AN URBAN GREENWAY DESIGN FOR THE CITY OF SHENYANG, CHINA

A CREATIVE PROJECT
SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
MASTERS OF LANDSCAPE ARCHITECTURE

BY

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MAY 2015
ACKNOWLEDGEMENTS

I would like to thank my committee, Leslie Smith, Susan Tomizawa and Lohren Deeg, for their guidance, advice and wisdom. I would also like to thank Kewan Cui from the Shenyang Agriculture University, for her help with data collection and her support during this process. My special thanks to Geralyn Strecker for her patience, support and assistance in the writing of this paper. Thanks to Alrie Middlebrook for her support and warm heart. Thanks to Kellie Suttle for assistance in the editing of this paper. Thanks to my parents for your love, and all my friends for your encouragement and support of me.
ABSTRACT

CREATIVE PROJECT: An Urban Greenway Design for the City of Shenyang, China

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DEGREE: Master of Landscape Architecture

COLLEGE: Architecture and Planning

DATE: May 2015

PAGES: 88

With China's rapid urbanization, a variety of issues are becoming increasingly serious, such as environmental pollution, ecological damage and traffic congestion. As more people suffer heavier pressures from their busy city life, there is a growing demand for beautiful natural places for recreation. An urban greenway requires less space than urban parks, but can serve more people, since it passes through a broader range of locations. It also connects different resources, providing an environmental and human-friendly multi-modal transportation choice.

This complex project designed an urban greenway along a major transit corridor in Shenyang, located in northeast China. As the capital of Liaoning Province, Shenyang is an important city with many beautiful natural and cultural resources. The project site shares similarities with many other cities; thus, the greenway can become a model that other cities can follow.

This project used a literature review, case studies, observation, and interviews as design methodologies to provide environmentally friendly transportation choices and unique commuting
experiences to invite people to enjoy nature during their daily lives. The project connected people with green features and other convenient amenities, increased accessibility and biodiversity of green open spaces, improved the city's livability, encouraged physical activity, provided mental relaxation and promoted a healthy and convenient community environment. The design also reflected the city's past as well as the present with unique and specific cultural language. By connecting important natural and cultural resources, the greenway became a landmark for Shenyang.
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CHAPTER ONE: INTRODUCTION

1.1 Introduction

This project examined urban greenways as environmental, social and cultural strategies for enhancing quality of life in dense Chinese cities. The plan brought a greenway into a high-density, recently developed area in Shenyang, China. The design created new opportunities for recreation and development while maintaining the region's ecological and cultural needs. This ideal site shares similarities with many Chinese cities; thus, the greenway became a model that other cities can follow.

Greenway design is becoming increasingly popular in China; however, existing projects have some design problems. This project avoided these problems, provided a case study for an urban greenway, and served to illustrate a framework model that allied goals for high-density urban greenway design.

1.2 Problem Statement

1.2.1 Major Question

What landscape architecture planning and design principles can be employed to design an urban greenway as a component of a dense urban setting in Shenyang, China?

1.2.2 Sub-questions

- What design guidelines should inform this greenway framework, and how should these guidelines be modified when applied to dense urban settings?
- How can public open spaces be designed as components of the urban greenway to express important cultural characteristics and principles from the past and present?
How can this urban greenway enhance the site's urban ecology?

1.3 Delimitations and Assumptions

1.3.1 Delimitations

The project will be developed in an urban environment, and the design should be adjusted if applied to a site that has different conditions. The design will not consider the underground situation, such as underground utility infrastructure, pipelines or other constructions. Public engagement and partnerships for funding and maintenance are important for a greenway project, but they will not be discussed in this project.

1.3.2 Assumptions

The government and property owners will support the project, and there will be enough budget for this project. The existing road system can be changed without boundary limitations. Shenyang residents will embrace pedestrian, bicycle, and public transit modes as alternatives to driving private automobiles.

1.4 Definition of Terms

**Greenway**--A linear open space established along a natural corridor, river system, ridgeline, or rail corridor, that has been converted to recreational use and is focused on pedestrian, bike, or other uses. These corridors can link parks, natural resources, cultural features, and historical sites with each other and with populated areas (Little 1).

**Sustainable Design**--Sustainable design is a design philosophy that seeks to maximize the quality of the built environments while minimizing of eliminating negative impact to the natural environment (Mclennan 4).
**Complete Streets**—A Complete Streets policy ensures that the entire of way is routinely designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street (McCann and Rynne 3).

1.5 Methodologies

This project used a literature review, case studies, observation and interviews as design methodologies to explore issues and strategies related to greenway design.

1.5.1 Review of Relevant Literature and Documentation

Since greenway design has a long history, many related literature and case studies provided references for the design. Government codes and policies will also affect the design.

The literature review included design manuals, guidelines and codes requirements for urban greenway design; local culture and history; and analyses and evaluations of completed similar greenway projects.

1.5.2 Case Studies

Case studies are another important methodology. Relevant projects provided references and inspiration for the design. Through case study, the design also avoided the mistakes or problems of previous projects. Case study selection followed design goals and objectives.

1.5.3 Observation

Observations were used to analyze existing site conditions. Analysis explored land uses on site, planting design situation, road surface condition, width of bike lanes and sidewalks, public facilities on site and user activities. On-site transportation is also important, so this urban
greenway design observed the existing subway stations, bus stations and parking.

1.5.4 Informal Interviews

This study augmented its methods for greenway planning and design decision-making using a limited number of informal interviews. The sole purpose of these informal interviews is to provide this project with a broader base of opinions and considerations with which to design the greenway and its support systems. A small sampling of potential greenway users, plus local government and private planners and designers familiar with greenway projects were interviewed. The individuals interviewed were asked only pre-determined open-ended questions (see questions below).

The interview questions focused on ideal greenway design characteristics, spatial dimensions and opinions about preferred activities and program elements that would optimize the greenway’s functions, community support and aesthetic characteristics. These interviews included no personal information from the interviewees. Statements from the interviews were recorded and summarized in the final document with no listing of the individuals’ names or contact information. The questions assisted this author in confirming greenway design principles already found in the existing body of literature, while also identified principles and considerations for greenway design that have not yet been addressed in current literature. The interview records from this creative project were not used as analytical data.

Before the questions, interviewees received the following definition:

Greenway--A linear open space that is established along a natural corridor, river system, ridgeline or rail corridor, that has been converted to recreational use and is focused on pedestrian,
bike or other uses. These corridors can link parks, natural resources, cultural features and historical sites with each other and with populated areas.

List of interview questions:

1. What do you think are the most important greenway elements?

2. When people talk about Shenyang, what comes to your mind first?

3. What is a comfortable walking distance for you?

4. What do you think is the most inconvenient thing along Qingnian Street?

5. What public facilities are the most important for you?

6. What will attract you the most if you hear there is a new greenway installed?

7. Which group(s) will be the main users for this greenway?

8. What will be the future land uses for specific areas along the greenway?

9. What will be the most challenging changes needs for implementing the greenway?

10. What are the most inconvenient aspects for pedestrian and bicycle users along Qingnian Street?
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Literature review is an important part of the design process. The term "greenway" first appeared in the 1950s, and the contemporary greenway movement never stopped developing. This literature review included five sections: greenway development, basic greenway design principles, streetscape design principles, ecological benefits and cultural celebration.

2.2 Greenway Development

Charles E. Little's *Greenways for America* is one of the most important publications about greenways. In his book, Little credits Frederick Law Olmsted as the founder of the greenway movement (7), and Little defines greenway in *Greenways for America*:

1. A linear open space established along either a natural corridor, such as a riverfront, stream valley, or ridgeline, or overland along a railroad right-of-way converted to recreational use, a canal, scenic road or other route. 2. Any natural or landscaped course for pedestrian or bicycle passage. 3. An open-space connector linking parks, nature reserves, cultural features, or historic sites with each other and with populated areas. 4. Locally, certain strip or linear parks designated as parkway or greenbelt. (1)

Little describes five general types of greenways: urban riverside, recreational, ecological, scenic and historic, and comprehensive (4-5).

Since the 1980s, European greenways have also earned widespread respect. Tom Turner is a British landscape architect, garden designer and garden historian teaching at the University
of Greenwich in London. In his 1998 book *Landscape Planning and Environmental Impact Design*, Turner defined greenway as "a route which is good from an environmental point of view." He regards greenways in a broad sense to include circulation routes for people, animals, air, water and plants (138).

In Asia, the greenway concept was introduced relatively late, but also developed quickly. Singapore greenways are primarily for recreational use, providing more public spaces for people who live in dense urban areas. Japan suffers from frequent natural disasters, so Japanese greenways play an important role in preventing natural disasters and providing protection for people (Zheng 61).

In China, the ancient greenway concept appeared before 1000 B.C. The Zhou Dynasty built one of the earliest ancient routes, and started planting vegetation and maintaining the route surface. Cuiyun Corridor is the oldest and best-preserved ancient route (Figure 2.1.). Some other ancient corridors in China such as Qinhan Ancient Road, the Silk Road, and Ancient Tea-horse Road are all modern greenway prototypes.

![Figure 2.1. Cuiyun Corridor (“Cuiyun Tourism”)](image-url)
Decades ago, China's primary goal was economic development. City sprawl increased the country's total urban area and population density (Figure 2.2.).

![City Sprawl (Langfang)](image)

Aware of the importance of ecological health, China has started to green cities. Recently, with the completion of the Guangzhou Greenway System, greenways have become more popular in China. In 2009, the *Green Pearl River Delta Road Network Master Plan Outline* was released, followed by the *Green Road (Provincial) Planning and Design Technical Guidelines of Pearl River Region (For Trial Implementation)* in 2010, and *Planning Guidelines of Urban Greenway in Guangdong Province* in 2011. The *Green Pearl River Delta Road Network Master Plan Outline* classifies greenways into three different levels: regional, urban and community. Regional greenways connect cities and protect the regional ecology's health. Urban greenways link critical functional nodes. And community greenways provide routes for residents to reach local public open spaces.
2.3 Basic Greenway Design Principles

2.3.1 Greenway Trail Design

Trails are the most common feature of greenways. Users are various (pedestrian, non-motorized vehicular, non-motorized water, pack-and-saddle animal, motorized vehicular and motorized water trail users), based on different types of trails (land-based, water-based, single user, and multiuser routes) (Flink and Searns 189-211). For urban greenways, sidewalks and bike paths are the main concerns for greenway trails.

A bike path is a necessary composition of an urban greenway. The National Association of City Transportation Officials’ *Urban Bikeway Design Guide* lists four kinds of bike lanes: conventional, buffered, contra-flow, and left-side (Figure 2.3.). The configuration of a bike lane requires a thorough consideration of site condition (NACTO, “Bike Lanes”). The project site has high travel speeds, travel volumes and safety requirements. Thus, a buffered bike lane was the best choice for the project site.

![Bike Lane Typologies](image)

Figure 2.3. Bike Lane Typologies (NACTO “Bike Lanes”)

Width is an important element of bike path and sidewalk design. Based on the *Chinese Urban Road System Planning Code* (1997), the width of bike paths should be based on the number of bike lanes. The number of bike lanes should consider traffic volume at the peak load
period. Thus, the bike path width will vary based on different sites' conditions.

*Guidelines for Guangdong Province Greenway (2010)* advise that for one-way bike paths, the lane width should be at least 5 feet, and at least 8 feet for double lanes. For two-way bike paths, the width should be at least 12 feet. When bike paths combine with urban bridges or tunnels, the width should be at least 6.5 feet.

Various guidelines and manuals provide different recommendations: sidewalks should be at least 5 feet wide, one-way bike paths should be at least 5 feet, 8-10 feet preferred, and one-way double bike paths should be at least 8 feet with buffers.

### 2.3.2 Critical Greenway Nodes

1) *Exits and Entrances*

Greenway exits and entrances bring people into the greenway system (Figure 2.4.). Different from public park entrances, these do not require large gates, and can just be identified by signage along the greenway. The style of an entrance should match the design of the nearby greenway (Zheng 6).

![Figure 2.4. Greenway Entrance (Downtown Greenway)](image-url)
Greenway design should also address nearby parking and bus stations. For instance, the size of the nearby parking will affect the size of the gateway. Bus station locations should also be considered when locating the greenway entrance (Luan 29-30).

2) Special Places and Amenities Near or in a Greenway System

Existing special places and amenities that are near or in a greenway system, such as plazas, parks, schools, commercial centers and communities, should be connected with the greenway. The design can also provide small plazas as buffers in congested areas. These plazas or parks will also be good display places to educate people about local culture.

3) Greenway Stations

Along the greenway, every 1/2-mile should provide a place for people to stop and rest (Figure 2.5.). The distance also should consider the whole length of the greenway, and other facilities along the greenway. Multi-modal greenway stations provide rest for pedestrians and travelers shifting between different transportation modes. It is better to locate these stations based on existing facilities, and they should be sustainable.

Figure 2.5. Greenway Station (He)
2.3.3 Greenway Facilities

1) Services

Public restrooms should be located every 1,500 feet, at the leeward side of main rest or recreation areas. They need not be too obvious, but signs or leading pavement are necessary. Shelters and seats can provide rest for people. Shelters should be placed at different nodes, such as the beginning or end of the greenway, landings of stairs or gathering spaces. Shelters and seats can combine with planting design at main locations to provide nice views for people who are stopping to rest. Other services, such as concessions, drinking fountains, air pumps, charging stations and information boards can combine with seats, shelters and public restrooms (Luan 35-39).

2) Water Features

Water can be potable, irrigation, display or play. It can come from local public water supply systems, wastewater treatment, surface runoff or large cisterns. Different fixtures can provide drinking water, such as hand-pump wellheads, pressure-active water spigots or mechanically cooled water fountains. Drinking water should be provided at every trailhead and combined with other facilities (Flink and Searns 221-76). Water features can be designed together for easier installation and maintenance. For instance, designs often combine drinking water facilities, wastewater treatment, restrooms and irrigation.

3) Trash Receptacles

Trash receptacles should be functional, but also attractive. Semi-open or covered-top trash receptacles are recommended. They should be accessible and set back 3 feet from the edge
of the trail (Flink and Searns 239-76). Trash receptacles should be every 500 feet, especially where people rest. They should be durable and not produce secondary pollutants (Luan 24).

4) Lights

An overall lighting plan should include ground light fixtures, overhead lighting and specialty lighting for signs, artwork and vegetation (Schwarz, Flink and Searns 239-76). Lights should not cause pollution, and must protect greenway safety at night.

2.4 Streetscape Design Principles

Urban greenways always involve streetscape, as evidenced in the Urban Street Design Guide, United States Federal Highway Administration, Metro and American Association of State Highway and Transportation Officials. Drawing from these organizations and work by Keith Richard Sattler (2012), Tables 2.1. through 2.8. summarize streetscape design attributes and specifications.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIDEWALKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidewalk zones</td>
<td>Frontage, pedestrian through, street furniture/curb, enhancement/ buffer</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Residential</td>
<td>4’ wide</td>
<td>AASHTO 2001</td>
</tr>
<tr>
<td>Commercial</td>
<td>&gt;8’ wide</td>
<td>AASHTO 2001</td>
</tr>
<tr>
<td>Minimum pedestrian through zone</td>
<td>6’ wide</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>ADA minimum</td>
<td>5’ wide @ 2% cross slope</td>
<td>Metro 2002</td>
</tr>
</tbody>
</table>
### Table 2.2. Bike lane design guidelines

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIKE LANES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-way bicycle travel, single lane</td>
<td>&gt; 5' wide</td>
<td>AASHTO 1999</td>
</tr>
<tr>
<td>Two-way bicycle travel, dual lanes</td>
<td>&gt; 10' wide</td>
<td>AASHTO 1999</td>
</tr>
<tr>
<td>Three lanes of bicycle travel</td>
<td>&gt; 12.5' wide</td>
<td>AASHTO 1999</td>
</tr>
</tbody>
</table>

### Table 2.3. Vehicle travel lanes (@ design speed 25mph)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VEHICLE TRAVEL LANES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lanes</td>
<td>10' wide preferred, 11' wide along designated truck and bus routes</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>On-street parking lane</td>
<td>7'–9' wide</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Speed reduction mechanisms</td>
<td>Median, pinchpoint, chicane, lane shift, speed hump, 2-way street, roundabout, diverter, signal progression, building lines, street trees, on-street parking</td>
<td>NACTO 2013</td>
</tr>
</tbody>
</table>

### Table 2.4. Crosswalks design guidelines

<table>
<thead>
<tr>
<th>Attribute</th>
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<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CROSSWALKS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crosswalk spacing</td>
<td>Every 200' or &lt; 3 minutes' walking distance</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Yield to pedestrian sign at mid-block crossing</td>
<td>Stop lines should be set back 20'-50' from pedestrian crossing</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Crosswalk marking lines</td>
<td>6”-24” wide, should extend entire crossing path</td>
<td>USFHA 2009</td>
</tr>
<tr>
<td>Spacing between marking lines</td>
<td>6’</td>
<td>USFHA 2009</td>
</tr>
<tr>
<td>Pedestrian safety island</td>
<td>Preferred 8'-10' wide, 40' long with a &quot;nose,&quot; may be enhanced using planters or street trees</td>
<td>NACTO 2013</td>
</tr>
</tbody>
</table>
### Table 2.5. Public transit design guidelines

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
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</thead>
<tbody>
<tr>
<td><strong>PUBLIC TRANSIT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus lanes</td>
<td>&gt;11' wide, if bus only, must be pained red</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Transit stops</td>
<td>Far-side bus stop preferred, Pedestrian crossing should be accommodated behind the departing transit vehicle</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Bus zone with shelters</td>
<td>7'-8' wide added to sidewalk width</td>
<td>Metro 2002</td>
</tr>
<tr>
<td>Bus shelter dimensions</td>
<td>&gt; 5' x 7.5'</td>
<td>Metro 2002</td>
</tr>
<tr>
<td>Information board</td>
<td>Station name, route maps, schedule</td>
<td>NACTO 2013</td>
</tr>
</tbody>
</table>

### Table 2.6. Curb extension design guidelines

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
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</thead>
<tbody>
<tr>
<td><strong>Curb Extensions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gateway</td>
<td>1'-2' narrower than the parking lane, the length &gt; the width of the crosswalk, with ADA access and stormwater management features</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Pinch point/ midblock</td>
<td>Pedestrian crossing should be marked when volumes exceed 2,000-3,000 vehicles per day</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Chicane/offset</td>
<td>May be 45-degree angle, s-shaped road</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Bus bulbs</td>
<td>Align the bus stop with the parking lane, 8'-10' wide, 45-degree return angle</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Corner radii</td>
<td>10'-15'</td>
<td>NACTO 2013</td>
</tr>
<tr>
<td>Visibility</td>
<td>Daylight intersections by removing parking within 20'-25' of the intersection</td>
<td>FHWA 2013</td>
</tr>
</tbody>
</table>

### Table 2.7. Street building guidelines

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
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</thead>
<tbody>
<tr>
<td><strong>BUILDING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height-to-width enclosure</td>
<td>1:1 to 1:3</td>
<td>Metro 2002</td>
</tr>
<tr>
<td>Building frontage types</td>
<td>Stoop, porch, and common lawn area</td>
<td>Metro 2002</td>
</tr>
</tbody>
</table>
Table 2.8. Street tree design guidelines

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specifications</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>STREET TREES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree spacing</td>
<td>12'-25' depending on species</td>
<td>Metro 2002</td>
</tr>
<tr>
<td>Tree wells</td>
<td>5' x 5'</td>
<td>Metro 2002</td>
</tr>
</tbody>
</table>

2.5 Ecological Benefits

Greenways can enhance the natural values of urban realms. In Conservation Buffers:

Design In Guidelines for Buffers, Corridors, and Greenways (2008), Gary Bentrup provides over 80 illustrated design guidelines synthesized and developed from a review of over 1,400 research publications. This guide focuses on designing buffers and corridors which involve linear elements such as windbreaks, fencerows, and riparian habitats. "Patches" are often remnant areas of woodland or prairie, and the "matrix" often includes developed cropland or urban areas (Figure 2.6). "Patches" and the "matrix" must be considered in the design process to help achieve many desired objectives. Location, structure, and management of nearby "patches" and "matrices" influence the types of functions that buffers will perform and their effectiveness (Bentrup 2-4).

Figure 2.6. Landscape Described in Basic Ecological Terms (Bentrup 3)
Urban greenways are usually too narrow to overcome the effects of edge, and may do little to foster the survival of native wildlife species. If the greenway's objective is to protect habitat, the design should minimize human impacts and human-wildlife conflicts (Flink and Searns 121-39).

For urban greenways, the design can use sidewalk planters (Figure 2.7.), landscaped medians, vegetated swales, vegetated curb extensions, permeable paving and street trees to reduce stormwater flow, improve water quality, reduce urban heating, minimize carbon footprints, enhance pedestrian safety and beautify neighborhoods (Environmental Protection Agency 1). Greenways can also help clean air, because vegetation filters carbon dioxide, carbon monoxide and other toxic pollutants from the atmosphere (Flink and Searns 121-39).

![Figure 2.7. Sidewalk Planters (ARRA, “Green Streets”)](image)

Solid waste includes garbage from trash receptacles, vegetation waste, mud and sand washed onto a tread surface by floodwaters and other garbage in public places (Flink and Searns 121-39). Greenway maintenance staff or volunteers should help keep the greenway clean. Onsite composting is a good solution. Garbage-sorting receptacles and educational signage are also important to sustainably treat solid waste.
Greenways can protect native vegetation and animal species. To remove exotic or noxious species that invade the corridor, plants should be cut before they go to seed, and species that shade or crowd out undesirable invasive species should be cultivated. Vegetating, repairing and replacing man-made facilities and planting native vegetation help greenways bring ecological benefits to an urban environment. However, they can also permit the transmission of fires, predators and infection. The design should consider potential diseases among the plant and animal species. Careful plant species selection is important because once invasive species are established in the greenway, they are difficult to remove.

Urban greenways can also be energy-efficient, generating solar, electric, thermal, piezoelectric, kinetic, biomass and wind power. A number of design strategies can reduce energy, such as carbon-neutral solutions, renewable energy installations, motion sensors, LED lighting, carbon sequestration and intelligent transportation systems (Sipes 90-95).

Shenyang is located in a limited wind resource zone, so wind energy is usable in limited ways. The average wind speed is 2.5 m/s-3.0 m/s, average wind power density is around 50 w/m², and available annual wind hours are 3,000-4,000. Wind speed changes seasonally: the highest speed is usually in spring (March to May), and the wind power density can reach 150 w/m². Solar energy is also limited, but can power greenhouse and solar lighting. The annual sunshine duration is around 2,400-2,600 hours, and the annual solar radiation is 4,800-5,000 mj/m² (Gong, et al. 654-661).

Travel is a natural human urge; however, the motorized transport mode has caused many problems in recent decades. Noise and air pollution have serious negative impacts on our health.
Changing our travel mode from driving to walking or cycling for short journeys, and using public transport for longer ones is necessary for our future development (Pitchie and Thoms 21-22).

It only took the Dutch a few years in the late 1970s to substantially reconfigure their streets to protect cyclists from cars (Fleming 8). This gives confidence that if a design can provide environmentally friendly alternative transit choices, this change of travel mode can be achieved successfully. Urban greenways can provide alternative transit choices, promote this change and put the road on a diet.

### 2.6 Cultural Celebration and Place Making

The U.S. National Park Service defines cultural resources as the "sites, structures, districts, and objects significantly associated with or representative of earlier people, cultures, and representative of earlier people, cultures, and human activities and events." China has a long history and splendid culture, with the rapid development, how to balance the culture protection and city development becomes a serious problem.

An urban greenway project can provide a series of dynamic public open spaces, using cultural language as place making strategy to remind people about their brilliant culture (Luan 13). Public spaces can also provide meeting, recreation, interchanges between different modes of transport and symbolic importance (Gehl and Gemzoe 86-87).

Ethnography and archaeology are two important tools to help identify cultural resources (Flink and Searns 62). A greenway project can use ethnography and archaeology to explore the city’s culture, and to create spaces that will foster people’s feeling of belonging and sense of
community.

The largest city in Northeast China, Shenyang is the capital plus the political, economic and cultural center of Liaoning Province. It is also an important industrial hub and a famous historical city. The Ancient Qing Dynasty began there, and Shenyang boasts one of the country's two best preserved imperial palace complexes.

2.6.1 Early Settlement

The 43-acre Xinle Neolithic site was first excavated in 1973. It is an important Neolithic matriarchal society relic, and also represents the earliest village culture of Shenyang city. Xinle relics include more than 40 semi-basements (Figure 2.8.), and many stone artifacts, pottery, jade articles, bone artifacts, jet products and wood carvings. One bird-shaped carbonized wood carving (Figure 2.9.) has a history of more than 7,200 years. It is the oldest historical relic found in Shenyang, and also the oldest documented wood carving in the whole world. The Shenyang government commissioned a sculpture named "The Sunbird" based on it to represent local culture (Yu 113).

Figure 2.8. Rebuilt Primitive Houses (Dian)  
Figure 2.9. The Sunbird (Dian)
2.6.2 Qing Culture

In 1625, Nurhaci and Hong Taiji started the Qing Dynasty in Shenyang. This was China's last imperial dynasty and therefore "Qing Culture" plays an important role in Shenyang's cultural iconography. The Mukden Palace (Figure 2.10.) is the former imperial palace of the early Qing dynasty. It was built in 1625, and the first three Qing emperors lived there from 1625 to 1644. Since the end of monarchy in China, the palace has been converted to a museum in the center of Shenyang. The Fu Mausoleum is the resting place of Qing Dynasty founding emperor Nurhaci and his wife, Empress Xiaocigao. Zhao Mausoleum is the burial site of the second Qing emperor Huang Taji, and his empress Xiaoduanwen Borjite. The tomb is located within Beiling Park, in northern Shenyang. Both mausoleums were declared UNESCO World Heritage Sites (Wang 112-18).

Figure 2.10. Qing Culture (Adimin)
2.6.3 Industrial City

Called "the eastern Ruhr," Shenyang is an important Chinese industrial city that has been diversifying its industry and now has a solid industrial foundation. Many industrial products were first made here, such as the very first airplane and the numerical control tool. Today, Shenyang has a series of industrial museums to educate people and remind citizens of the city's brilliant industrial history (Chen 36).

2.6.4 Recreational Life

Shenyang is a "Happy City", meaning people know how to enjoy their lives here. An important part of people's recreational time is Quyi, Chinese folk art forms including ballad singing, story telling, comic dialogues, clapper talks and cross talks.

Chinese fitness dancing, also called "public-plaza fitness dancing," is a popular activity throughout China (Figure 2.11.). Several forms exist, the most common being a line dance where a large number of women dance in synchronicity to music played over a loudspeaker. The main purpose is fitness, but it is also done to continue and perform traditional dance moves, for community spirit and simply for fun. Another form of fitness dancing consists of ballroom-style dancing in pairs, with male-female partnerships being most common. Many people enjoy this dancing, but some are bothered by its loud music (Mou 86-88).

Figure 2.11. Chinese Fitness Dancing (Hong)
Night markets (Figure 2.12.) are another popular recreational activity. Typically open-air markets, they operate at night and are generally dedicated to more leisurely strolling, shopping and eating than more businesslike day markets (Zhou 13).

![Night Market](image)

Figure 2.12. Night Market (“Love the Night”)

2.7 Summary

The literature review above provided an analysis summarizing various street, ecological and cultural design issues addressed in the following project planning and design. It only selected information suitable for the site's unique condition and the design principles that can be applied in a high-density urban area. It also helped inspire this urban greenway's design considerations and framework, such as greenway services and greenway programs.

The greenway design followed these design principles and framework, but was also flexible based on site conditions. For instance, different design codes have various requirements for sidewalk widths. This literature review identified a suitable range of guidelines for the project site. The greenway design followed this range, but chose a suitable width based on site analysis.
CHAPTER THREE: CASE STUDIES

3.1 Introduction

The following case studies are different projects addressing multimodal circulation, culture and environmentally friendly designs. Projects discussed include Kitsilano Neighborhood, MetroGreen greenway and the Pearl River Delta Regional Greenway.

3.2 Kitsilano Neighborhood

3.2.1 Project Introduction

Kitsilano is a neighborhood located on the shore of English Bay, in downtown Vancouver, British Columbia (Figure 3.1). The original landform was mostly dense forest and wetlands. By the late 1940s, Kitsilano was a fully developed Vancouver neighborhood, attracting many college students and other young people. Then, because of nearby beaches and parks, many older, wealthier residents moved there (Figure 3.2). By providing better alternative transportation infrastructure, the city reduced dependence on personal vehicles. Today, because of the site's improved walkability, safer bike lanes, and comprehensive bus service, fewer than half of Kitsilano's residents drive a private vehicle to work.

Figure 3.1. Location (Brooks)  Figure 3.2. Historical Picture(Gordonelson)
While most parts of Kitsilano are residential, West 4th Avenue (Figure 3.3.) and West Broadway are two main commercial corridors that serve residents’ various demands within a comfortable walking distance. Because blocks are divided into small lots, the higher intersection density makes Kitsilano a highly walkable and accessible neighborhood. Kitsilano also keeps adding more public open space, like the new 11th Avenue Greenway connecting the Arbutus Corridor with a city park (Figure 3.4.).

Figure 3.3. the West 4th Avenue (Vancouver) Figure 3.4. Walking Map (KitsTreemap)

3.2.2 Lessons Learned

Kitsilano is a well-developed neighborhood with an appropriate density; so public projects have sufficient users. Services along the two commercial corridors are various, so people can reach their daily demands within walking distance. With alternative modes of transportation, and a convenient walking experience, Kitsilano has reduced private car usage. This urban greenway project is a high-density area with various land uses, which makes it a good site to develop an alternative transportation system to reduce private car use and to support sustainable development.
3.3 MetroGreen Greenway

3.3.1 Project Introduction

MetroGreen is a proposed 1,144-mile regional greenway system, which will connect seven counties in the Kansas City metropolitan area (Figure 3.5.). MetroGreen will link corridors of land to the landscapes and destinations that people value. It will build pathways that people can travel by foot, bicycle, rollerblade or horseback (Figure 3.6.). Corridors will be wide enough to protect water courses, preserve historic landscapes and beautify area roadways. The MetroGreen system plan covers Leavenworth, Johnson, and Wyandotte Counties in Kansas, and Cass, Clay, Jackson, and Platte Counties in Missouri. Because of its huge scale, the contexts are complicated, including public and private natural areas, greenways and trails.

Figure 3.5. MetroGreen Map (Greenways)

Figure 3.6. Various Types of Greenways (Briechle)
The original MetroGreen Vision was completed under the support of the American Society of Landscape Architects and the Community Assistance Team associated with their 1991 national conference. MARC took charge of the project, providing the base funding for regional coordination but depending on local support for implementation of the green infrastructure network.

A broad coalition of the region’s stakeholders—including local and regional staff, elected officials, and civic leaders—participated in identifying the regional greenway priorities. The greenway planning integrated GIS analysis of existing natural resource information and development trends. Planners held many open houses to get more people involved.

### 3.3.2 Lessons Learned

MetroGreen provides a safe, convenient and unique transportation experience. It connects people with nature and encourages physical activity and mental relaxation. When people get close to nature, they know more about the importance of protecting natural resources and easily get education on site (Figure 3.7). The greenway system also promotes economic development and environmental protection. The concept of connecting people to nature is important for an urban greenway. The linear features can also heal a dense urban environment.

![Figure 3.7. MetroGreen’s Event (MARC)](image-url)
3.4 The Pearl River Delta Regional Greenway

3.4.1 Project Introduction

The Pearl River Delta (Figure 3.8.) is the low-lying area surrounding the Pearl River along the southern coast of China. It is one of the most densely urbanized regions in the world and one of the main hubs of China's economic growth. The Pearl River Delta Regional Greenway began in 2010, when China hosted the Asian Games and the World University Games.

Figure 3.8. The Pearl River Delta Region (Zhou 45)

The Greenway is an area of more than 13,000,000 acres located in the Pearl River Delta region and connects nine cities. It also connects main natural and cultural resources in the whole region with three types of greenway planning: habitat, countryside and urban (Figure 3.9.-3.11.).
Several goals are behind the planning of this greenway, including protecting habitats, improving livable conditions, expanding domestic demand and guaranteeing economic growth. The project also celebrates historical resources (Figure 3.12.), and encourages rural-urban integration.

Six main greenways, totaling about 1,050 miles, construct the framework of the whole greenway network (Figure 3.13.). Those six lines connect more than 200 forest parks, natural reserves, scenic areas, country parks, waterside parks and historical and cultural heritage.

This greenway has been built since 2010 and was planned to be completed within three years. The regional plan was constructed first, and then local planning followed the regional plan's guidelines with an examination of local conditions to apply into its own detailed designs. After the design was completed, trees were planted. Spring is the best time for planting, so missing this time would have resulted in a low survival rate for plants, as well as other negative effects.
3.4.2 Lessons Learned

This is one of the most important recently developed greenways in China. It has driven the development of other greenways and provided a practical case study to be evaluated. It is a good start to familiarizing people with the greenway concept.

It has provided a new recreation choice and more green open spaces for people, slowing them down and bringing them to nature from a busy city life (Figure 3.14.). It encourages people to value nature, thereby protecting it.

However, this project still has some problems.

1) **Greenways do not connect together as a system.**

Although now, people and governments are paying more attention to environmental design, "greenway" is still a new term for China. More huge public parks and plazas are built each year, but if they can be connected together, they will work more effectively and can have a broader service radius to serve more people.

2) **The design lacks landscape ecological theory.**

Greenways are not just for recreation; they also have an important impact on ecosystems.
If greenways are wide enough, and designed well, they will bring more ecological benefits to the urban environment. However, in China, greenway design still mostly focuses on recreation but ignores ecological functions.

3) *Greenways should be multifunctional.*

Urban greenways should be multifunctional, serving ecological, recreational, cultural and educational functions. But most greenway designs in China do not achieve these goals. A well-designed greenway system can meet various people's demands and be multifunctional.

4) *Public facilities are lacking.*

Greenways must have enough facilities to serve people who actually use them. Some greenways in China do not provide enough public facilities, such as seating areas, trash receptacles or restrooms. Greenways must also provide enough shade in summer and shelter in winter.

3.5 **Summary**

All three case studies showed how a greenway can increase livability and support sustainable development, and identified some design considerations for this urban greenway project. This design considered all lessons learned from the case studies. When a design becomes reality, these cases are references that help designers recognize successful elements that should be highlighted and mistakes that should be avoided.
CHAPTER FOUR: SITE INVENTORY AND ANALYSIS

4.1 Introduction

The project site is located in the recently developed district of southern Shenyang (Figure 4.1.), starting from the Hunhe River bank, moving north along Qingnian Street. It is an exciting place and highly used by local residents, citizens from all over the city and tourists.

![Site Location](image)

Figure 4.1. Site Location

4.2 Background Information

4.2.1 The City of Shenyang

1) Introduction

Shenyang is located in the north of China's northeast region, in the middle of Liaoning Province. Shenyang is the largest central city in the northeast region of China. It is the political, economic, cultural, scientific, educational and military center of the northeast region. Shenyang's area covers more than 13,000 square kilometers, with a population of 8,257,000. The downtown area is 3,495 square kilometers, with a dense population of 7,280,000.

Shenyang's primary geographical condition is plains, with some mountains and hills...
mostly in the southeast part of this city. The Liao, Hun and Xiushui Rivers run through the city.

Shenyang has a warm sub-humid continental climate with four seasons. Temperatures range from -31°F to 97°F, with an average temperature of 47°F. Annual precipitation is 500mm, with an annual frost-free period of 183 days. The city flower is the rose, and the city tree is the Chinese pine.

2) Design Considerations

Shenyang is a metropolis with a brilliant history and abundant natural resources, but rapid urbanization has consumed most open spaces and displaced cultural elements. Therefore, Shenyang is a great site to develop a new urban greenway model that other cities can replicate.

![Figure 4.2. Site Contexts](image)

4.2.2 Hun River

1) Introduction

Hun River is a 229-mile-long tributary of the Liao River, called the Mother River of Shenyang (Figure 4.2.). The Xinle Culture started here 7,200 years ago. During the Ming and
Qing dynasties, the river was also heavily used for logistics and transportation. The river was once called "Shen River," and "Yang " means north. The ancient city was located on the north side of the river, thus the name "Shenyang."

Shenyang is an industrial city, and many factories used to drain waste directly into the river, leaving it heavily polluted and smelling terrible (Figure 4.3.). In 2001, the Shenyang government closed all drain outlets along the river, and started to heal its ecologic systems. Hun River is now a healthy, beautiful place, and many different types of development projects are being built along both sides of the river (Figure 4.4.).

Figure 4.3. Polluted Hun River (Wang) Figure 4.4. Riverfront Walk (Shuangye)

2) Design Considerations

This greenway project starts from the Hun River bank and travels north along Qingnian Street. Connect people to their "Mother River" reminds them about their culture, while also providing more opportunities for people to enjoy the beauty of nature. The project site is heavily used by automobiles; impermeable surfaces cover much of the area, causing polluted stormwater to flow directly into the river. Transforming the site into an urban greenway and managing stormwater on site can reduce river pollution.
4.2.3 Qingnian Street

1) Introduction

Qingnian Street (Figure 4.2.) is the geographical, political, economic and cultural central axis of Shenyang City. It is one of the most important 8-10-lane commuting streets in Shenyang, and leads people from Shenyang Taoxian airport into the central business district. Land uses vary along Qingnian Street, to support an active street life.

Left turns are not allowed along the entirety of Qingnian Street, and the increasing number of private cars has made traffic congestion a serious problem (Figure 4.5.). Pedestrians, bicycles and motor vehicles share the same lanes, and high travel speeds along Qingnian Street make the street become dangerous and disordered. With urban sprawl, old buildings have disappeared, replaced by expensive residences, commercial buildings and offices along Qingnian Street.

Figure 4.5. Traffic Congestion along Qingnian Street (Niu)
2) Design Considerations

Qingnian Street is the primary arterial street through downtown Shenyang. The government expects to redevelop this street not just for transportation, but also for creating places where people want to be. Now it is a dangerous urban thoroughfare, without any unique characteristics. It is a great site for a demonstration project to show how a new urban greenway can provide a convenient multi-modal transit experience, ecologically friendly urban environment and unique cultural identity as a place where people want to live, work and play.
4.3 Site Land Uses

1) Introduction

The site in southern Shenyang is a recently developed area, and land use varies from natural, institutional and residential to commercial (Figure 4.6.).

Figure 4.6. Land Uses
Five green spaces are located within a 5-minute walk from the project site: 2 riverfront parks, 2 parks related to exhibition centers and 1 street park. The average size of the five green spaces is 93 acres. These parks are all popular, but some are inadequately designed with low-quality connections to surrounding areas. These green spaces are still developing, attracting more people to spend their leisure time here, getting close to nature.

Commercial land uses include shopping malls, department stores, automobile dealerships, restaurants mixed-use complexes, combining commercial, office and hotels. Xinshijie Commercial Center is a newly planned regional shopping center, still under construction. On the west side of Qingnian Street are many hotels with restaurants, and the east side has many auto dealerships and some mixed-used commercial and office buildings.

Cultural institutional uses along the site are all popular places, and most are on the east side of the project site. Many institutions are for educational purposes, primarily serving youth. The Shenyang Science Center, Shenyang Public Library, Children’s Activity Center and Shenyang Cultural and Arts Center are all popular destinations for citizens and tourists.

The site location is convenient and close to nature, so it attracts much residential development. Residential typologies are various, including high-rise multi-family and suburban-style houses. Some projects are still under construction, and more are still being planned.

2) Design Considerations

Based on various land uses, the urban greenway design must be flexible. Physical patterns and functions must be suitable for the surrounding land uses. For instance, the greenway
passes near commercial areas where public plazas should provide gathering spaces to attract consumers. When the greenway passes near a residential area, more soft lines and colors can relax people from their daily work, and native plant communities can create a sense of place, while also providing a buffer from the busy street, reducing air pollution and noise.

Now different land uses are isolated, without any connections to each other. The greenway project can connect these various land uses and provide a more comfortable walking experience. People can walk to riverfront parks from their homes, have a picnic there and then go to see an art exhibition. They can also go to a nice restaurant after the exhibition or just find a concession near the exhibition center. After dinner, they can go out with their family to the night market, watch a movie or enjoy fitness dancing together.
4.4 Activities

1) Introduction

Since the project encompassed an area with various land uses, there were various human activities to consider, which differed depending on the context (Figure: 4.7.). Natural areas attract more families to enjoy their time together, people mingle at bus stations, commercial areas draw many shoppers, and residential areas are lively with families.

Figure 4.7. Activities along Qingnian Street

2) Design Considerations

The greenway design should provide suitable spaces and services to support different human activities. For instance, waiting always happens at bus stations, and the environment for waiting is just a simple shelter. To provide a better experience, the design offered seating at bus stations. From the inventory, another consideration is many people talking while standing outside
the commercial areas. Adding more public plazas will provide better gathering spaces for people.

Other activities also should be considered, and the greenway design must support and improve people's different experiences along the site.

4.5 Circulation

1) Introduction

The major street through the site is a segment of Qingninan Street (Figure 4.8.). It is a north-south arterial, bringing people from the airport or other cities to downtown. The part of Qingnian Street within the site boundary is an 8 to 10-lane 2-way thoroughfare where left turns are not allowed. The average width of Qingnian Street is 150 feet, with a structural median but no plantings. Along the whole project site, most pedestrians and bicycles share the same lane (Figure 4.9.). Some parts of the project site have a bike lane, but people always feel unsafe and seldom use it. On-street parking is common along Qingnian Street, which causes many conflicts (Figure 4.10.)
Figure 4.8. Main Street and Feeder Routes

Figure 4.9. Pedestrian and Cyclists Share a Same Lane

Figure 4.10. On-street Parking Cause Conflicts
The whole site has three different areas with their own characteristics (Figure 4.11.). The first, from the Hun River to the Shenshui Road, is a 10-lane street, and linear parks along both sides of Qingnian Street make this segment more open and natural feeling. The next area spans between Shenshui Road and the public library. It turns to an 8-lane street, with tall buildings along both sides, making this segment more enclosed. Then the site becomes open again, with street parks and the public library. Figure 4.11. shows different dimensions of various segments of Qingnian Street.

![Figure 4.11. Different Characteristics of Qingnian Street](image)

The site currently has two subway stations, and six bus stations (Figure 4.12.). The average distance between stations is 0.3 mile. Major transit routes going through the project site include 11 bus routes, 1 airport bus and 1 subway line.
The Shenyang subway system is new and still under development. The first planning phase included 7 routes, with two already in use. Line 1 is a 17-mile-long east-west route, opened on September 27, 2010, with 22 stations. Line 2 is a 12-mile-long north-south route, opened on January 9, 2012, with 19 stations. The five other routes will be complete by 2018. Line 2 passes through the project site. Shenyang's public transportation system is still developing. For instance, the tramway network currently comprises 3 lines but eventually will expand to several more. Better public transportation will bring more people to this project site and connect
the greenway to other parts of the city. It will also help to reduce private cars’ usage.

2) Design Considerations

The project site has different characteristics, so the greenway design must be flexible to fit each context. The major considerations are to reduce private automobiles, solve conflicts on site and design safe, comfortable sidewalks and bike paths. Enhancing public transportation systems is an important way to attract more users and reduce private vehicles. Sidewalks and bike paths should be separated and buffered from fast automobiles, but also convenient to users. Connections between different destinations also should be unique, beautiful and comfortable.

4.6 Microclimate

1) Introduction

Shenyang's latitude is 40 degrees north. The solar altitude in summer is 72.2 degrees, and is 24.6 degrees in winter. The prevailing wind direction is south-north. The middle part of the site has more tall buildings. The canyon effect produces more shade, increases wind speed, and releases heat at night. Vehicles on Qingnian Street release pollution and heat, while green spaces evaporate moisture (Figure 4.13.-14.).
Figure 4.13. Microclimate—Wind and Emission

Figure 4.14. Microclimate—Shades, Prevailing Winds and Sun Path
2) Design Considerations

Planting design should be based on various microclimates. Adding shelters and plants will reduce surface temperature. Shelters can also block cold winter wind and protect people from rain. Widening street vegetation can help reduce noise pollution and heat from the street.

4.7 Vegetation Conditions

1) Introduction

The main tree species on site are Ginkgo biloba, Ponulus hopeiensis, Robinia pseudoacacia, and Pinus tabulaeformis Carr. The main shrub species are Amygdalustriloba (Lindl.) Ricker, Syringa oblata, and Ligustrum obtusifolium Sieb. et Zucc. The main ground cover species are Hosta plantaginea (Lam.) Aschers., and Canna indica Linn. These are all well adapted to the street environment, but some parts of the groundcover are badly damaged by pedestrians. Many vegetated areas are not accessible (Figure 4.15.).
Figure 4.15. Vegetation Condition
2) Design Considerations

The vegetated area along Qingnian Street is widened to add more layers, gain ecological value and create vertical interests. Some planting beds are too formal for the context, and not accessible. It will be better to combine the plants with seating and pedestrian paths. Adding more native plant species to mimic local plant communities will give the site unique characteristics and bring more environmental benefits.

4.8 Noise

1) Introduction

Noise along the site averages more than 65dB, and mainly comes from Qingnian Street, especially around intersections, where the noise is louder than 85 dB. People can clearly feel the noise while walking along the whole site. Street trees do not block the noise, and linear parks will work better (figure 4.16.).
2) Design Considerations

Adding vegetation can help reduce noise, especially near residential areas, but the design should also consider noise barrier panels. Shelters can provide seating, and if they also can reduce noise, then the seating environment will be more comfortable for users.

4.9 Night Views

1) Introduction

During the night, user groups along Qingnian Street are primarily young people. The climate is cooler, and people go out to enjoy their leisure time after a busy work day. More
people gather in residential areas and near the public library. Some people use the plaza in front of the library for talking and recreation, but most people just walk through the area. Some retailers and security workers are still working at night.

Lights along the project site are sufficient, but all lights are the traditional yellow type. They also have too much wasted uplight. Traditional lanterns are used as lights. Big display screens on some buildings and on bus stations show advertisements (figure 4.17.).

![Figure 4.17. Night Views along Qingnian Street](image)

2) Design Considerations

Replacing lighting along this site with sustainable alternatives will save more energy and let people enjoy the beautiful stars in the sky. Green energy lights with less wasted uplights can be a good choice. Fixtures also can be more interesting than just yellow color and single form. Adding more traditional elements will make the night view more interesting and give people a sense of place.

During the night, many people still use the site. If the design can provide more spaces to
support activities and seating with good security, this place can be used more efficiently. For instance, those display screens can be LED screens and play some movies in the evening. They can be more sustainable, but also attract more people gathered together. Based on site inventory, adding retailers who sell food would also be a great asset. A night market can be a lively place to provide food. Night fitness dancing is another popular activity to consider for the greenway project.
CHAPTER FIVE: INTERVIEW ANALYSIS

5.1 Introduction

Research for this creative project included interviews with a group of 50 potential greenway users, 2 city planners and 3 landscape architects. The interview process selected random locations and times to cover a broader sample pool. Since many Chinese people are still not familiar with greenways, interviewers provided respondents with several greenway photographs with definitions of relevant terms. Interviewers asked six questions relating to greenways: general greenway elements, local culture, walking distance, site evaluation, public facilities and greenway attractions. Interviewers also asked design professionals (city planners and landscape architects) four questions related to user groups, land uses, design challenges and design concerns.

5.2 Responses From Potential Greenway Users

The following sections report potential users' responses about general greenway elements, local culture, walking distance, site evaluation, public facilities and greenway attractions.

5.2.1 General Greenway Elements

Interviewers asked what people think are the most important greenway elements. Almost all interviewees (49 out of 50, 98%) mentioned shade and plants (natural features). One interviewee said, "A greenway is successful to me if it provides a comfortable walking experience, and lets me escape from urban life." This man was also one of 37 (74%) interviewees who mentioned a comfortable pedestrian experience as important. People want a quiet, wide path with quality pavement. One interviewee said, "There are always crowded people everywhere,
and the road surface is so boring and uneven." Most interviewees (42, 84%) said their major commute mode is public transportation, and all 50 interviewees walk to destinations after work during leisure time. The other top three answers about what people associate with greenways were exercise facilities (34, 68%), snacks (29, 58%), and transit stations (24, 48%).

5.2.2 Local Culture

When asked what first comes to their mind about Shenyang, 44 people (88%) named the Northeast culture. One interviewee said, "Everyone knows that Northeastern people are open and direct. I also love our food, such as night market snacks." Interviewees also talked about the industrial city (38, 76%) and Qing Dynasty Culture (32, 64%).

5.2.3 Walking Distance

All interviewees said for daily life or commuting, shorter walking distances are better. But for recreation or exercise, 43 (86%) expressed willingness to walk more than 30 minutes but less than two hours.

5.2.4 Site Evaluation

Most interviewees (47, 94%) believe the current project site does not offer enough shade. One interviewee said, "It is too hot during the summer time when walking along Qingnian Street. And when people wait for a bus, there are no shelters or trees to provide shade either." No seating is another concern for 38 (76%) of interviewees. Safety also concerned 34 (68%) of the on-site interviewees. One said, "There are not enough intersections for pedestrians, so people randomly cross this 10-lane street, which is really dangerous." Some (14, 28%) also mentioned that Qingnian Street is supposed to be a boulevard with a unique characteristic, because of its
importance to Shenyang city. But now it is just a wide, fast and boring thoroughfare that provides no sense of place.

5.2.5 Public Facilities

Interviewees identified the three most important facilities along greenways as seating (44, 88%), trash receptacles (41, 82%) and lights (38, 76%). People also mentioned shelters, charging stations, food and drink, exercises facilities, restrooms and exhibitions.

5.2.6 Greenway Attractions

Natural features are the most important greenway attractions for 48 (96%) of respondents. One said, "If someone tells me there is a linear park built recently, with a high density of plants, I definitely will go and explore that." Another said, "I love water features. If the water quality is good, I will feel interested in this project." Many interviewees (33, 66%) also expressed interest in new things. "New things always attract people. When the newspaper says there is a ‘first’ something installed somewhere, everyone wants to check it out." A few interviewees (9, 18%) also expressed that if public transportation is convenient, they will feel curious and will go at least once.

5.3 Responses From Design Professionals

The following sections report responses from city planners and landscape architects about user groups, land uses, design challenges and design concerns.

5.3.1 User Groups

All five design professionals agree that older people (>60) and college students will be the major user groups for the greenway. They are more independent and have more leisure time
to spend walking or biking along the greenway. Perhaps more people will commute through this
greenway, because of the more comfortable experience. This group of respondents also
mentioned that research shows male users typically outnumber female users for a greenway
project.

5.3.2 Land Uses

Land uses along the project site will not change too much in the next several years. It is a
recently developed zone, so most projects are relatively new. Mixed-use is the major
characteristic for this site. Many buildings are multi-function, combining retail, offices,
restaurants and hotels. Land uses are highly varied, mixing commercial, institutional, recreational,
educational and residential.

5.3.3 Design Challenges

Left turns are not allowed along the whole site, which is the greatest concern for the
design. The context is complex, and connecting and unifying all the destinations with a flexible
design will be another challenge. Because of the complex context, applying cultural elements and
appropriate cultural programming will also be challenging.

5.3.4 Design Concerns

Design professionals also see insufficient shade, lack of seating and safety problems as
major concerns. The heavy traffic moves too fast, creating serious air pollution and noise. The
paved street surface is too open, without enough plants, making it an urban heat island with
stormwater runoff problems. The site is also too generically modern, and lacks unique
characteristics.
5.4 Summary

Most people in both respondent groups expressed that too much traffic and crowds of people along Qingnian Street make them feel uncomfortable. They want more shady areas, natural features and public facilities. Safety is another problem for the project site. It is common for pedestrians and bicyclists to share one lane. Some intersections are too far from public transit stations or the main gateways to residential and commercial areas.

Respondents mentioned enjoying natural features as the most desirable factor along greenways. People also expressed the demand for public facilities. They want shady areas, fitness equipment, shelters, lights, restrooms, trash receptacles and seating areas. Most people also mentioned that having places to buy and enjoy food and drink coffee while relaxing along the greenway would be a great experience for them. When asked to name the most important elements of Shenyang city, many people mentioned Northeast culture, industrial success and imperial culture.
CHAPTER SIX: DESIGN CONSIDERATIONS

Based on the research discussed in prior chapters, and specific conditions of the project site, the following design goals support the framework for the final design proposal.

6.1 Design Goals and Objectives

Goal 1: Redesign the Qingnian transit corridor to encourage walking, cycling and public transit to reduce private car use.

Objective 1: Enhance the existing bus and subway system by making them more accessible, convenient and aesthetically engaging.

Objective 2: Develop well designed bike paths and sidewalks.

2.1. Design sidewalks and bike paths that are safe, separate, comfortable and aesthetically attractive.

2.2. Offer public pedestrian facilities (shelters, seating, trash receptacles etc.) within a 5-minute walking distance, at the main or most attractive greenway components.

2.3. Provide services within a 10-minute biking distance (air pumps, restrooms, concessions, electric charging, seating, trash receptacles, shelters, transit stations etc.).

Goal 2: Use cultural language for place-making.

Objective 1: Design a series of public spaces based on different contexts, combined with local cultures that unfold like a chronological timeline of stories.

Objective 2: Plant native vegetation based on different microclimates and the designed themes on site to mimic the local ecosystem.

Objective 3: Incorporate cultural programming, such as fitness dancing, ice-sculpture festivals,
farmer's markets, night markets and outdoor exhibits.

**Goal 3: Enhance environmental benefits.**

**Objective 1:** Transform excess pavement into native vegetation which is tolerant to road conditions.

**Objective 2:** Manage stormwater on site.

**Objective 3:** Use green energy (solar, wind) to support facilities on site.
6.2 Greenway Frameworks and Programming

Based on the three design goals, the proposal redesigned circulation, enhanced ecological benefits and celebrated culture for place-making (Figure 6.1).

Figure 6.1. Greenway Framework
Figure 6.2 shows services this greenway design provided. The whole project site – Qingnian street, various destinations along the street and the edges between the street and destinations – linked together to create places where people want to live, work and play. Programs varied along the greenway based on different contexts, seasons and time of day. For instance, the multi-functional stage will host a morning farmers' market, a night market, and an ice rink in winter. Exercise facilities were proposed in existing green spaces because of the quieter environment and clearer air quality.

Figure 6.2. Greenway Services and Programming

The final master plan (Figure 6.3) developed all the design considerations. All components worked together to form this master plan. It expressed how the proposed parks,
plazas, frontages and circulation systems communicate with the contexts and interconnect as dynamic public open spaces.

Figure 6.3. Final Master Plan
6.3 Redesign of the Transit Corridor

The transit corridor (Qingnian Street) is an important component of the urban greenway. It links people to destinations, joins places to places and connects this greenway with a broader context.

Based on the prior research and site analysis, the redesign followed three design principles: narrow lane width, reorganization of transit zones with buffers, and management of on-street parking as buffers (Figure 6.4).

![Transit Design Principles](image)

Figure 6.4. Transit Design Principles

The original lane width is 15', which is a waste of space. Wider lane width also increases traffic speed, making the street more dangerous for pedestrians, cyclists and drivers. The proposed lane width is 10', which will help reduce vehicle speed and save more space for adding green infrastructure. The diagram in Figure 6.5 compared a general section of Qingnian Street before and after the proposed design. After narrowed the lane width, and reduced the road by two traffic lanes, the corridor could add a green median and buffers between cars, bicycles and pedestrians.

Figure 6.5 also showed how the proposed design added buffers for different user groups.
The proposed design reorganized transit zones and separated cyclists, pedestrians and motor vehicles to make transit experiences more comfortable.

Figure 6.5. Comparison of Original (Above) and Proposed (Below) Qingnian Street

On-street parking is common along Qingnian Street, which causes dangerous conflicts, and makes the place unattractive. The proposal moved some on-street parking to the outside edges of building frontages and made them a buffer for cyclists (Figure 6.4-6.5).
Figure 6.6 described how public transit, greenway stations, underpasses, bike parking and underground parking worked together to support the greenway circulation system.

Figure 6.6. Support Components for the Circulation System
The transit corridor must be flexible, so Figure 6.7 selected three sections along Qingnian Street to show different design solutions based on various contexts.
6.4 Culture Celebration

Informed by the background research and interviews, this greenway design highlighted three cultural themes: early settlement, Qing culture, and the industrial city (Figure 6.8).
Typical forms and materials are extracted from each culture (Figure 6.8). The greenway design applied these elements to remind people about the city's brilliant culture.

The original site has three clear characteristics, and the three cultural themes perfectly fitted into the context (Figure 6.8).

The Hun River supported the city's early settlement, and the original site has existing green spaces, making this area match the early settlement theme. Curving lines brought a more natural feeling, and all plazas and paths created the form of the bird-shaped wood art from the early culture.

Water was an important element in Qing culture, and it represented wealth in ancient China. Adding some water features along the commercial frontage area expressed a good wish to all the commercial businesses. Straight lines are good forms for linear commercial frontages; wood, stone and other natural materials bring a historical feeling to relax people's busy urban lives.

The industrial city culture theme created a cool modern feeling along the public library frontage area and provided multiple functions. Gear shapes and metal material created an industrial feeling and recalled people's memories of the old industrial age.

6.5 Ecological Benefits

The greenway was also designed to enhance site ecology. The design used green energy, managed stormwater and used native plants (Figure 6.9) to help minimize carbon footprints, clean air, reduce urban heating, manage stormwater runoff and improve water quality.
The design proposed to install solar panels on top of greenway stations' roofs and shelters. The energy will be stored and used as an electric charging resource for personal electronics.

Wind energy was considered in commercial frontage areas. Because of the tall buildings, the street canyon effect can increase wind speed. Small wind energy lights were suggested in this area to use the wind energy.

Bioswales were proposed along Qingnian Street. Plazas, bus stops, building frontages and other paved surfaces will be converted to pervious paving. The proposal harvested stormwater through bioswales and pervious paving, filtered again, and then reused for water play or display. Some roof rainwater harvesting facilities were also designed at greenway stations, so the harvested water could be used for irrigation or restroom flushing.
The major plant communities for Shenyang are temperate deciduous forest, marsh, pinus tabulaeformis forest, and meadow. Microclimates on site and different culture themes determined plant selection. Native plants require less maintenance, last long, and create a unique characteristic for the site.

6.6 Greenway Nodes

The following drawings illustrate how the design principles applied to the greenway plan on a detailed level. Figure 6.10 shows the design characteristics inspired by early settlement, Figure 6.11 expresses how the design fitted into the commercial frontage, and Figure 6.12 shows the design characteristics inspired by industrial culture.
Figure 6.10. Early Settlement Theme Greenway
Figure 6.11. Qing Culture Theme Greenway
Figure 6.12. Industrial City Theme Greenway
CHAPTER SEVEN: CONCLUSION

As illustrated throughout the previous chapters, an urban greenway is a good landscape design solution for high-density areas. It requires less space than an urban park, but can serve more people, since it passes through a broader range of locations. The project site shares similarities with many other high-density urban areas, and thus, the greenway can become a model that other cities can follow.

This landscape design demonstrated how an urban greenway uses environmental, social and cultural strategies to enhance quality of life in high-density cities. It is a transit corridor, connects people around the whole region, and is also a "place" that attracts people as a destination. This design solution applied three goals: redesign the transit corridor, enhance ecological benefits and celebrate local culture.

The following discussion summarizes the design and provides a post-design assessment, illustrating the potential impact of this urban greenway on the project site (Figure 7.1).
Figure 7.1. Potential Impacts
After redesigning the transit corridor, all user groups (pedestrians, cyclists, public commuters) will enjoy a safer, more comfortable and more convenient transit experience. Alternative transit choices can help reduce environmental problems caused by private cars and save expenses from road and highway improvements. Convenient mass transit also improves the site's location efficiency by connecting people to other great city and regional destinations.

The proposed greenway plan will increase livability and the site's mixed-use diversity, which will attract visitors, new residents and commerce. The design will create new job opportunities and enhance the outdoor working environment, which will promote employment.

The project used cultural language to redesign a series of public open spaces, giving people a sense of place and celebrating the city's brilliant culture. The well-designed public spaces will increase social encounters and foster people's feelings of belonging and sense of community.

The urban greenway will also bring significant ecological benefits. The design increased pedestrian and bicycle space, maximized tree canopy coverage, managed stormwater and harvested green energy on site to reduce noise, air pollution, atmospheric carbon and energy consumption.

The broader scope of this project is to contribute to the development of urban greenways in high-density cities, increase livability, and achieve the balance of social, economic and environmental sustainability.
WORKS CITED


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