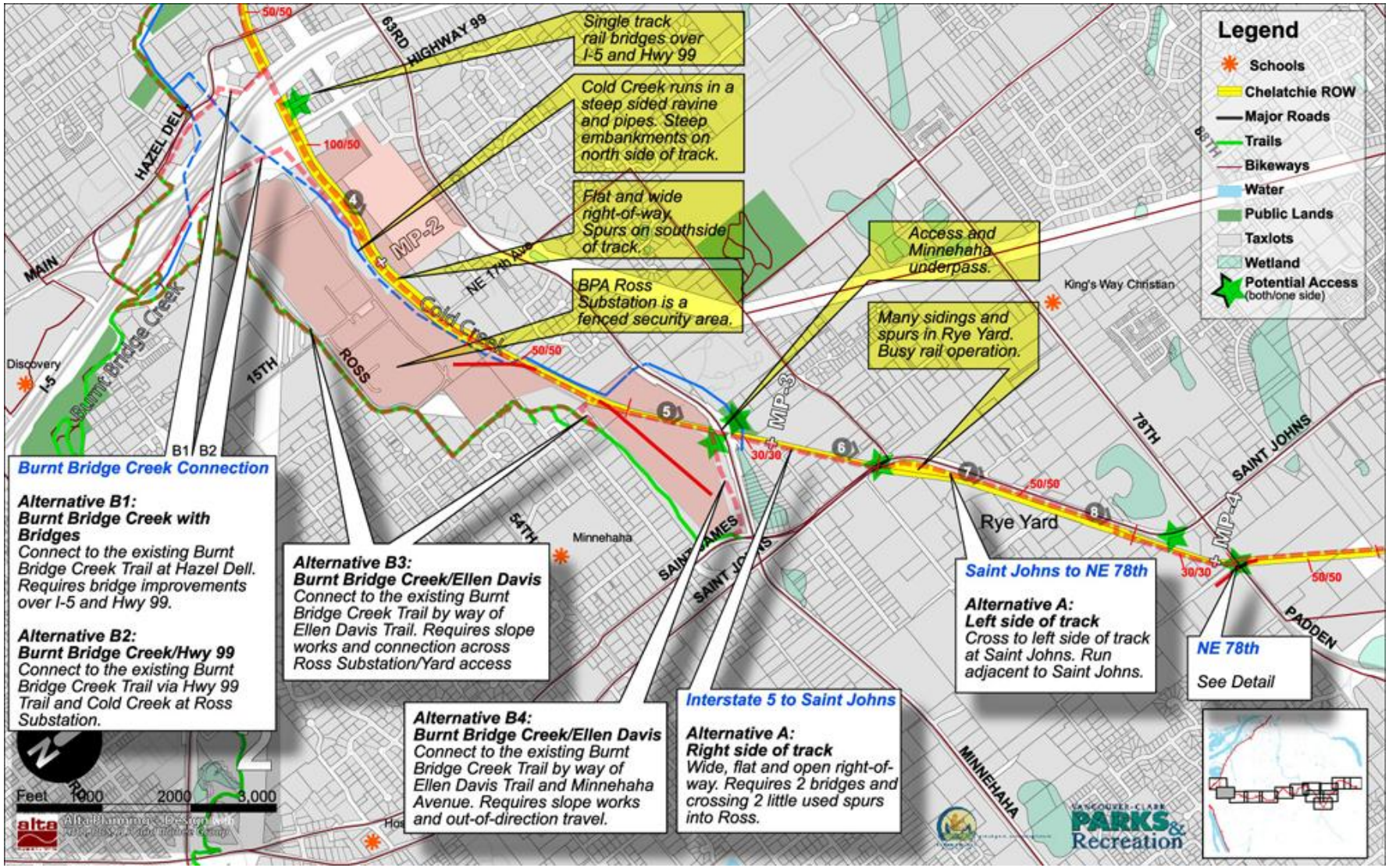
2. Data Collection

- Existing Planning Documents
- Relevant Demographic Info
- Field Work
- Site Data (Topography, Ownership etc.)

3. Identifying Issues

- Road crossings
- Creek crossings
- Safety
- ROW acquisitions
- Terrain
- Natural Resources
- Cultural Resources

Identifying Issues



Securing Right of Way

- Negotiating with property owners
- Utilities – Power lines, sewer easements, irrigation canals
- Railroads

4. Developing Evaluation Criteria

- Proximity to features
- Safety
- Directness of route
- Connectivity
- Aesthetics/Comfort
- Ease/Cost of Implementation
- Adjacent properties
- Environmental benefits & impacts

5.Determine and Evaluate Alignments

- List advantages & disadvantages of each
- Cost of each option

SECTION A

A-01 Loop around Bowman Reservoir

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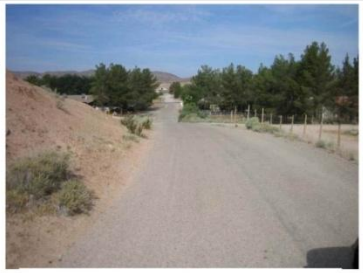
Crossings: 6 residential driveways and MV Blvd.



Bowman Road, looking west

A-03 MV Blvd. between Bowman Road and A & W Farm Rd.; A & W Farm Rd. from MV Blvd. to Muddy River

Key Issues
- Crossing of major irrigation ditch
- Moderate to steep slope at interface between valley floor and Wells Siding

Character
- 100' NDOT R-O-W on MV Blvd & 55 mph
- 50' R-O-W on A & W Farm Rd.
- Undeveloped land with dedicated R-O-W
- Some agricultural land in production

Connections: Bowman Reservoir, Wells Siding, Muddy River

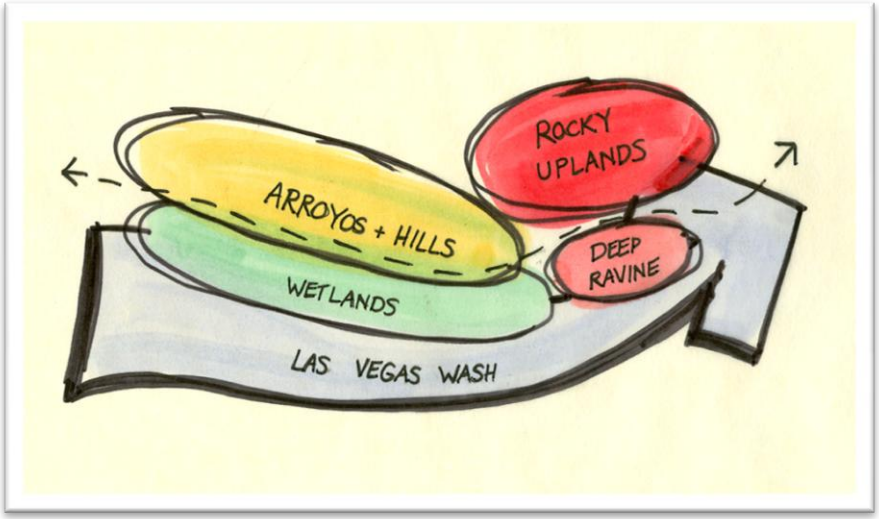
Crossings: Future unnamed street, major irrigation ditch

A & W Farm Rd. alignment, looking west

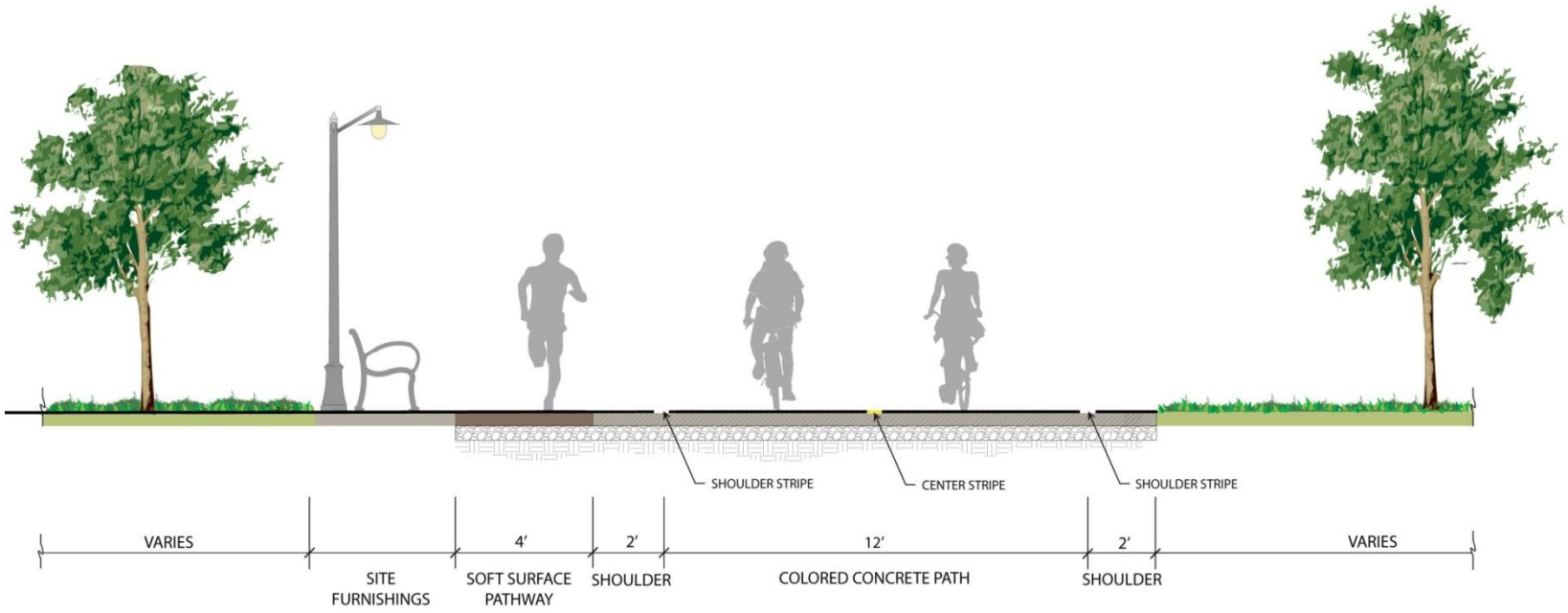
6. Develop Preliminary Designs

Conceptual Design

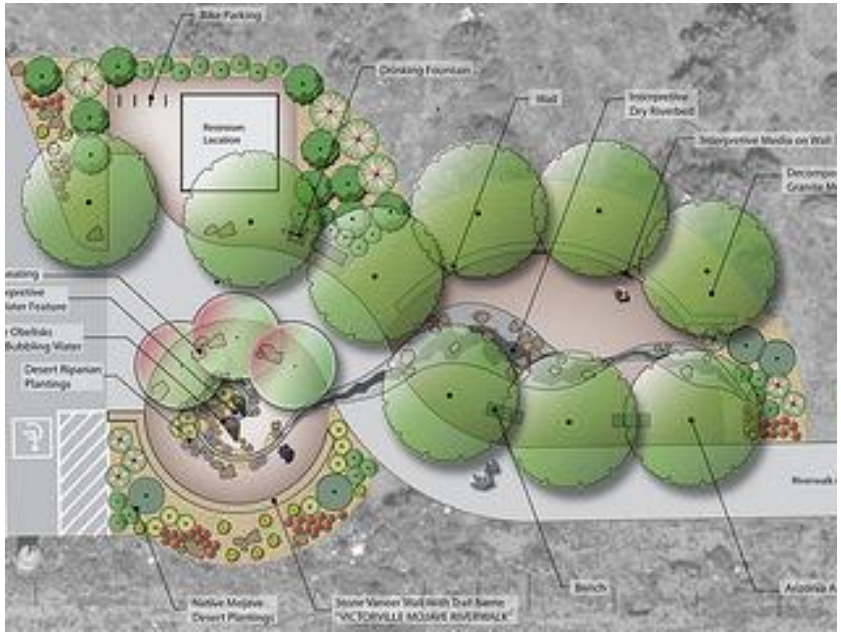
- The early design phase
- Illustration of design ideas using sketches, renderings, photo simulation



Preliminary Designs



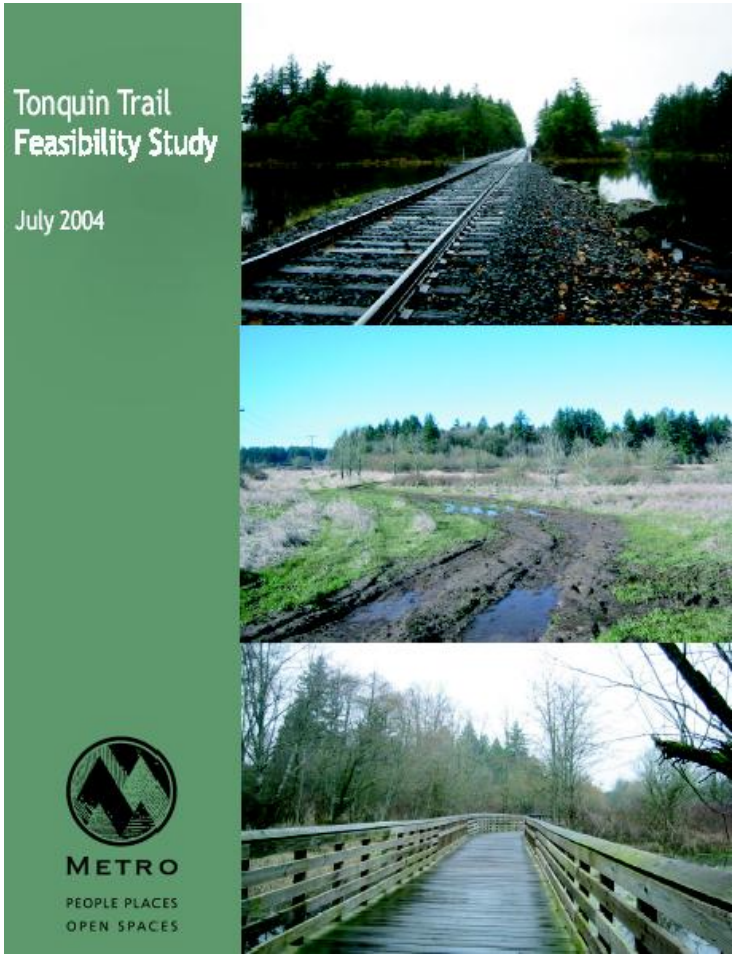
Concept Drawings



6. Cost Estimates

Segment 3 (5000 feet): Russell Rd. to Morris St.					**$1,075,308**
0-B	Asphalt trail - 6" base, 3" surface (10-12 ft width)	$2.50	SF	60000	$150,000
0-C	Asphalt Coloring Sealant	$1.25	SF	60000	$75,000
1	Clearing and Grading	$0.25	SF	80000	$20,000
2	Red Granite Fines (1/4" minus) for Shoulders	$34.00	TON	508	$17,288
3	Silt Fence	$3.70	LF	5000	$18,500
4	Dust Control	$1.00	LF	80000	$80,000
11	100 MM Trench Drain	$10.74	LF	3000	$32,220
20	Trail Signs	$250.00	EA	4	$1,000
32	Shrub Plantings	$1.25	SF	60000	$75,000
33	Irrigation	$1.75	SF	60000	$105,000
56	Trailhead with restroom (space for 15 cars)	$300,000.00	EA	1	$300,000
57	Undercrossing - Russell Rd.	$55.00	SF	1140	$62,700
57	Undercrossing - US 95	$55.00	SF	2520	$138,600

Final Document



ibpi
Initiative for
Bicycle & Pedestrian
Innovation

Discussion

Trail Design:
planning for trails and shared-use paths

Assignment 1: Evaluate Existing Trail System

Assignment Description for *Instructor*:

This assignment will allow students to think critically about content discussed in the lecture and apply it to an evaluation. Students will look at an existing trail network in a city and its associated plan, and evaluate the strengths and weaknesses of the facilities as well as its relation to the current plan. Students should examine the trail elements and evaluate how they enhance or detract from trail use. The students will use an inventory form as part of this assignment. Students should also note and discuss any weaknesses found with the inventory form and how that impacts trail evaluation.

Instructor Prep Work:

Find examples of local trails to evaluate. It is preferable that trails have several access points and a variety of features. Assign trail segments to each student. You may want to do a practice run with the inventory form to prepare for any questions or difficulties the students may encounter. A couple of potential audit/inventory forms are saved in the lecture folder. Modify these as you feel appropriate or use another one if you have one you prefer. Students should consider the following in their evaluations:

- Is the trail connected to meaningful destinations?
- Are there ways to access the trail?
- Who are the primary trail users?
- What are the amenities present on the trail?
- Is it a part of a wider transportation network?
- The process of implementing the plan
- Conditions or items not included in the inventory form.

Time Required for Students:

- Out of class time (observations and write up)
- In-class presentations

Assignment:

This can be either an individual or group project depending on the quantity and proximity of trails within the area. Students should write up a 5-8 page evaluation, with photographs, of the trails, its elements and uses, and present a 5-minute overview on the trail to other students. A completed, legible inventory form will be attached as an appendix.

Trail Design:
planning for trails and shared-use paths

Assignment 1: Evaluate Existing Trail System

Assignment Description for Students:

You will look at an existing trail network in a city and its associated plan, and evaluate the strengths and weaknesses of the existing facilities. You should examine the trail elements and evaluate how they enhance or detract from trail use. You will use the provided inventory form in your analysis of your assigned trail segment.

Things to consider

- Is the trail connected to meaningful destinations?
- What is the surface and width of the trails?
- How is the trail accessed?
- Who are primary the trail users and modes?
- What are the amenities present on the trail?
- Is it connected to the broader transportation network?
- What aspects of the trail enhance or detract from user safety?
- How does the inventory form reflect the current conditions of the trail?
- Are there conditions or items not included in the inventory form?

Time Required:

- Out of class time
- 5 minute in-class presentation

Assignment:

Write up a 5-8 page evaluation, with photographs, of the trails, its elements and uses, and present a 5-minute overview on the trail to other students. A completed, legible inventory form will be attached as an appendix.

Pathway Count Form (use different form for each 15-minute period)

Name of Data Collector:_____
Location:_____
Date:_____ Time Period:_____ Weather:_____
Notes:_____
_____
_____

Users		**Northbound**	**Southbound**	**Totals**
Bicyclists	Male			
	Female			
	Child			
Pedestrians	Male			
	Female			
	Child			
Other (scooter, rollerblade, wheelchair, etc.)	Male			
	Female			
	Child			
Totals				

Pathway Count Form (use different form for each 15-minute period)

Name of Data Collector:_____
Location:_____
Date:_____ Time Period:_____ Weather:_____
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Other (scooter, rollerblade, wheelchair, etc.)	Male			
	Female			
	Child			
Totals				

Trail Design:
planning for trails and shared-use paths

Assignment 2: Trail User Count Report

Assignment Description for *Instructor*:

This assignment will introduce students to a counting protocol to document the number and types of users on the trail. This count will help create a baseline of information on users and help the planning process to provide needed facilities.

Things to consider

- How time of day impacts user volume
- How day of the week impacts user volume
- Mode share by gender
- Split between adults/child

Prep Work:

Select a local trail network and select counting locations for the students. Determine how long students need to spend counting at their locations. Review counting protocol with the students so they understand how to use the spreadsheet as well as count trail users. Create an excel spreadsheet template for student data entry. Determine type of graphics required to display data. Provide a template for graphics.

Time Required for Students:

- Out of class: roughly 4-6 hours
- In-class: 5 minute presentation

Assignment:

Produce a 3-5 page report highlighting key findings, including a 5 minute, in-class presentation of data. A completed, legible count form should be attached to each report as an appendix.

Trail Design:
planning for trails and shared-use paths

Assignment 2: Trail User Count Report

Assignment Description for Students:

This assignment will introduce you to a counting protocol to document the number and types of users on the trail. This count will help create a baseline of information on users and help the planning process to provide needed facilities.

Things to consider

- How time of day impacts user volume
- How day of the week impacts user volume
- Mode share by gender
- Split between adults/child

Time Required:

- Out of class: trail observations and report production
- In-class: 5 minute presentation

Final Product:

Your instructor will assign you a period of time for trail counting. After observing and counting users upon the assigned trail for the assigned length of time, produce a 3-5 page report highlighting key findings. You will also give a 5 minute, in-class presentation of your data. A completed, legible count form should be attached to each report as an appendix.