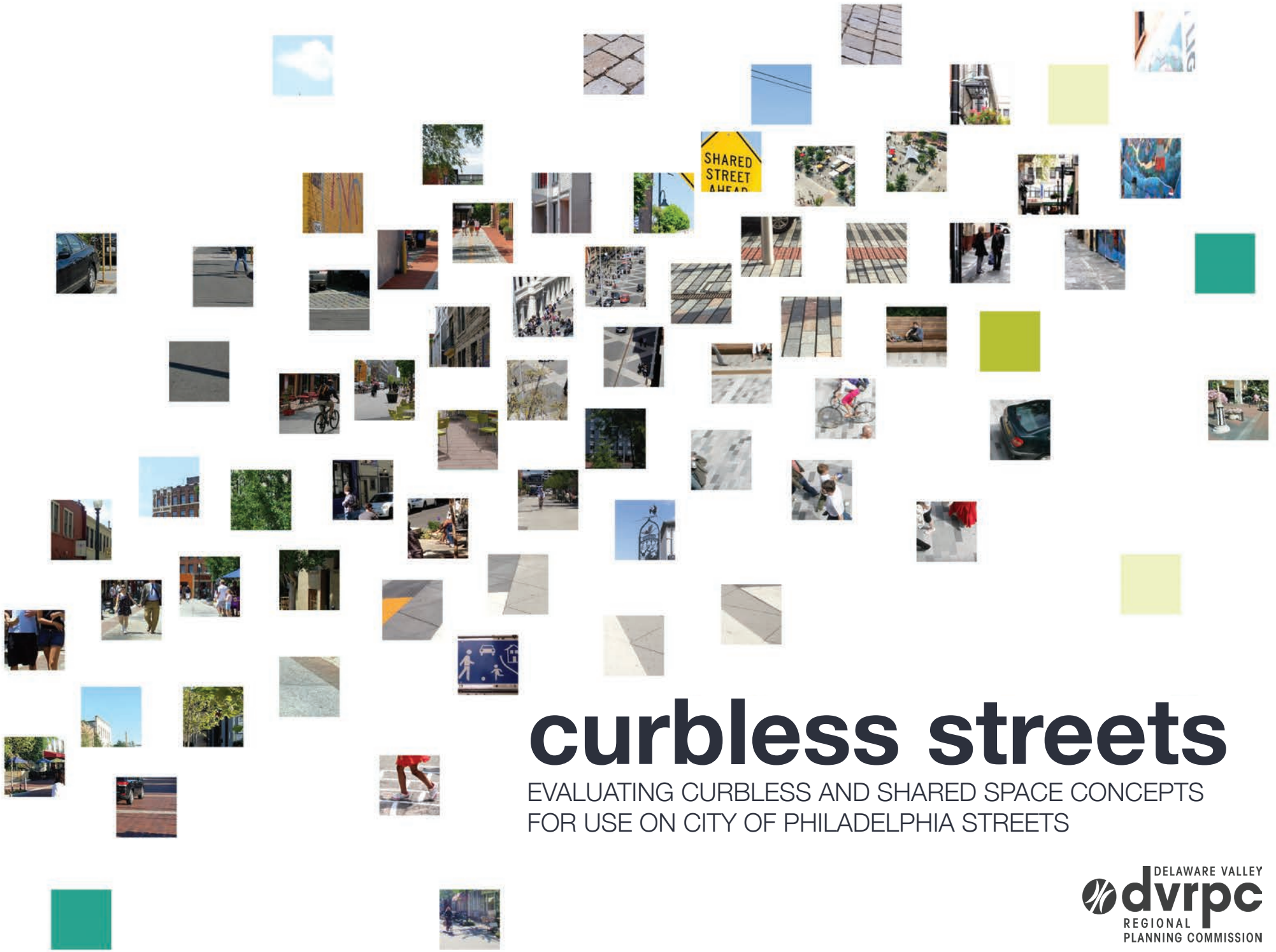


# curbless streets

## EVALUATING CURBLESS AND SHARED SPACE CONCEPTS FOR USE ON CITY OF PHILADELPHIA STREETS

DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION

JANUARY 2018


## The Delaware Valley Regional Planning Commission

is the federally designated Metropolitan Planning Organization for a diverse nine-county region in two states: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey.

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

**DVRPC's vision** for the Greater Philadelphia Region is a prosperous, innovative, equitable, resilient, and sustainable region that increases mobility choices by investing in a safe and modern transportation system; that protects and preserves our natural resources while creating healthy communities; and that fosters greater opportunities for all.

**DVRPC's mission** is to achieve this vision by convening the widest array of partners to inform and facilitate data-driven decision-making. We are engaged across the region, and strive to be leaders and innovators, exploring new ideas and creating best practices.



*DVRPC is funded through a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.*

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# Acknowledgments

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SHARED
STREET


# Executive Summary

**Curbless shared space is an approach to using the public right-of-way in which physical edges are removed and all modes share space.**

**Curbless design de-emphasizes vehicle throughput in favor of comfortable, functional spaces for social and mobility purposes.**

Curbless streets,  shared space, flex space, and *woonerven* (or the singular, *woonerf*) stem from a concept in which typically narrow streets with low vehicle volumes are designed without a curb and with high-quality streetscape materials, enabling the street to function like a plaza or a paved yard. Through the use of design elements such as paving treatments and strategically placed vertical elements, curbless design cues drivers to behave differently than on conventional streets. In addition to being safe and comfortable streets for pedestrians, curbless streets are often beautiful places to visit. They span diverse physical contexts, including both historic and contemporary settings, and each seems to be relevant and vibrant.

On lower-volume streets, curbless streets can function as a shared space where all modes are integrated, and users have equal priority to share the space. Navigating through the street requires increased interaction and slower speeds, making the space safer and more comfortable for pedestrians and other vulnerable users.  Movement on these types of curbless streets requires negotiation between users, such as eye contact between pedestrians and drivers. The mixing of low-volume, slow-moving cars in a plaza-like setting makes the space comfortable and safe for non-motorized travel.

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Curbless streets can operate as more traditional streets with very few changes to the street, save for the absence of a curb. In this way, the separation of modes is still necessary, primarily because of high vehicle volumes. Contrasting pavement, tactile warning strips, and vertical streetscape elements (such as trees or lighting) do their part to encourage modes to stay within their portion of the right-of-way. The range of curbless street types—from traditional streets that maintain separated rights-of-way, to low-volume shared streets—is explored in this report, and depicted in the graphic below.

This process of transformation from a street you go through to one you go to, or place making, is an opportunity to activate space and meet community goals. To encourage place-making outcomes, a place should feel a healthy sense of safety, economic vitality, quality of life, and efficient mobility for multiple modes of transportation. Curbless streets have been shown to improve all four. A discussion of the benefits of curbless streets is included in Chapter One; highlights are shown on the opposite page.

At the same time, curbless street concepts represent a paradigm shift from streets designed for cars to being comfortable and safe for all modes and can therefore require a shift from conventional street policies and operational frameworks to new approaches. New approaches may need to be taken for issues of accessibility, liability, responsibility within the right-of-way, emergency access, maintaining or changing vehicle volumes, honoring culturally important streets, and sharing the funding for projects.

**Curbless Street Types** (Chapter One)


Curbless Traditional Street

*maintains the separation of modes into specific channels*

Retail or Pedestrian-Only Street

*permanent or temporal limits on vehicle access, and priority is given to patrons shopping, eating, or drinking along the street*

Shared, Flexible, or Festival Street
Curbless Alley
Woonerf or Home Zone

*give equal priority to all modes and may serve as programmable community space for events, gathering, gardening, or playing*

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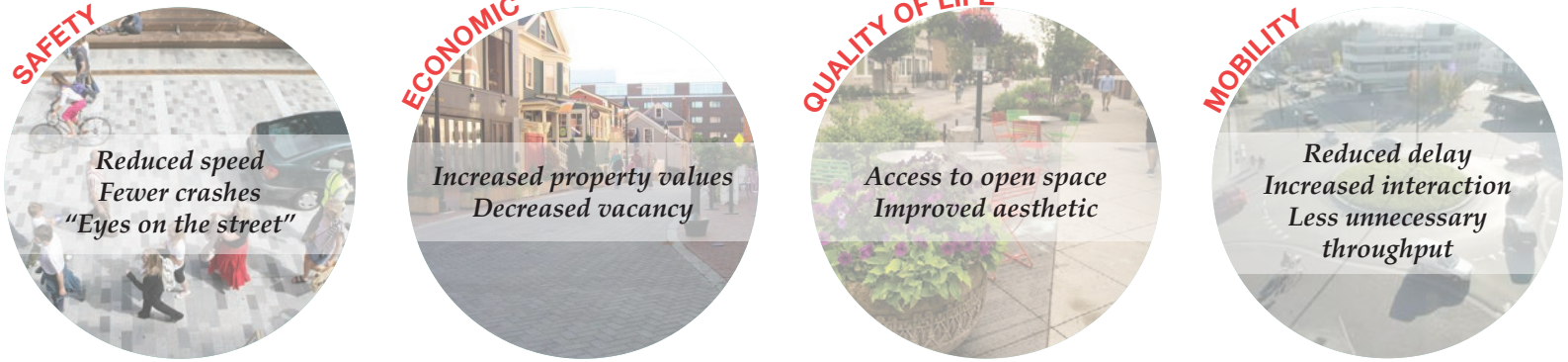
**Benefits of Curbless Streets** (Chapter One)




*sources:* NACTO via Flickr (CC BY-NC 2.0); Cara Seiderman, City of Cambridge; TIA International Photography for Seattle Parks via Flickr (CC BY 2.0); NACTO via Flickr (CC BY-NC 2.0)

In Philadelphia, planners, developers, and advocates increasingly include curbless streets within their design proposals. This report summarizes the traits common to curbless streets in peer cities within the United States. Some traits and priorities were found to be universal, while others are more supportive to a change to curbless. These traits, shown at right, can be used to assess opportunities for curbless streets in Philadelphia.

Some streets that meet many traits common to curbless streets are more or less likely to have utilitarian demands that would outweigh the potential to become walkable, curbless, shared street destinations. Characteristics that define how walkable a street is, such as how much of the adjacent land use is dedicated to on-street parking, and how many windows and doors face the street, influence the degree to which a street is necessarily service oriented. A greater number of utilitarian characteristics may indicate that a transition to a walkable, shared street is difficult or prohibitive.

Designs along residential and commercial streets, and along Philadelphia's tiny streets, should respond to the specific needs of those sites and context of the street. Design case studies for each of those contexts are included in Section 4.2 and serve as a reference to jump start design ideas.

Implementing curbless streets into Philadelphia's street network will require coordination between the public and private sectors, ingenuity, and a willingness to experiment. Setting clear expectations about goals, design, and public support requirements will help ease the process by which shared and curbless street proposals are assimilated into the City of Philadelphia. The following actions, shown on the next page, are suggested for consideration as a means of legitimizing curbless streets as a design option. Just as curbless streets can be a public, private, or public-private partnership project, so too can these actions.

**Characteristics for Siting Curbless Streets**
(Chapter Three)

**Universal Traits**

- high bicycle/pedestrian volume, low vehicle volume; and
- safety and accessibility needs.

**Supportive Indicators**

- private partnering potential;
- in stakeholder project pipeline;
- supports commercial uses/economic development;
- needs public realm investment;
- presence of school-aged children;
- open space/tree canopy desert;
- community programming opportunities;
- operates as a shared street already;
- access to, but not on, a transit route; and
- architecturally or culturally significant.

**Curbless Street Case Examples** (Chapter One)


*Georgetown, District of Columbia*

*photo source:* Eric Fidler via Flickr (CC BY-NC 2.0)

*Auckland, New Zealand*

*photo source:* Greater Auckland

- **Experiment** with curbless street implementations on a variety of street types, both by the adjacent land uses and by their width and vehicular volumes. Use performance measures to assess outcomes.
- **Evaluate** publicly and privately led proposed streetscape projects for their appropriateness to be curbless using the information provided in this report and summarized in *Appendix, A-2: Curbless Street Checklist.*
- **Go live** with a webmap to catalogue proposed curbless street locations. An interactive webmap could be used by City of Philadelphia staff to document or propose locations, or it could be open sourced to allow the public to propose, comment on, and potentially vote for locations.
- **Track** Play Street, Block Party, and Pedestrian Plaza application locations for consideration as future curbless street designs.
- **Integrate** specific language about shared and curbless streets into the Philadelphia Streets Department's *Complete Street Design Handbook* checklist.
- **Review** city and state ordinances whose definitions of liability and right-of-way as defined by curbs limit shared, curbless streets. Adapt so that the streets are suitable for pedestrians to walk in the cartway and for right-of-way to be defined without a curb in curbless situations, or create new ordinances specifically for shared, curbless streets.
- **Contract** with waste removal systems that pick up frequently and that centralize and conceal trash facilities in a manner that is fitting for surrounding land uses.
- **Develop** a strategic loading zone plan that identifies specific locations and temporal restrictions for loading. Enforce measures once they are implemented.

# CHAPTER ONE

## Understanding Curbless Streets



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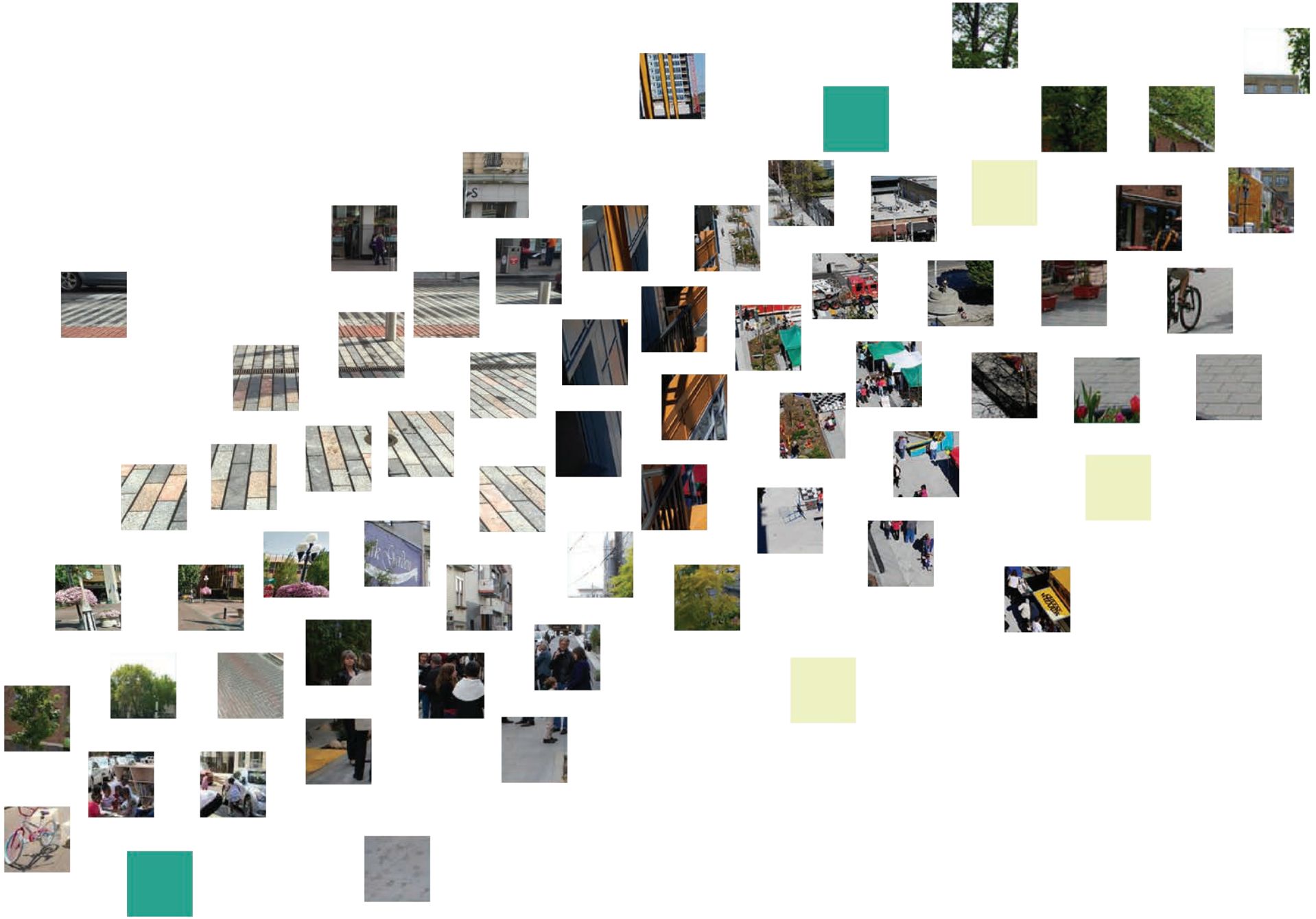

# 1.1 Project Background

Curbless streets,  shared space, flex space, and *woonerven* (or the singular, *woonerf*) stem from a concept in which typically narrow streets with low vehicle volumes are designed without a curb and with high-quality streetscape materials, enabling the street to function like a plaza or a paved yard.

This represents a paradigm shift from the way most streets are designed, used, and perceived, where typically separated areas exist for specific modes. By removing the curb, the delineation of mode-specific space is blurred.

Curbless streets can operate as a more traditional street with very few changes to the street, save for the absence of a curb. In this way, the separation of modes is still necessary, primarily because of high vehicle volumes. Contrasting pavement, tactile warning strips, and vertical streetscape elements (such as trees or lighting) do their part to encourage modes to stay within their portion of the right-of-way.

On lower-volume streets, curbless streets can function as a shared space. On this type of curbless street, all modes are integrated, and users have equal priority to share the space. Navigating through the street requires increased interaction and slower speeds,  making the space safer and more comfortable for pedestrians and other vulnerable users.

These safety and comfort outcomes are complemented by economic, livability, and mobility benefits. Transforming the right-of-way is an opportunity to meet many community, city, and regional goals.

## PROJECT OVERVIEW

In Philadelphia, city stakeholders, institutions, and advocates strive to improve the city's livability and vitality, and the potential to meet these objectives through curbless streets is recognized. Recently there have been many formal conceptual plans suggesting a curbless street component, and several editorials and articles highlighted the potential of Philadelphia's streets for this design treatment.

Amid the momentum of curbless design in Philadelphia, the Delaware Valley Regional Planning Commission (DVRPC) conducted this project to evaluate curbless streets' potential to meet city goals and to conceptually design case studies. This report equips the city with an understanding of the opportunities, constraints, and design elements of curbless streets relative to Philadelphia's context and current policies.

### Project Objectives

In partnership with city stakeholders within the Philadelphia City Planning Commission (PCPC), the Managing Director's Office of Transportation and Infrastructure Systems (OTIS), Department of Streets (Streets), Philadelphia Water Department (PWD), and Philadelphia Department of Parks and Recreation (PPR), this project aimed to achieve two primary objectives:

1. Identify the role of curbless streets in meeting transportation, stormwater management, and livability goals within the City of Philadelphia.
2. Illustrate the design and function of curbless street projects within the City of Philadelphia.

## PROJECT PROCESS

This project used the following approach to understand potential outcomes of curbless design and their consistency with City of Philadelphia and regional goals, including *Philadelphia2035*, the *Philadelphia Pedestrian and Bicycle Plan*, and *Green City, Clean Waters*.

### Peer City Case Studies

Data on curbless street design concepts and the effect on surrounding communities' safety, quality of life, economic vitality, and mobility was gathered through compiled peer city case studies, phone interviews, and literature reviews. Peer city projects informed best practices for implementing curbless street design concepts and identified a collection of supportive traits and characteristics common to successful projects. This information shaped the method for siting curbless opportunities in Philadelphia.

### Design Considerations

DVRPC staff, together with input from project stakeholders, developed conceptual design strategies for curbless streets within different contexts of the city. These concepts can educate and promote curbless streets to stakeholders.

## REPORT OUTLINE

This report is organized as follows:

### Chapter One: Understanding Curbless Streets

An overview of curbless street concepts, different street types, and benefits associated with this design treatment are discussed in the first chapter.

### Chapter Two: Special Considerations

Chapter Two includes a summary of some of the characteristics of curbless streets that may require new or unique approaches to transportation design and policy.

### Chapter Three: Evaluating Curbless Street Locations

The third chapter provides direction on the selection process for curbless projects, including supportive site selection criteria. And on possible curbless streets, this chapter provides direction on what are some common site characteristics that can be used to assess whether the street's utilitarian demands might preclude the ability for it to be converted to a shared, curbless street.

### Chapter Four: Designing Curbless Streets

Chapter Four provides an explanation of the design tools that are used to create a curbless, or shared, street. Residential, commercial, and tiny Philadelphia streets case studies are presented to show how the design tools can be applied to those streets in Philadelphia.

### Chapter Five: Next Steps

The report finishes with an overview of potential next steps toward implementing curbless streets in Philadelphia.

### Appendices: Resources and Guides

Included in the appendices are curbless street siting and design checklists, data tables on peer city case studies, and resources.


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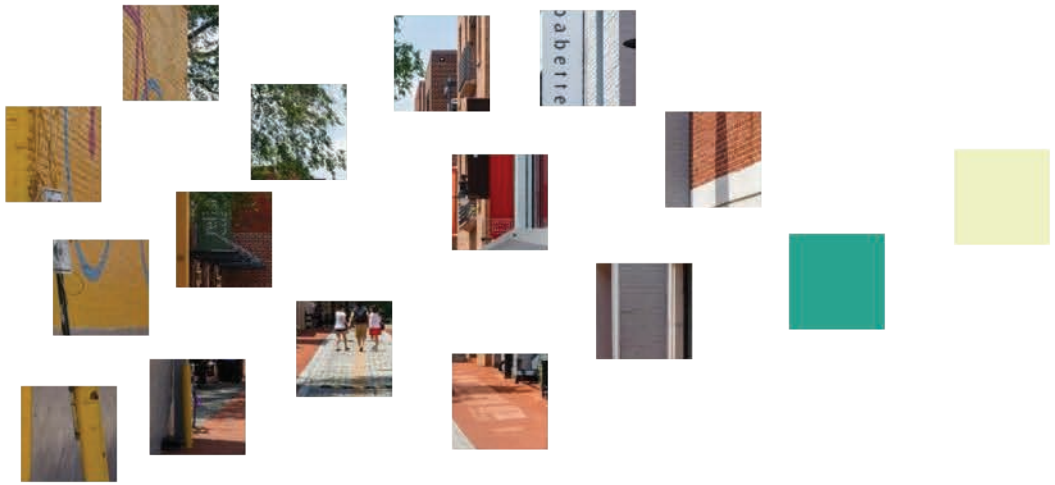

# 1.2 The Evolution of Curbless Streets

## WHAT ARE CURBLESS STREETS?

Curbless streets are a design tool to encourage sharing of the right-of-way by all modes. In most streets, the curb separates pedestrian and vehicular space within the right-of-way. Without a curb, pedestrians, bicyclists, motorists, and parked cars share space. The street is designed to slow drivers and alert them to street conditions.

A more traditional expression of a curbless concept includes vertical streetscape elements to maintain distinct space within the right-of-way for each mode. At the other end of the spectrum, curbless streets may deliberately blur the boundary between modes in order to encourage the mixing or sharing of space between all street users.

Movement on these types of curbless streets requires negotiation between users, such as eye contact between pedestrians and drivers. The mixing of low-volume, slow-moving cars, in a plaza-like setting, makes the space comfortable and safe for non-motorized travel.

In addition to being safe and comfortable streets for pedestrians, curbless streets are often beautiful places to visit. They span diverse physical contexts, including both historic and contemporary settings, and each seems to be relevant and vibrant.

Curbless street design is not a new idea: it was the basis of many early streets, in which the street served as community gathering space, shared by carriages, pedestrians, cars, and other users. In recent decades, livability-focused trends and policy have revisited curbless street concepts to challenge conventional auto-centric street design and priorities.

The evolution of curbless design is depicted on pages 14 and 15, which describes the major transportation approaches and movements influential to the concept. Today, curbless streets are an increasingly common design concept in urban places worldwide.

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1900

## All modes share space

Before the 20th century, many streets were shared spaces, in which all users—bicycles, carriages, cars, pedestrians—navigated the space through interaction. Delineation between areas for separate modes was minimal, if at all.

Filmed by the Miles Brothers in 1906, "A Trip Down Market Street" shows the negotiation and movement of various users along Market Street in San Francisco. A still from this film, pictured above, displays the mixing of five different modes within the shared right-of-way (from left: a cable car, horse-drawn carriage, pedestrians, a car, and a bicyclist).

*photo source:* Library of Congress, Motion Picture, Broadcasting, and Recorded Sound Division

## Cars reign in street design

The emergence of the automobile and its quick rise in popularity redefined how streets were understood. The mid-20th century saw the expansion of the automobile market, the rise of suburbanization, and the Highway Act—all of which further established the car as a dominant form of travel in the United States and beyond.

Streets and engineering standards adjusted to prioritize motorists, with the majority of space allocated to vehicles and the priority in efficiency devoted to vehicle movement, often at the expense of other modes.

*photo source:* DVRPC

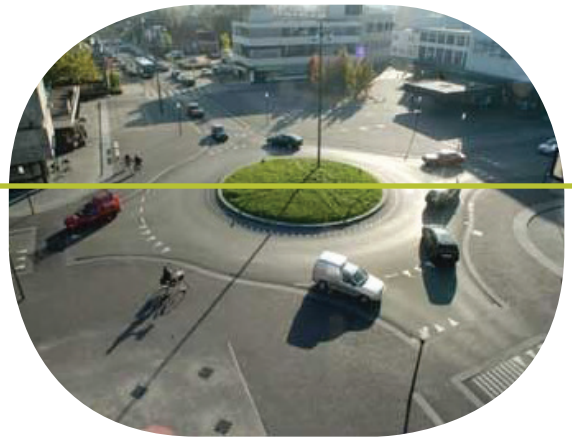

## Pedestrians prioritized

The *livable streets* movement, a 1960s counter to auto-centric design and society, stressed the importance of streets as public space.

In the Netherlands, the *woonerf* was created as an experiment to slow vehicles and reclaim residential streets as a safe space for children. Similar concepts emerged elsewhere, such as Germany's "Play Streets" and Finland's "Yard Streets."

Professor of Urban Design Donald Appleyard's *Livable Streets*, a study of the relationship between quality of life and through-traffic, suggests that there are detrimental impacts of auto-centric design on neighborhoods and emphasizes the importance of human-scale development.

*photo source:* Ron Roggenburk



## New shared space concepts

In the 1990s, Dutch traffic engineer Hans Monderman pioneered the concept of naked streets: removing conventional signage on Dutch streets. Without signage, users are required to collectively negotiate space, notably at Leiweplein Intersection (seen above) in Drachten.

In the United Kingdom, a nine-site pilot study of residential shared space, or Home Zones, launched in 1999. Following positive study results, the pilot expanded to 60 sites.

*photo source:* NACTO via Flickr (CC BY-NC 2.0)

2000

## Shared street interest increases

Shared space as a design movement continued to expand internationally. Developments spanned a range of contexts and settings, as well as a variety of street uses and functions.

Several countries, including the Netherlands, Denmark, Germany, and Israel, established regulations and design guidelines for shared streets.

Trends of increased active transportation paired with growing preference for walkable neighborhoods reflected a re-emergence and strengthening of the livable streets movement. In their capacity to meet these objectives, curbless design concepts continued to gain momentum in urban areas worldwide.

*photo source:* Jeff Hitchcock via Flickr (CC BY 2.0)

## Curbless streets in the United States

Within the United States, curbless streets already exist in a mix of small towns and major cities like San Francisco; Pittsburgh; Seattle; Washington, DC; and Houston. Cities considering curbless retrofits include Baltimore, Chicago, New York, and Philadelphia.

Because of the lack of formal research and traffic studies of U.S. implementation, some cities initiate curbless retrofits as pilot projects.

*photo source:* Payton Chung via Flickr (CC BY 2.0)

## SHARED STREETS IN PHILADELPHIA

With an eye toward healthy transportation and community building in Philadelphia, planners, developers, and advocates increasingly include curbless streets within proposals. *Figure 1* shows renderings of seven local projects with curbless street designs, as described below.

### 1. Vision 2026

***Old City District***
*proposed 2016*
As part of its Vision2026 Framework Plan, Old City District reimagined a segment of Market Street as a curbless street, referred to as the "Second Street Market Plaza."

### 2. Schuylkill Yards

***Brandywine Realty Trust, Drexel University***
*proposed 2016*
In the *Philadelphia Inquirer* review of the 14-acre West Philadelphia development project, architectural critic Inga Saffron noted the proposal to convert JFK Boulevard into a curbless street as the project's boldest feature.

### 3. Maplewood Mall

***City Commerce Department, Philadelphia Department of Parks and Recreation***
*proposed 2013*
Necessary street repairs gave impetus to reimagining Maplewood Mall, a narrow retail corridor in Philadelphia's Germantown neighborhood. Proposed renovations depict a curbless shared street with stormwater management and place-making elements.

### 4. Destination Frankford

***Community Design Collaborative***
*proposed 2016*
The Community Design Collaborative released a conceptual streetscape plan for a Frankford neighborhood with a curbless festival street component.

### 5. Drury Street Pedestrianization

***McGillin's Olde Ale House, Center City District***
The McGillin's management, along with agency partner Center City District, wants to activate Drury Street by transforming the dumpster-lined service alley into a pedestrian-friendly, shared space.

### 6. Grays Ferry Triangle

***South of South Neighborhood Association***
*established 2014*
The Grays Ferry Triangle is a public pedestrian plaza in southwest Center City Philadelphia. A former one-way street in a commercial and mixed-use area, the street was closed to vehicular traffic in 2014 and redesigned as a pedestrian-only space.

### 7. East Market

***National Real Estate Development***
*anticipated completion 2018*
East Market, an under-construction Center City retail and mixed-use development, plans to incorporate a curbless, three-block pedestrian-only street with adjacent multimodal streets.

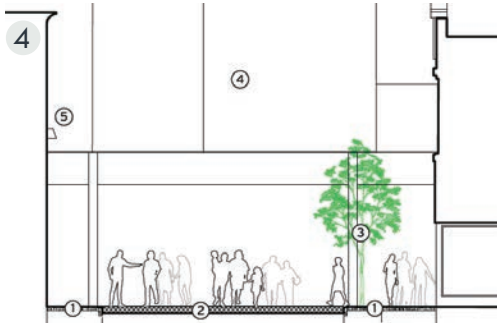
In addition to these proposals and renderings, curbless streets have hit a stride with local advocates and community groups as well. Campaigns to transform Philadelphia's many underutilized alleys, both in terms of mobility and beautification, have been a recurring concept among Philadelphia residents, journalists, design advocates, and others.

In the past two years there have been multiple proposals suggesting particular streets to undergo this transformation: the Asian Arts Initiative developed a series of proposals for Pearl Street, Inga Saffron of the Philadelphia Inquirer envisioned a pedestrianization of Filbert Street near 8th Street behind the former Lits Brothers department store, Center City Residents' Association considered candidate streets and design approaches to reclaim alleys, and other curbless ideas have been lofted through social media and urbanist discourse.

With a growing interest in curbless design concepts, this project is well suited and timed to provide additional background and information regarding the ideas and proposals circulating in Philadelphia, including being one of the strategies in the Vision Zero Action Plan, Philadelphia's roadmap for getting to zero traffic deaths. The following sections will delve into curbless street elements, best practices, and implementation tools for use on Philadelphia streets.

**Figure 1. Local Curbless or Shared Street Development Proposals**






*sources:* 1. JVM Studio; 2. West8; 3. Whitman, Requardt & Associates, LLP/Ground Reconsidered;
4. Community Design Collaborative; 5. McGillin's Olde Ale House; 6. South of South Neighborhood Association (SOSNA)

## 1.3 Curbless Street Types

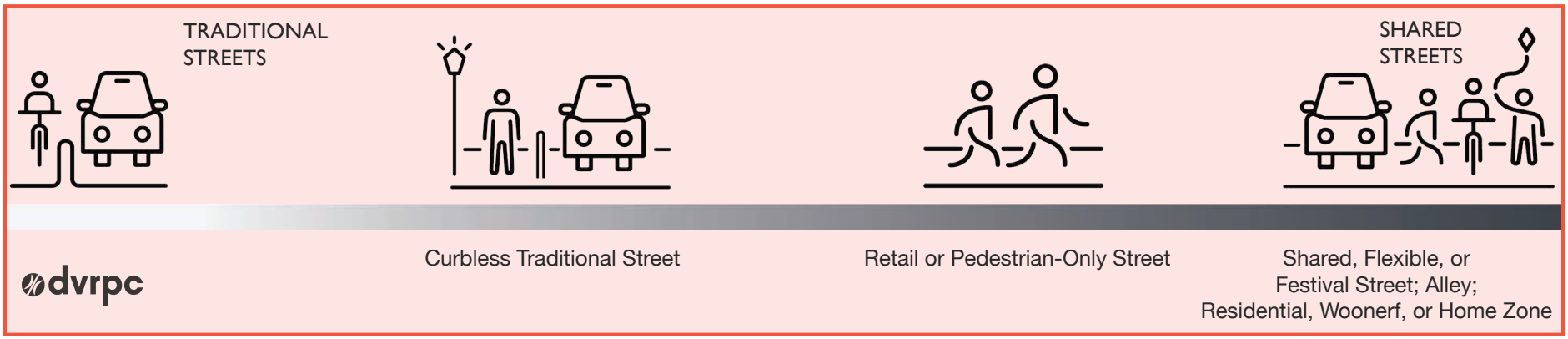
*Curbless street* describes any number of streets designed without a curb, a design strategy applicable to a notably large variety of contexts and uses. Depending on a project's context, design intent, or programming, curbless streets may be referred to by different terminology.

*In this report, the term* curbless streets *will be used to describe characteristics common to all types. Specific typologies will be mentioned when the project city or sponsor particularly refers to it as one of these specific curbless street types, or it is meant to specifically refer to the definition provided in this section.*

This project differentiates curbless street types by their roadway function; adjacent land uses; and allocation of space for pedestrians, bicyclists, vehicles, and parking. For example, *Figure 2* shows how different types of curbless streets vary in their channelization of modes. The curbless typologies identified were developed through evaluation of peer city implementations and are as follows:

- curbless traditional street;
- retail or pedestrian-only street;
- alley;
- shared, flexible, or festival street;
- residential, woonerf, or home zone; and
- raised intersection.

**Figure 2. Understanding Curbless Street Types by Channelization of Modes**




## Curbless Traditional Street

Rather than mixing modes in a shared area, some curbless streets use design elements and paving treatments to maintain the conventional separation of modes into specific channels. This delineation allows curbless traditional streets to carry comparatively higher levels of vehicle and pedestrian volumes than shared streets do.

In some cases, curbless traditional streets may use restrictions or movable design elements to temporarily limit vehicular throughput and operate as festival streets.

## Retail or Pedestrian-Only Street

Retail or pedestrian-only streets are curbless streets in commercial or mixed-use areas that are closed to vehicle traffic permanently or during certain time periods. The street is used primarily for patrons shopping, eating, and drinking along the street.

## Alley

A curbless alley is a narrow street that can be located in residential or commercial areas and typically provides access to the backs of properties. Alleys may or may not allow for parking, and may be able to accommodate green stormwater management practices, depending on utilities and land ownership and access. Curbless alleys may serve as community space for gathering, gardening, or playing.

## Shared, Flexible, or Festival Street

A broadly defined and popular term for curbless streets is a *shared street*. Shared streets give equal priority to all modes, and design strategies encourage modes to intermingle within a space rather than be channelized by mode.

Shared streets are sometimes referred to as *flexible streets* due to the programmable nature of the street. Those with capacity to be temporarily closed to vehicles for events and programming are known as *festival streets*. Shared streets are adaptable for different land use contexts.

## Residential, Woonerf, or Home Zone

The category of residential, woonerf, or home zone refer to a subset of shared streets in residential areas. Reduced speeds, increased safety, and open spaces incorporated in the street encourage small gatherings and play areas. In the Netherlands, the term *Woonerf* refers to a curbless residential street, and in the United Kingdom it is known as a Home Zone.

## Raised Intersection

In this design the intersection is elevated to the level of the sidewalk while the rest of the corridor has a standard curb. Raised intersections are used to improve pedestrian accessibility, reduce vehicle speeds, and encourage eye contact between modes at intersections only. A generalized view of where each curbless street type falls along a spectrum ranging from traditional, mode-channelized street to shared space is provided above in *Figure 2*. The following pages provide pictures of peer city case studies for each curbless street type identified for this study. Additional case study information is included in *Appendix, A-4.*

## Curbless Traditional Street

*Indianapolis, Indiana*

*Santiago, Chile*

*Paris, France*

***Key Characteristics:***

Clear delineation of modes into separated areas remains.

Appropriate for streets with greater vehicular volumes.

## Retail or Pedestrian-Only Street

*Bethesda, Maryland*

*Cambridge, Massachusetts*

***Key Characteristics:***

High-density residential, commercial, and office areas where destinations are very close to one another may support pedestrian-only streets.

Pedestrian-only streets that are near transit increase their foot traffic.

*photo sources:* (top row, left to right) NACTO via Flickr (CC BY-NC 2.0), Google Maps, Google Maps (bottom row, left to right) ehpien via Flickr (CC BY-NC-ND 2.0); Cara Seiderman, City of Cambridge

## Alley

*Seattle, Washington*

*Cambridge, Massachusetts*

***Key Characteristics:***

Alleys create alternative routes for bicyclists and pedestrians.

Dumpsters or other unsightly elements are directly addressed by containing, consolidating, or strategically removing them.

## Shared, Flexible, or Festival Street


*Auckland, New Zealand*


*Washington, District of Columbia*


*Seattle, Washington*

***Key Characteristics:***

Mixed-use surroundings promote all-day usage of the street.

Connections to destinations are prioritized.

Flexible design promotes use without prescribing it.

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*photo sources:* (top row, left to right) Calvin Hodgsin via Flickr (CC BY-SA 2.0); Michael Hicks via. Flickr (CC BY-NC 2.0)
(bottom row, left to right) wfeiden via Flickr (CC BY-SA 2.0); Eric Fidler via Flickr (CC BY-NC 2.0); Bruce Englehardt via Flickr (CC BY-SA 2.0)

## Residential, Woonerf, or Home Zone

*Bristol, England, United Kingdom*


*Boulder, Colorado*


*Amsterdam, The Netherlands*

***Key Characteristics:***

Consistent design materials and arrangement help distinguish a well-defined neighborhood.

Designed for residents at all stages of life.

Areas where interaction between residents is already high are strong curbless candidates.

## Raised Intersection


*Phoenix, Arizona*


*Portland, Oregon*

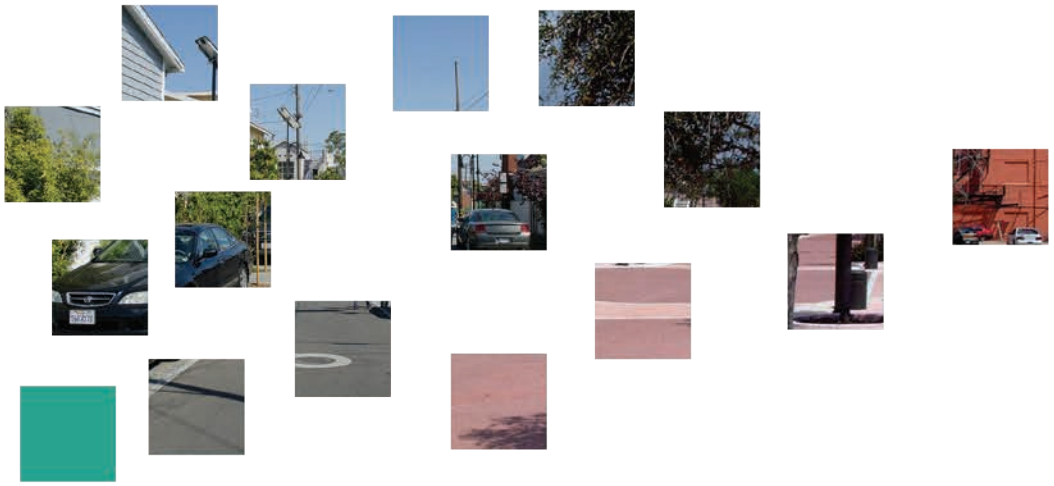
***Key Characteristics:***

Best suited for local and collector streets, or for arterials with high pedestrian volumes.

Often serve as gateway features for commercial, business, or residential areas.

*photo sources:* (top row, left to right) Sustrans; Google Maps; Joel Mann via Flickr (CC BY-NC 2.0) (bottom row, left to right) NACTO via Flickr (CC BY-NC 2.0); NACTO


coffee



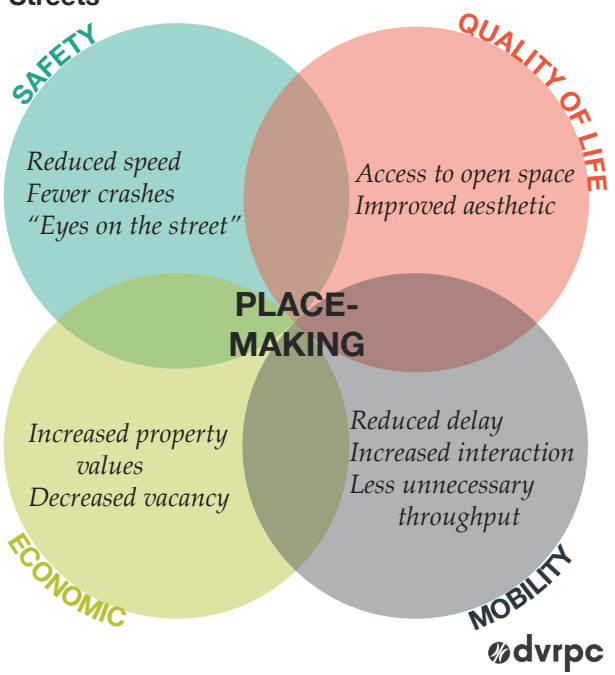
# 1.4 Benefits of Curbless Streets

## PLACE MAKING

Curbless streets are destinations, streets that de-emphasize vehicle throughput in favor of comfortable and functional spaces for social engagement—from routine interactions to large-scale events. This process of transformation from a street you go *through* to one you go *to*, or *place making*, is an opportunity to activate space and meet community goals.

To encourage place-making outcomes, a place should feel a healthy sense of safety, economic vitality, quality of life, and efficient mobility for multiple modes of transportation. Curbless streets have been shown to improve all four, as shown in *Figure 3*. If a city builds a curbless street in an appropriate location, safety, quality of life, economic vitality, and mobility are likely to improve.

**Figure 3. Place-Making Benefits of Curbless Streets**

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## SAFETY

Traditional rights-of-way are delineated by user type to prioritize vehicular movement and efficiency. By blurring the separation of modes and incorporating traffic-calming measures, curbless design requires a more engaged approach to navigate the street. Studies reflect decreased speeds and an increased awareness of other users due to unique design features.[1] As a result of this adjustment in behavior, curbless streets prove effective in creating safer streets.

The safety benefits of curbless streets reflect—and promote—five factors: increased interaction among all modes, reduced vehicular speed, improved street geometry, reduced crash rates, and reduced crime rates. Outcomes of example streets for each of these factors are highlighted in *Figure 4*.

### *Toward Vision Zero*

The safety benefits of curbless streets fall closely in line with the City of Philadelphia's Vision Zero program. The program, which started in November 2016 after City of Philadelphia Mayor Kenney signed an executive order creating a Vision Zero task force, is centered on reducing traffic deaths to zero in Philadelphia.

By increasing safety, the program anticipates added benefits of improving health and mobility. With improvements to these conditions, the program aims to increase the overall number of pedestrians and cyclists with the notion that there is safety in numbers. Similarly, curbless streets projects address safety issues with the aim of increasing the number of people walking and biking.

### Increased Interaction

Accommodating multiple modes without giving any one priority creates an atmosphere of uncertainty, forcing users to negotiate with each other. Interaction is facilitated through increased eye contact, hand signals, and reduced speeds, and users may become more attentive and mindful of other users.

- Observations of curbless areas in the Netherlands show greater rates of hand signaling and communication, especially among active modes of transportation.[2]
- On shared streets in the United Kingdom, drivers were 14 times more likely to yield to pedestrians.[3]

### Reduced Speed

Vehicles traversing curbless streets are apt to display caution, and case studies reveal reliable speed reductions following retrofit.[4] To ensure vehicles integrate safely with other modes, speed limits are often lower than on traditional streets.

- The Dutch woonerf and German *speilstrasse*, or "Play Street," require vehicles to travel at walking speed.[5]
- In the United States, typical vehicle speeds posted for curbless streets were 15 to 20 miles per hour (MPH).

It should be noted that the reduced speed and increased interaction among modes derive safety benefits from placing trust in drivers to negotiate movement through the space appropriately and cautiously.

### Improved Street Geometry

Adjusting the street layout and surface offers an opportunity to correct issues with street geometry and accessibility. Many case studies used curbless design to update street geometry and meet Americans with Disabilities Act (ADA) compliance.[6] For example, leveling the street's surface may remove tripping hazards. This expands available travel paths for mobility-limited and vision-impaired users.

- A focus group of vulnerable road users identified mobility benefits of improved navigation, better quality and more maneuverable paving treatment, and fewer areas for vehicles to obstruct pedestrian movement on curbless streets.[7]

### Fewer Crashes

The effect of increased interaction, reduced speeds, and better geometry is fewer crashes.

- In residential settings, crash rates on curbless streets were found to be 20 percent lower than on similar non-curbless streets.[8]
- For rates of severe or injury-related crashes, statistics demonstrated a 50 percent lower crash rate on curbless streets.[9]
- Anecdotal reports revealed an improved perception of safety as well. Of the U.S. case studies reviewed, none reported injury-related pedestrian crashes.

Similar outcomes are achieved on large-scale sites such as the Laweiplein Intersection (Drachten) or Kensington High Street (London), on which crash rates reduced despite annual average daily traffic of 22,000 and 40,000 vehicles, respectively.[10, 11]

## Less Crime

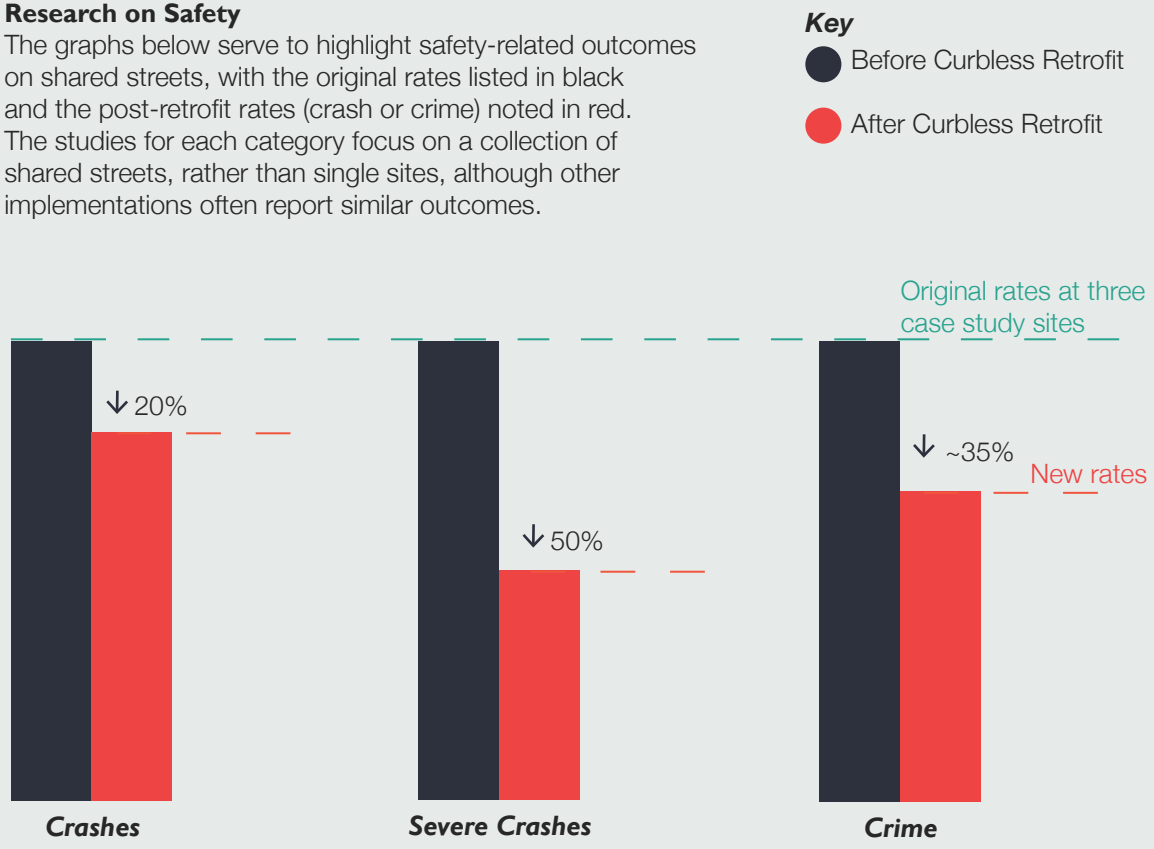
Addressing physical and perceived safety concerns and incorporating pedestrian-friendly programming and streetscape furnishings crafts a more welcoming environment and is shown to deter criminal activity.

Research suggests the relationship between increased foot traffic, and resulting increased eyes on the street, leads to a reduction of incidents.[12] Likewise, the traffic-calming methods employed to generate foot traffic have been linked to less crime by slowing potential escape routes.[13]

- An analysis of U.K. residential sites, including in a Home Zone pilot study, found significant drops (22 to 50 percent) in domestic burglary, vehicle crime, and other incidents within a year of curbless retrofit.[14]
- The most drastic example was in Morice Town Home Zone, where reported crimes dropped from 92 incidents before curbless redesign to nine in the year post-redesign.[15]
- This correlated with a 25 percent increase in residents spending time outside the front of their homes, demonstrating an improved perception of the street and its safety. [16]

**Figure 4. Before and After Safety Comparison of Three Example Curbless Streets**

**Research on Safety**
The graphs below serve to highlight safety-related outcomes on shared streets, with the original rates listed in black and the post-retrofit rates (crash or crime) noted in red. The studies for each category focus on a collection of shared streets, rather than single sites, although other implementations often report similar outcomes.




*sources:* (left to right) John Woodside, "Sharing the Streets," Landscapes/Paysages 12, no. 1 (2010): 32–33; Federal Highway Administration, "Traffic Calming," University Course on Bicycle and Pedestrian Transportation (U.S. Department of Transportation, July 2006); Department for Transport, Home Zones: Challenging the Future of Our Streets (London: Department for Transport, 2005).

## QUALITY OF LIFE

Curbless streets, in their capacity to improve safety and perceptions, can improve quality of life. They establish a unique identity and craft functional space. Curbless streets can build a sense of community by accommodating social interaction, play areas for children, or other programming. The right-of-way may be re-imagined to serve as a resource for neighborhoods with limited parks or gathering spaces. Quantifying the improvement in quality of life is typically measured through metrics like community perceptions, time spent and activity on the street, and access to open space.[17]

### Community Perception

Curbless street designs use vertical elements, pavement treatments, and other visual cues to distinguish the street from the adjacent street network. This alerts vehicles, cyclists, and pedestrians to new conditions and establishes the aesthetics, or look, of the street. Improved appearance and perception of the street can spur less-tangible outcomes, such as residents' pride in the street, and perceived attractiveness.

- Surveys of European sites found 70 to 75 percent of subjects considered woonerven, or curbless streets, to be "beautiful."[18]

The attractiveness of the street can also be measured by monitoring the ways in which it is used: for example, noting the time spent on the street to see if it serves as a destination or a throughway.

### Time Spent on Street

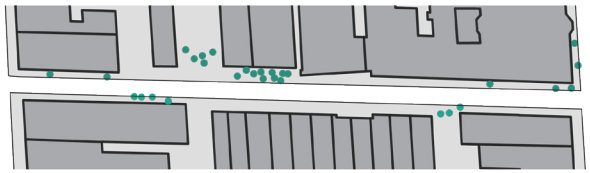
Rethinking the use of the right-of-way from a travel path to a social, livable area is a principal objective of curbless streets. This objective was the emphasis of Appleyard's *Livable Streets*, which advanced the connection between street use and residents' quality of life by mapping the density of social interaction opportunities.[19] This methodology, behavior mapping, was later used by landscape architect Brenda Eubank-Ahrens to study livability of woonerven, specifically the impact of curbless redesign on children's play.

- The study, conducted on a low-income street in Germany, reported five times as many interactions on the street after removing the curb. Twice as many children were playing, and children spent 50 percent more time on the woonerf than when it was a conventional street.[20]

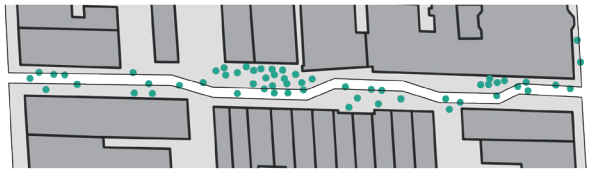
**Figure 5. Behavior Mapping**

*pedestrian gathering and interactions relative to a block:*

• = *person, interaction*



**Conventional Street** *(before)*



**Woonerf** *(after)*

*source:DVRPC*

Commercial curbless streets also report increased time spent on the street, better utilization of the right-of-way for activities, and enhanced pedestrian experience.[21] In discussing the flexibility of the street:

- Fifty-seven percent of respondents felt comfortable stopping within the shared space to socialize.[22]

These findings suggest increased comfort using the street and more opportunities to engage in activities beyond simply traversing the street. *Figure 5* depicts a behavior map of increased interaction on a curbless street after redesign.

### Access to Open Space

The first woonerven were built in the 1960s as experiments to counteract the volume and speed of motorists cutting through Dutch neighborhoods, and to reclaim the street as a space for residents and children.[23] Today's curbless design continues these goals. By enhancing safety and adding pedestrian-friendly streetscape furnishings, the street becomes a desirable social and play space, which is particularly valuable in areas where these needs are unmet by existing parks.

The premise of crafting space in the right-of-way was realized in Bell Street Park, Seattle's four-block-long curbless street developed in 2014 with funding designated for parks. The project aimed to create usable space in an area with limited park access and to improve the safety of the street. An overview of the project is included in *Figure 6* (Case Study of Bell Street Park).

**Figure 6. Case Study of Bell Street Park**

### Project Background

Residents of Belltown, a diverse Seattle neighborhood, felt the area lacked an identifiable center and access to parks. The city conducted a gap study to determine feasible park locations and, after reviewing the available land, determined the best possible site for a new park was Bell Street, a wide street surrounded by a mix of land uses. Four blocks are now designated park space.

### 1 Pre-curbless Street Conditions

Bell Street, a local street serving night clubs, restaurants, and some residential uses, was notorious within the neighborhood for illicit behavior. The majority of the right-of-way was dedicated to vehicles, with on-street parking lining the sidewalks.

### 2 Curbless Street Design

To design a street to function as a park, SvR Design Company prioritized pedestrian activity over vehicle throughput. A parking lane and a travel lane were reclaimed, and new traffic rules limited vehicle throughput to one block before requiring drivers to turn onto adjacent streets.

Sidewalk bulb-outs with planters and parking areas create a chicaning design to slow down vehicles. Street narrowing at entrances and contrasting pavement create visual cues for drivers to behave differently on the street. By using diagonally tiled pavers, the street aesthetic highlights crossing opportunities rather than forward-moving throughput.

Additional street trees and increased lighting along the street improve Bell Street's perception of safety and attractiveness. Park-like street furnishings are complemented by outdoor seating at restaurants, helping to activate the space.

### 3 Project Outcomes

Bell Street Park created 1.7 acres of new park space, which serves 18,000 residents as an attractive and pedestrian-friendly area.[24] Several street festivals, concerts, and events have closed off the street temporarily. Anecdotally, traffic speed and crime rate have reduced, while attractiveness of the space has improved greatly. In interviews, project staff reported the potential for replication of the festival street concept in other park-limited areas.

*photo sources:* 1. Google Maps; 2. Google Maps; 3. TIA International Photography for Seattle Parks via Flickr (CC BY 2.0); TIA International Photography for Seattle Parks via Flickr (CC BY 2.0)

## ECONOMIC VITALITY

The combination of improved accessibility, use, and perception of the street contributes to economic vitality. Studies of curbless street performance report higher property values, decreased vacancy, and healthy business growth. The streets are more functionally and aesthetically appealing to pedestrians and bicyclists, and are generally viewed as attractive locations for businesses and homes.

To demonstrate the economic vitality influenced by curbless or shared street redesign, *Figure 7* provides a sample of streets pictured before and after redesign. When applicable, specific findings and outcomes related to economic growth, changes in vacancy, street activity, and overall atmosphere are called out in the following pages.

**Figure 7. The Economic Value of Curbless Streets**

*Winthrop Street—Cambridge, Massachusetts*

*photo sources:* Cara Seiderman, City of Cambridge

*Cameron Road —Normanton Home Zone, Derby, United Kingdom*

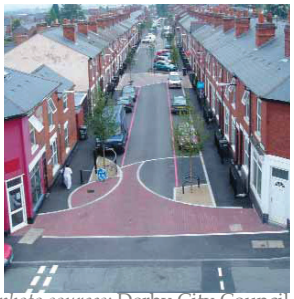


*photo sources:* Derby City Council

## Increased Property Values

Quality street design is closely linked with the perception, appeal, and value of the surrounding neighborhood or area—and the buildings, homes, and spaces within it. By creating attractive and usable spaces, curbless streets have leveraged economic impacts through increased property values.

The economic vitality of curbless streets is exemplified by the housing markets for woonerven and Home Zones, where homes sell faster and for an average of 10 to 15 percent more than on similar residential streets with curbs.[25]

The "living street" quality and availability of play space can enhance a street's desirability and lead to increased longevity of homeowners or renters.

- Tenancy within the Bolton Home Zone experienced a 60 percent turnover reduction after a curbless retrofit.[26]
- The effects experienced in commercial areas are equally favorable: attractive, well-designed, and safe streets are comparably more valuable than average streets, with a mean 4.9 percent increase in rent per square meter after redesign.[27]

## Strengthening Business Districts

The economic value of curbless streets is similarly reflected by their effect on business districts. By giving priority to all modes, curbless streets serve as a valuable foundation for retail areas in dense, walkable neighborhoods. In Philadelphia, curbless plans have been proposed as components of current development projects, demonstrating the appeal and economic potential of attractive, pedestrian-focused streets. Throughout the United States similar plans have been built and, in some instances, are closed to vehicles entirely to provide programmable space and comfortable access.

This impact on stores and businesses is reflected in research that suggests walkable retail provides proportionate priority to customers' means of access.

- A 2003 study of business owners and their perception of shoppers' modes of transportation concluded that many owners underestimated the amount of customers who walked or biked, and overestimated the importance of driving customers by 26 percent.[28]

Crafting a comfortable shopping area and increasing foot traffic are proven methods for boosting economic vitality.

## MOBILITY

In terms of street movement efficiency, curbless design can improve a street's overall mobility. Findings suggest the mixing of modes within a shared space may improve traffic flow in three distinct ways: reducing vehicle and pedestrian delay, increasing interaction between modes, and reducing unnecessary throughput.

### Reduced Vehicle and Pedestrian Delay

By incorporating traffic-calming measures and creating a shared space for all modes, curbless streets require additional engagement. All users, in theory, become more mindful of each other and navigate the space based on communication and interaction, rather than relying on signalization and strictly regulated movements.

This coordination, shown in *Figure 8*, gives both pedestrians and vehicles more fluidity of movement than on conventional streets.

- In a comparison of the delay on shared streets versus conventional intersections, researchers Wargo and Garrick reported that the majority sampled experienced less than 20 percent of the anticipated vehicle wait time.[29]
- Likewise, pedestrians in all instances waited less than one second before proceeding, compared with an average 10 seconds' wait in traditional settings.[30]
- Similar results were reported from Laweiplein Square in Drachten, on which congestion decreased despite vehicle volume increasing more than 30 percent.[31]

### Increased Interaction

The greater efficiency of movement in curbless or shared spaces is in part due to traffic-calming designs and features, as well as improved coordination across modes. Users of redesigned streets anecdotally report an increase in communication and negotiation, as well as measurable increases in hand signaling.[32]

**Figure 8. Multiple Modes Navigating Shared Space**

*London, England, United Kingdom*

*photo source:* Stu Smith via Flickr (CC BY-ND 2.0)

*Coventry, England, United Kingdom*

*photo source:* Coventry City Council via Flickr (CC BY-NC-ND 2.0)

## Reduced Unnecessary Throughput

Traffic volume reduction is perhaps the most debatable element of traffic flow improvements linked to curbless redesign. The design features and required concentration make curbless streets uncomfortable for drivers, who may opt to use other streets instead.

While this may result in better traffic flow for the curbless street, the consequence of displacement onto other streets should be considered.

Some curbless streets, such as Seattle's Bell Street Park, enforce policy measures to ensure a reduction in unnecessary throughput within shared spaces. In this setting, drivers are allowed to travel one block of Bell Street before they are required to turn onto adjacent streets.[33]

# CHAPTER TWO

## Special Considerations



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HARED
TREET

# 2.1 Special Considerations for Curbless Streets

## A New Way of Thinking

Curbless street concepts represent a paradigm shift from streets designed for cars to being comfortable and safe for all modes. Likewise, curbless streets require a shift from conventional street policies and operational frameworks.

When transforming a conventional right-of-way to a curbless street, there are seven areas in particular that require special consideration and new approaches to managing the street:

- *Accessibility*: ensuring the street is usable and accessible for all users;
- *Responsibility*: clarifying the roles of stakeholders and property owners on a new type of street, reviewing issues surrounding new uses of the right-of-way;
- *Liability*: updating policies and legislation to support new design and street functions;
- *High-vehicle-volume streets*: considering the safety of vulnerable users and street network impacts of streets with a lot of cars;
- *Services*: considering and mitigating the impact of curbless design on service and delivery functions;
- *Culturally important sites*: retaining the historic and cultural heritage of unique streets in the city; and
- *Funding*: cultivating partnerships to help fund various aspects of design that are out of the scope of what the public sector can spend on installation or maintenance.

## ACCESSIBILITY

### Easier Movement for All Users

For all users, curbless streets can represent a more usable and safer area. A single-level surface removes tripping hazards and allows greater area for movement. This accessible design is especially valuable for people with physical or mobility impairments, wheelchair users, and people pushing strollers. On traditional streets, these users typically rely on curb ramps to access or cross the right-of-way. Without limiting access to end-of-block curb ramps, users with mobility impairment or those operating carts, wheelchairs, and strollers have greater flexibility crossing and navigating the street.

The ease of movement in and out of the shared space is beneficial for overall accessibility but poses concerns for certain vulnerable users, including pedestrians with low vision.

### Considerations for Low-Vision Users

A primary concern of shared street design is the transition from pedestrian path to the shared area. Traditionally, curbs provide a physical barrier to alert users to potential interaction with vehicles. Without a curb, people with limited or low vision—or their service animals—may have difficulty detecting entrances to shared areas.

In 2017, the FHWA published a report identifying challenges for low-vision users on curbless streets, and strategies to facilitate navigation and movement. The report, *Accessible Shared Streets: Notable Practices and Considerations for Accommodating Pedestrians with Vision Disabilities,* outlines design tools and streetscape features to help low-vision users navigate and feel comfortable in shared, curbless spaces. Many strategies focus on meeting ADA compliance.

In the absence of a curb, ADA standards require a color-contrasting, tactile warning area between shared and pedestrian areas to provide both visual and tactile cues to users. In most cases, this is accomplished through grooved pavement, stormwater grates, or truncated domes.

In addition to meeting ADA compliance, design teams are urged to take a proactive approach to thinking about accessibility. In Chicago, staff from the Argyle Street project worked closely with the Mayor's Office for People with Disabilities throughout the design process. Through facilitating discussions and reviews, the team developed strategies to accommodate all users, and people with vision-related issues contributed to the design.

There are other approaches used by curbless or shared streets to ensure all users can navigate the space. On London's Exhibition Road, vision-impaired users can reference the street layout using a tactile map (*Figure 9*). Navigation of shared streets requires interaction that is often visual, so it is crucial to take measures toward making the area safe for users with limited vision.

**Figure 9. Accessibility Measures on Curbless Streets**

*Tactile Map*

*photo source: Josephine Browne for Topografik*

*Tactile Warning Strip*

*photo source:* NACTO via Flickr (CC BY-NC 2.0)

## RESPONSIBILITY

Traditionally, curblines serve as a delineation between municipality and property owner responsibility for street or sidewalk maintenance, and permission to place items in the right-of-way. Without curbs, residents and city agencies express uncertainty in how to determine who is responsible for issues such as upkeep of the sidewalk or who is liable in the event of an injury on a curbless street.

In interviews, peer city project staff noted that the visual and tactile cues required of ADA standards and in the design execution are clear markings to show where street responsibility for each stakeholder begins and ends.

## LIABILITY

In the United States, the dominance of vehicles is well established on streets and in law. Engineering standards prioritize motorists, with the majority of space allocated to vehicles and priority in efficiency devoted to vehicle mobility, often at the expense of other modes. In their pursuit of better vehicle movement and relegation of other users and activity off the street, local and national policies tend to favor vehicles.

### Existing Laws

The concept of *contributory negligence* highlights the aforementioned vehicle preference. Contributory negligence places a disproportionate burden of liability on pedestrians and bicyclists in an instance of a crash with a vehicle, prohibiting bicyclists or pedestrians from recovering any damages if considered at fault to any degree.[34]

Whereas this policy presents challenges to bicycles and pedestrians, other policies make it more difficult to cite at-fault motorists in the event of a crash. New York's recently enacted "Vulnerable User" and "Right of Way" laws reverse existing vehicle-prioritizing policies that required police officers to witness crashes in order to cite violations, and increase the penalty for injuring or killing a pedestrian in a crosswalk.[35]

In Pennsylvania, like with most U.S. motor vehicle codes, liability is determined based on physical street features, such as crosswalks and curbs. This reliance on mode-specific areas conflicts with the intentional ambiguity of the right-of-way of curbless streets. Addressing liability requires reconsideration of vehicle codes to emphasize the way users travel, not where they travel.

**Figure 10. Excerpts from Chicago City Council Ordinance 9-12-045**

*Definitions:* "Shared street means a public right of way which can be shared at the same time by pedestrians, bicyclists, motor vehicles, and other legal conveyances, and where pedestrians have the right of way over all other traffic."

*Rules:* "Pedestrians may enter, walk along, or cross a shared street at any time or point. Nothing provided in this subsection shall relieve a pedestrian from the duty of exercising due care."

*source:* City of Chicago Office of the City Clerk, 2016

In comparison, shared or curbless streets in other countries offer much different approaches to liability. If a crash between a motorist and another user occurs on a Dutch woonerf, the motorist is automatically assumed to be at fault.

### Rethinking Liability

Addressing the disfavor of bicyclists and pedestrians in Pennsylvania's motor vehicle code is being contemplated. Two bills favorably making their way through State Senate review could facilitate implementation of curbless streets. The first broadens the definition of a curb and the associated liability functions. The second, as part of a legislative agenda, increases penalties for careless driving. This amendment would lessen the dependence on physical street features to define where vulnerable users are protected from fault and broaden the definition of vulnerable users. While this bill is still being discussed at the legislature, passage of an amendment to better protect vulnerable users outside of sidewalks from fault in a crash would ease apprehensions about converting traditional streets to shared streets.

Without committing to adjustments in state or city vehicle codes, many peer cities designate new curbless streets as "pilot projects" as amendments to existing vehicle or municipal code, with their own unique set of rules, guidelines, and liability.

This concept has already been used with existing and proposed curbless streets in New Jersey, California, Oregon, and Illinois, and is depicted in the excerpts in *Figure 10* (Chicago's full ordinance is provided in *Appendix, A-1*). Through the use of a temporary ordinance or pilot designation, projects can move forward without additional delay from legislative processes. In return, updates or changes to the prescribed code can be incorporated later based on pilot project findings.

## HIGH-VEHICLE-VOLUME STREETS

Some of the easiest streets to convert to curbless will be streets that already have low vehicle volumes and high pedestrian and bicycle volumes (as discussed in Chapter Three, Section 1.2) because they likely already function as a shared street. However, there may be streets with greater vehicular volumes than bicycles and pedestrians that may be proposed to be curbless or shared. For these locations, it is critical to consider the safety of all road users and the street network impacts of changing the geometry of the street.

### Determining Project Goals

A curbless project on a high-vehicle-volume street must consider whether the goal is to be curbless and change the aesthetics and general pedestrian friendliness of the street or if the goal is to be curbless and function as a shared space. If the primary goal is to change the aesthetics and pedestrian-friendly feel of the street, it may not require measures to try to reduce the number of cars using the street if modes are separated as on traditional streets.

Without measures to reduce vehicle volumes, design strategies should retain separation of modes to prevent conflicts between them. For example, if vehicle volumes are anticipated to remain the same, a tactile paving treatment, detectable warning strip, and vertical elements like trees and benches where the curb typically is, could prevent pedestrians from stepping into the street or crossing mid-block. Pedestrians in this context would still be encouraged to cross only at intersections.

Project goals may target making a street more pedestrian and bicycle friendly by way of converting to a shared street. In this practice, the aim would be to slow, or relocate, some of the vehicle traffic to better engage active modes. Fewer cars at slow speeds naturally create a low-stress environment in which pedestrians and bicyclists can more casually and comfortably walk along and across a street.

### Network Impacts

Lower speeds enable drivers to stop more quickly for those crossing the street. Drivers not destined for the street itself will likely find alternative routes to avoid a shared street where they are slowed by pedestrian traffic. Careful modeling analysis should occur early in the process to understand potential network impacts and trade-offs. If adjacent streets have the capacity to take on additional auto traffic, and the capacity is part of the future vision for those streets, then it may be possible to change the existing high-vehicle-volume street to a shared, curbless street.

## SERVICES

Like all streets, curbless streets must maintain access for emergency vehicles and accommodate other service vehicles and uses such as trash storage and removal, snow removal, and deliveries. Maintaining clearance for service vehicles is advised for streets, in order to provide comfortable access for oversized vehicles such as firetrucks. Best practices of peer cities include involvement of service agencies and professionals throughout the design process.

## CULTURALLY-IMPORTANT SITES

City of Philadelphia streets are steeped in a rich historic and cultural legacy. Paving materials, like wood and unique blue brick, and countless historic structures exist on streets, particularly on Philadelphia's narrow historic streets, called here *tiny streets*. Design materials and approaches should respond to improving the accessibility of streets without sacrificing the historic or cultural importance within or along the street. This might include saving, reusing or matching the elevation of existing paving or working around historic signs or other street amenities.

Coordination with local stakeholders and the Philadelphia Historical Commission ensures that any redesign includes proper preservation and an awareness of unique conditions of tiny streets. For example, the City of Philadelphia has an ordinance mandating that residents shovel their sidewalks after a snowfall. However, on tiny streets, sidewalks are often so narrow that they are unpassable for pedestrians, while the street, or cartway, is the width of a sidewalk (six feet, or so). A curbless design of a tiny street could address the shoveling conundrum by treating the sidewalk and cartway as one in the same.

Some streets within the city are under the jurisdiction of the federal government because they are part of the National Park Service. These streets would necessitate coordination at the local and federal level.

## FUNDING

In most case studies, public-private collaborations provided the financial support to realize street redesigns, as the added site amenities and costs typically exceed what most municipal public works or streets departments can fund. Other approaches included Tax Increment Financing (TIF), private development, foundation grants, and a public levy, among others.

Based on the case examples evaluated, the cost per square foot (in 2016 U.S. dollars) ranged from $40 to $187, with an average price of $110 per square foot. More intensive design strategies, such as the U.K. Home Zone Pilot Project, report higher price ranges, averaging upwards of $500 per square foot.

Streets that are originally designed and built to be curbless are comparatively cost effective, as they do not require adaptation of existing infrastructure or remediation of existing streetscape.

### Public-Private Partnerships

In most cases, a partnership between public and private enterprises will implement curbless streets. Many projects will be initiated from the private side in an effort to support economic, walkability, and place-making efforts. Those projects will need to secure policy and safety support from the public sector, particularly for the network and service impacts of changes to the role of mobility on the street. Other times, the public sector may suggest a potential location for safety and accessibility reasons. These projects would be more impactful with private support to leverage additional site furnishings and material cost and to garner community support.

In addition to mitigating costs, this approach may streamline the process of securing support, funding, and working to build consensus among stakeholders on behalf of both the public and private sectors.

For existing public streets, funding sources may be available through agencies committed to improving communities, enhancing accessibility, or fostering economic development. For example, Portland's redevelopment of two streets as festival streets was facilitated through the local community development institution, the Chinatown Development Corporation. Such agencies may have capacity to leverage additional funding or sponsorship.

Linden Alley, a small curbless project in San Francisco, relied on a more grassroots public-private partnership approach to securing funding. The underutilized mixed-use alley was revisioned by surrounding businesses as a street with potential for revitalization. These surrounding businesses and property owners donated $40,000 to realize this idea, which was complemented by two grants: a $10,000 Seed Fund Grant from the Studio for Urban Projects, and nearly $100,000 in funding through a Community Challenge Grant from the City Administrator's Office (with the Neighborhood Parks Council operating as the fiscal sponsor). This mix of private and public partnerships and funding sources, along with over $78,000 in in-kind design and engineering services, helped to transform the alley from an unattractive throughway to a local destination.

### Funding Sources

In Philadelphia there are several innovative options and strategies for financing curbless streets or securing partnerships for projects. Competitive state funding opportunities are available through PennDOT's Transportation Alternatives Set-Aside Program (TAP) and Multimodal Transportation Fund. The TAP is an allocation of FHWA funding through the Surface Transportation Program, focusing on "non-traditional projects designed to strengthen the cultural, aesthetic, and environmental aspects" of transportation systems.[36]

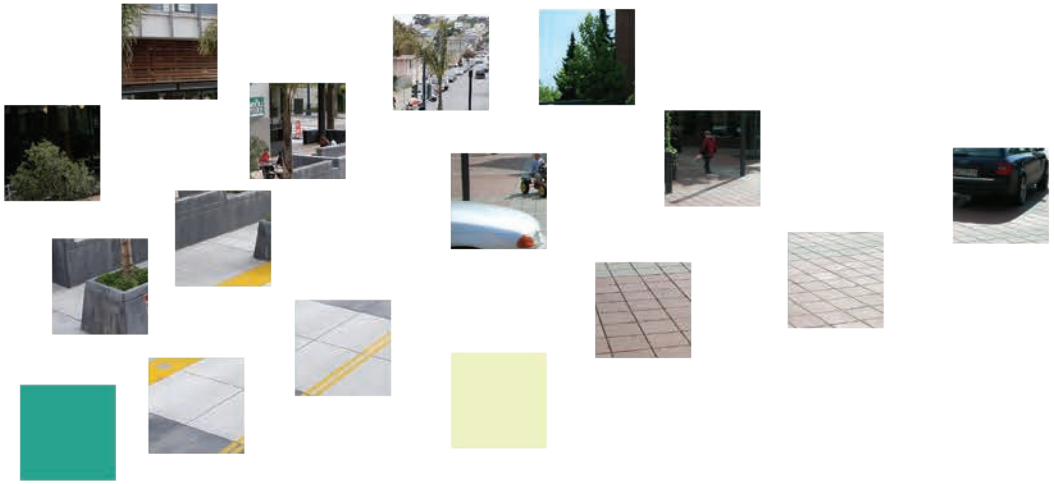
Locally, the Philadelphia Commerce Department provides support for projects aimed at revitalizing corridors through Business Improvement District (BID) support, as well as the Streetscapes, Corridor Beautification, and Corridor Cleaning programs. For projects that incorporate sustainable water-related design or include stormwater infrastructure, there is potential to learn about ongoing initiatives through the PWD. As mentioned, collaborating with private developers and/or adjacent projects may also present a viable financial partnership.

# CHAPTER THREE

## Evaluating Curbless Street Locations



dvrpc



# 3.1 Siting Curbless Streets

## STREET CHARACTERISTICS

Curbless design can have impressive effects on the ways in which communities perceive and use the right-of-way. However, not every street can accommodate a curbless retrofit and have users safely share space. Site selection depends on physical, social, cultural, and environmental contexts. Characteristics of the street, along with project sponsor goals, largely determine the appropriateness for curbless street design.

To determine the traits common to curbless streets in the United States, data on peer city sites was assessed for siting consideration. Some traits and priorities are universal, while others may be supportive. The traits, discussed in this section, are as follows:

*Universal Traits*

- high bicycle/pedestrian volume, low vehicle volume; and
- safety and accessibility needs.

*Supportive Indicators*

- private partnering potential;
- supports commercial uses/economic development;
- responds to deteriorating street conditions;
- community programming opportunities;
- presence of school-aged children;
- in implementing agency's project pipeline;
- open space/tree canopy desert;
- operates as a shared street already;
- access to, but not on, a transit route; and
- architecturally or culturally significant.

In this section each trait is introduced and peer city examples provide support for the trait. Contexts unique to Philadelphia are highlighted to examine potential benefits and opportunities areas within the city.

## UNIVERSAL TRAITS

The following are essential for candidate streets:

### High Bicycle/Pedestrian Volume, Low Vehicle Volume

Candidate streets are typically low-speed streets featuring high pedestrian and bicycle activity and lower vehicular activity. For shared streets, it is suggested that candidate streets carry below 100 vehicles per hour.[37] As traffic volumes increase, pedestrians feel less comfortable sharing the right-of-way, and vehicles are less likely to yield to other modes.[38] Ideally, the street should primarily function for local access. On many successful implementations, this low level of vehicle traffic is matched or exceeded by levels of bicycle and pedestrian traffic, and the street is part of an established or proposed bicycle or pedestrian network.

Some higher-vehicular-volume streets may be designed curbless if they are coupled with high bicycle/pedestrian volumes. These streets are typically more reminiscent of traditional street design, with vertical elements, contrasting pavement, and street drainage infrastructure acting as a stand-in for the curb.

#### *Case Example: Living Alleys Toolkit*

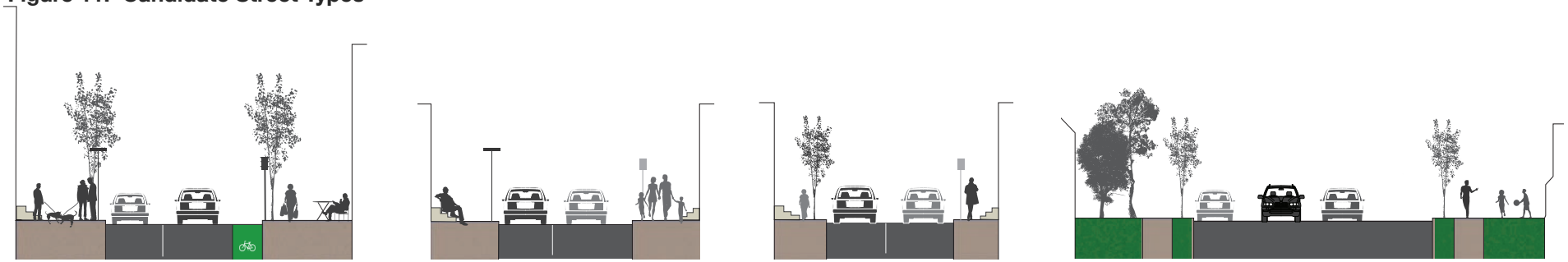
Retrofitting the rights-of-way of alleys has become a popular approach to implementing curbless streets across the United States. In 2015 San Francisco developed the *Living Alleys Toolkit* to establish guidelines for removing the curbs from narrow alleys to create usable, welcoming spaces.[39]

#### *In Philadelphia...*

The Philadelphia *Complete Streets Design Handbook* and *Philadelphia Pedestrian and Bicycle Plan* categorize street types. Published in 2012 by the PCPC, the *Pedestrian and Bicycle Plan* establishes a classification of the city's street network, with eleven categories based on features such as vehicle and pedestrian significance. PCPC's categories informed the Mayor's Office of Transportation and Utilities' 2012 *Complete Streets Design Handbook*. These resources can also be used to identify streets that fit a high bicycle and pedestrian/ low vehicle volume criteria.

By reviewing each street type's qualifications and suitability for curbless retrofit, four types are noted as strong candidates: (1) City Neighborhood, (2) Local, (3) Shared Narrow, and (4) Low-Density Residential Streets. Typical cross-sections of these street types are provided in *Figure 11*.

**Figure 11. Candidate Street Types**



*source:* DVRPC

**City Neighborhood**

- Pedestrian significance: MEDIUM
- Vehicle significance: MEDIUM

**Local**

- Pedestrian significance: LOW
- Vehicle significance: LOW

**Shared Narrow**

- Pedestrian significance: MEDIUM
- Vehicle significance: LOW

**Low-Density Residential**

- Pedestrian significance: MEDIUM
- Vehicle significance: LOW

## Safety and Accessibility Needs

Improving safety and accessibility is a primary objective associated with most curbless streets. Presence of physical obstacles, poor geometry, or ADA non-compliance are appropriate triggers for curbless design.

### *Case Example: Cambridge, Massachusetts*

On Winthrop Street in Cambridge, MA, pedestrians walked in the right-of-way to avoid the uneven brick sidewalk. When repairing the street, the city chose to promote the existing behavior by leveling the street surface and using high-quality pavers to create a more appealing and accessible environment (*Figure 12*).

### *In Philadelphia...*

The sidewalk infrastructure of Shared Narrow streets is particularly susceptible to safety obstacles: narrow sidewalks are often below the ADA-required four-foot minimum clearance, and trees, stoops, and other furniture pose obstacles to pedestrians. Similarly, the narrow carriageway can prohibit vehicular access due to the wider wheel width of modern vehicles. A typical Shared Narrow is exemplified by *Figure 13*. For these reasons, and due to low vehicle volume, pedestrians walk within the carriageway, and the street operates as a shared street. Removal of curbs could improve accessibility for all users.

**Figure 12. Winthrop Street**


*Cambridge, Massachusetts* *photo source:* Cara Seiderman, City of Cambridge

**Figure 13. Shared Narrow Accessibility Concerns**

*Philadelphia, Pennsylvania* *photo source:* DVRPC

## SUPPORTIVE INDICATORS

The following are street conditions and characteristics indicative of candidate streets well suited for curbless design, and qualities that may support specific livability goals.

### Private Partnering Potential

Instances in which a private entity or campaign is present and interested in streetscape investments are advantageous due to stakeholder buy-in, opportunities for collaboration, and financial support.

***Case Example: San Francisco, California***

The retrofit of San Francisco's Linden Street is an example of place making through partnership. Despite serving as a connector to Octavia Park and existing within a network of pedestrian streets, the original Linden Street was an unremarkable pass-through route for cars and pedestrians, serving residential and delivery use. A nearby firm saw potential and focused on improving a 100-foot stretch of the alley. Through collaboration with adjacent businesses and alley-facing storefronts, the street was activated and transformed into a welcoming destination shown in *Figure 14*. The organizations associated with the project continue to manage annual maintenance costs.

***In Philadelphia...***

BIDs, such as University City District, pursue projects that enhance the viability, reputation, and economy of their area. Partnering with similar agencies may leverage financial and political support among businesses and residents.

Another strategy is partnering with development firms to incorporate curbless design in proposed plans. Philadelphia's current curbless proposals for East Market, Schuylkill Yards, and Drury Street each connect with larger private property and development agendas.

**Figure 14. Linden Alley, Before and After**

*photo sources:* NACTO via Flickr (CC BY-NC 2.0); NACTO via Flickr (CC BY-NC 2.0)

*San Francisco, California*

- San Francisco Planning Department, Neighborhood Parks Council, Studio for Urban Projects, stakeholders
- funding: Private Seed Fund grant, City Community Challenge Grant, Fundraising

## Supports Commercial Uses/ Economic Development

Commercial or retail districts are often well suited for curbless design due to activity level, corridor identity, and opportunity for boosting economic vitality.

***Case Example: Batavia, Illinois***

The small city of Batavia, Illinois, utilized the economic potential of River Street's curbless design to secure Tax Increment Financing (TIF), where project funding is borrowed to realize the project and paid back through the increase in taxes from increased property values. The objective of the TIF program, and of River Street, is to revitalize the city's downtown district. Since its development in 2014, the street has established itself as a part of the local economy and character.

***In Philadelphia...***

Commercial corridors in Philadelphia are prime for shared space, including pending and proposed retail-focused developments. Several pedestrian-focused pilot projects, such as Grays Ferry Triangle (shown on the right in *Figure 15*), have demonstrated the positive economic and place-making effects of crafting areas as appealing destinations for pedestrians.[40]

## Responds to Deteriorating Street Conditions

Environmental Justice factors for a candidate site should be evaluated as a way to improve safety, economic viability, and engagement. A sense of community formed around a curbless street project could go a long way to improve pride, safety, and belonging in urban communities.

***Case Example: Chicago, Illinois***

Currently under construction, the Argyle Streetscape Plan aims to reduce throughput and excessive speed, improve perceived safety, and lower the crime rate in an Uptown Chicago neighborhood. To ensure the street's safety for all users, the design team collaborated with accessibility experts and local stakeholders. The street design promotes walking speeds, operating as a low-volume, narrow, two-way street with specific areas for passing vehicles. Increasing the foot traffic on the street is anticipated to improve the safety and reputation of the area, and local stakeholders are encouraging businesses to stay open later hours.

***In Philadelphia...***

DVRPC assesses Indicators of Potential Disadvantage (IPD) throughout Greater Philadelphia. Using census data, DVRPC identifies concentrations of specific Environmental Justice populations, including: households that are carless or in poverty, Hispanic and non-Hispanic minority populations, elderly persons and those with a physical disability, limited English proficiency, and female head of household with child. Using data for these groups, DVRPC determines existing transportation service gaps for these groups. IPD may be a method around which to select candidate curbless streets.

**Figure 15. Events at Grays Ferry Triangle**


*photo sources:*
South of South Neighborhood Association (SOSNA);
Geoff Kees Thompson

## Community Programming Opportunities

Sites with high levels of engagement are good candidates. Peer city contacts noted a strong community mainstay (non-profit, association, or otherwise) as an imperative component of successful projects. These stakeholders facilitate community buy-in and serve as partners for both official programming and informal gatherings, and help the street become part of the neighborhood identity.

***Case Example: Portland, Oregon***

In developing a plan for Portland's Chinatown district, planners saw untapped potential of two parallel, low-volume streets. Reframing the streets, Flanders NW and Davis NW, as festival streets with sculptures and design that highlighted the culture of the area, made for more welcoming and walkable paths. These streets are easily closed off to vehicular traffic, allowing the space to serve as venues for concerts, movies, and community events. In a discussion of the festival streets, project contacts emphasized the importance of streetscapes that are simple, in order to accommodate the widest range of community programming possible.

***In Philadelphia...***

Characterized as a "city of neighborhoods," Philadelphia is comprised of dozens of unique communities, many with established agencies focused on creating local programming for residents. These cornerstone institutions hold the capacity to coordinate programming in the shared space. Examples of agencies may include neighborhood associations, non-profits and development corporations, universities, or religious institutions.

## Presence of School-Aged Children

Areas that would be well served by play space and safer road conditions for children should be prioritized.

***Case Example: Home Zones, United Kingdom***

Understanding the limitations of existing streets to meet the needs of children, and building off the success of other European curbless streets, a nationally funded Home Zone pilot project was implemented in nine U.K. sites to improve neighborhood environments and improve play space for residents and children. Based on the success of the pilot in meeting these goals, the study was expanded to 60 sites in the year following its completion and review.

***In Philadelphia...***

Philadelphia's Play Streets program provides children with meals and closes streets to vehicle traffic to provide a safe area for activities, particularly in underserved areas. Examples of play street programs are shown in *Figure 16,* depicting how rights-of-way are reclaimed as spaces for play and recreation.

To become a Play Street, a site must meet location requirements and submit an application providing a petition with 75 percent of signatures from neighborhood residents. If selected, these small, one-way streets are closed to vehicle traffic on weekdays between 10 AM and 4 PM. In 2015 Philadelphia designated approximately 650 sites as Play Streets. While these designations are both temporary and completely restrictive to vehicles, the Play Street program provides a framework for rethinking the value and potential use of a street. It may be suitable to convert an established Play Street into a permanent installation, similar to a woonerf.

**Cultivating support and buy-in from the surrounding community—both residents and commercial or institutional stakeholders—is reported by existing sites as invaluable to the success of a curbless street.**

**Figure 16. Play Streets**

*Philadelphia, Pennsylvania*

*Chicago, Illinois*


*London, England, United Kingdom*

*photo source:* Sisters of Saint Joseph; Hammersmith and Fulham Council via Flickr (CC BY-NC-ND 2.0); World Sport Chicago

## In Implementing Agency's Project Pipeline

Streets that are due for maintenance, utility, pavement, or lighting investment are more likely to be considered for construction and new approaches to the street design. Curbless retrofit includes expensive removal of existing pavement and adjustment of infrastructure; these costs can be mitigated by selecting sites already in the pipeline for stakeholders.

***Case Example: The Green Alley Program***

Similar to the premise of Winthrop Street's redesign, which focused on accessibility repairs, cities may opt to implement curbless streets as a means to incorporate improvements, such as stormwater management. Curbless streets represent opportunities to rethink flowlines, pavements, and other measures. Overviews of treatments that may meet design and stormwater goals are outlined in *The Chicago Green Alley Handbook*, which advocates for homeowners to consider transforming privately owned rights-of-way into more sustainable streets.

***In Philadelphia...***

In Philadelphia, site selection should review Streets Department, PWD, and PennDOT's pipeline of replacement projects as potential candidates. Repairing and improving stormwater management along corridors is a priority for PWD, and a concern that can be addressed or complemented through curbless redesign.

## Open Space/ Tree Canopy Desert

Areas devoid of public space or parks are strong candidates in the potential of curbless streets to introduce new landscaping, open space, and street trees.

***Case Example: Seattle, Washington***

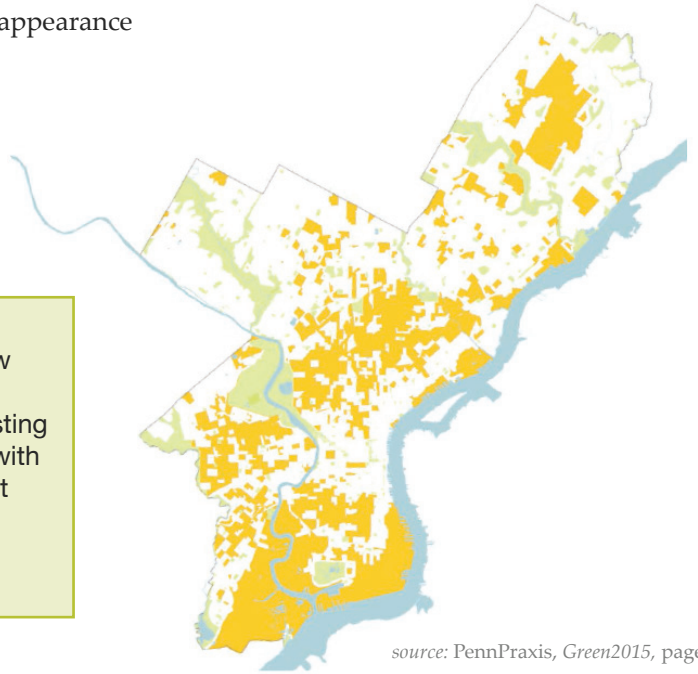
Bell Street Park, Seattle's previously discussed four-block curbless street, allowed the city to increase the available park space in an area underserved by existing parks. Prior to Bell Street's renovation, the neighborhood's only designated park space was a dog park, which was insufficient for the 18,000 nearby residents.[41] When surveys of potential park areas were limited, the ability to carve usable green space from an underutilized right-of-way allowed Seattle to bring a park into the neighborhood while providing the many safety and appearance benefits linked with curbless streets.

***In Philadelphia...***

*Green2015*, PennPraxis and PPR's plan for transforming underperforming areas into parks, notes that 12 percent of Philadelphia residents do not live within walking distance of a park. When traditional park access is limited, curbless streets may add usable public, and potentially green, space to the neighborhood.[42] A map of PennPraxis's priority areas for parks is shown in *Figure 17*.

In *Green2015*, PennPraxis determined priority areas for new parks by identifying areas that reported the least access to existing parks, and combined that data with equity indicators such as highest density, the highest population makeup of children and seniors, and the lowest third of incomes.

**Figure 17. Park Priority Areas in Philadelphia**



*source:* PennPraxis, *Green2015*, page 41

## Operates as a Shared Street Already

Curbless design is a good application for streets on which the carriageway is already shared by multiple modes, such as narrow alleys where pedestrians walk within the vehicular space.

***Case Example: Cambridge, Massachusetts***

Palmer Street, a service alley within Harvard Square, was a traditionally designed street that operated as a shared street due to low traffic volumes and narrow and uneven sidewalks. In 2007 the street underwent a place-making transformation: the level of the street was adjusted to become curbless, and the street incorporated several elements of public art and lighting features to create an attractive space. Palmer Street continues to be shared by service vehicles, small volumes of through-traffic, and pedestrians, and the right-of-way is more accessible and attractive than prior to redesign.

***In Philadelphia...***

Philadelphia's grid system comprises many streets with relatively narrow right-of-way widths, on which pedestrians may opt or need to walk within the vehicular space. In other areas, comparatively wider streets with heavy pedestrian traffic serve busy commercial and retail uses, often paired with pedestrians entering the carriageway more frequently, and vehicles traversing the street more slowly to accommodate them. These streets could be formalized as curbless streets.

## Access To, But Not On, a Transit Route

Transit issues such as oversized bus vehicles, turning radii, and stop location may pose obstacles to the notion of a shared space with more vulnerable users like pedestrians and cyclists. However, nearby access to transit may provide better access and connectivity with curbless streets.

***Case Example: New York City, New York***

A newly released plan from the New York City Department of Transportation proposes to transform the intersection at Broadway and Fifth Avenue and its surrounding area into a shared street. This area is noted as a prime candidate for redesign thanks to the existing transit accessibility and walkability, allowing for visitors to access the site using alternative modes of transportation. In this two-block area, there are station entrances for several subway lines (N, Q, R, and W) and docks for the city's bikeshare operation, CitiBike.

***In Philadelphia...***

Philadelphia's transit system includes an effective bus network and rail lines connecting most city neighborhoods. Choosing sites and developing destinations accessible by transit may allow for greater equity of access and should be considered in a selection process.

## Architecturally or Culturally Significant

Notable architecture or sites should be emphasized. If the site itself, or something along the street, is significant to the community's image, a curbless street design may be a great fit to draw a brand and attention to the locale.

***Case Example: Pittsburgh, Pennsylvania***

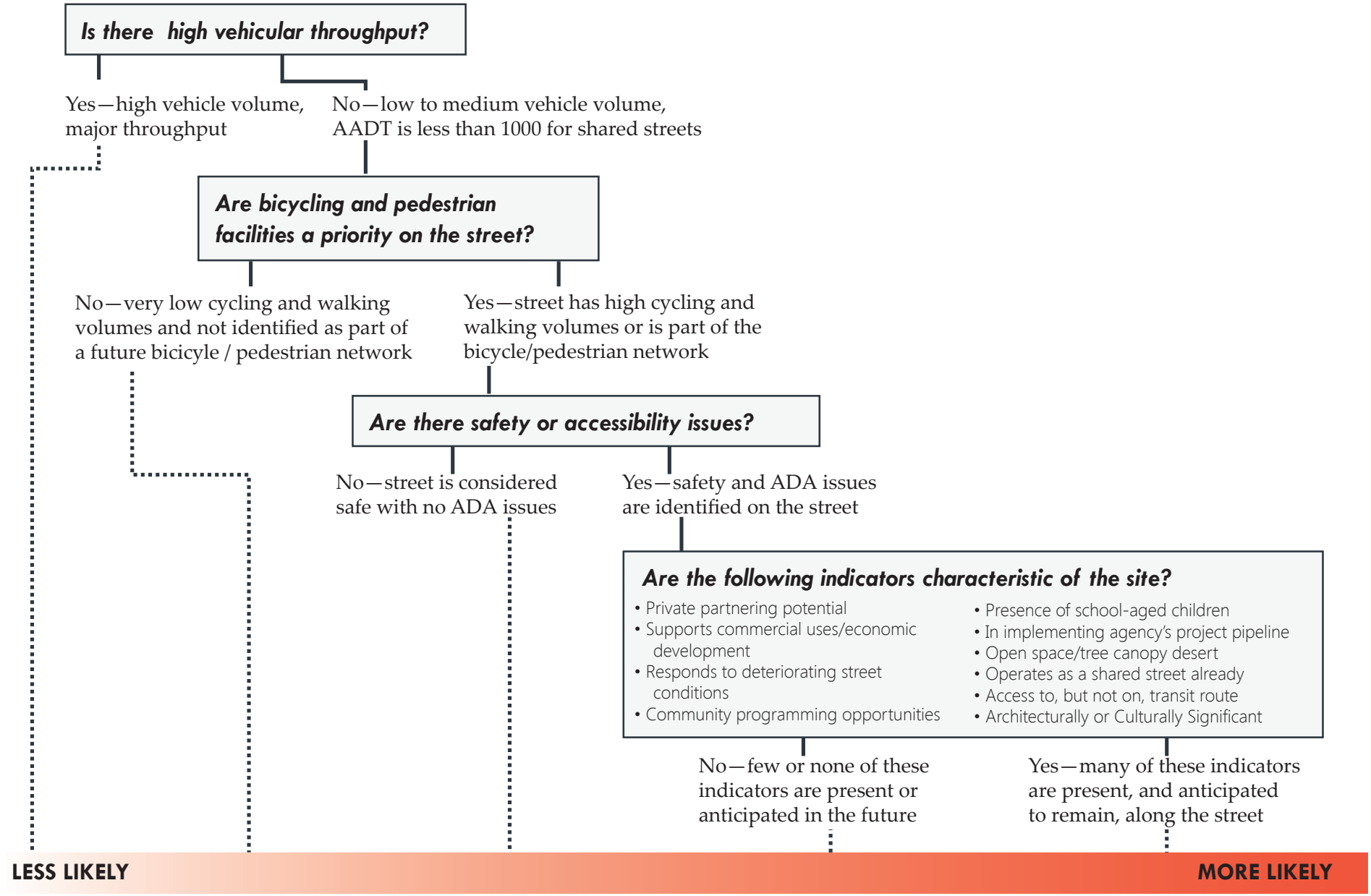
Prior to its redesign as a curbless street and plaza, Market Square in Pittsburgh, Pennsylvania, was a thoroughfare for buses and other vehicles and an unwelcoming place for pedestrians. To reverse the impact the streetscape was having on the surrounding businesses, historic attractions, and residences, the Urban Redevelopment Authority opted to turn the intersection into a pedestrian-only plaza, with a curbless, shared space connecting the plaza to the shops lining the square. Creating a programmable space allowed the city to better promote its history and establish a cultural center open to the public at all times.

***In Philadelphia...***

As the first and only World Heritage City in the United States, Philadelphia has an abundance of historic sites and architecture. Creating a space designed around notable features is an idea already promoted by *Philadelphia Inquirer* architecture critic Inga Saffron, who suggested the pedestrianization of Lits' Alley to highlight a Venetian-esque walkway and arch that connects the buildings on opposite sides of the alley.[43]

Many opportunities for curbless streets exist within the city of Philadelphia. *Figure 18* suggests the universal traits and supportive indicators to be considered when selecting candidate streets, and how each indicator influences the suitability of a street for curbless design.

**Figure 18. Assessing Supportive Traits to Determine Candidates for Curbless Design**




SHARED
STREET


## 3.2 Weighing Service Demand Versus Walkability

Constructing a curbless street poses a unique set of challenges and features that must be accounted for in the design. For example, in commercial areas, service delivery or freight trip generation is typically more frequent and of higher capacity than on residential streets, and may require specific design strategies to meet those utilitarian needs in an aesthetic and safe way. In this chapter, the term *service demand* refers to the level of service needs or functions on the street and is contrasted with *walkability*, which more refers to the elements typical of pedestrian-friendly or pedestrian-attractive streets.

This section serves to introduce the features that make some streets more or less likely to have utilitarian demands that would outweigh the potential to become walkable, curbless, shared street destinations. The following section introduces the considerations that influence the degree to which a street is necessarily service oriented when considering curbless streets. A greater number of utilitarian characteristics may indicate that a transition to a walkable, shared street is difficult or prohibitive.

In this discussion, three example streets are referenced to illustrate the spectrum of suitability to be a converted shared street. The traits of the three example streets responding to each characteristic are referenced in an adjacent figures.

The example streets, shown on the following page, include:

- **Sydenham Street**, between Walnut and Locust streets;
- **Drury Street**, between Juniper and 13th streets, and
- **Camac Street**, between Spruce and Locust streets.

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## EXAMPLE STREETS

**Figure 19. Example Streets Used to Demonstrate Service Demand and Walkability**


*source:* Google Maps

The three streets highlighted in *Figure 19* serve as example candidate streets to demonstrate curbless street design considerations.

Each selection is limited to a one-block segment, although block lengths vary by site. All example streets are located within a half-mile radius of each other in the Center City district of Philadelphia.

Sydenham, Drury, and Camac streets provide a spectrum of street forms, and each incorporates unique uses, surroundings, and functions that require context-appropriate design.

**Sydenham Street** is connected to a principal arterial and commercial corridor in Walnut Street. Primarily used as an alternative to south-running 16th and Broad streets, Sydenham provides delivery and service access to businesses that front the surrounding commercial streets.

**Drury Street** also serves the backs of surrounding businesses that front onto higher-vehicle-volume roads, save for one restaurant that fronts Drury Street. More recently adjacent businesses have opened frontages onto the street, increasing its appeal as a pedestrian corridor between Sansom and Chestnut streets.

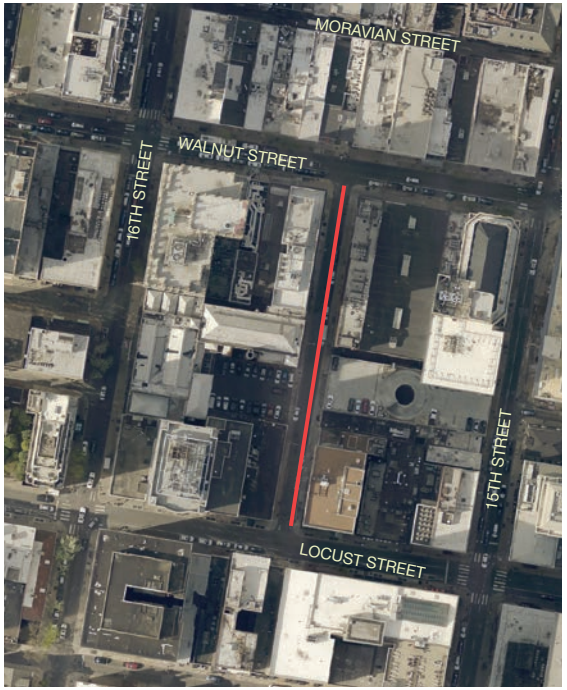
**Camac Street** is part of a strong network of shared narrows and private alleys, largely along primarily residential streets, creating attractive and walkable pedestrian routes.

In the following section, design considerations focus on the existing street network, street geometry, surrounding density frontages and uses, and utility functions to determine a range from inherently walkable to inherently utilitarian. An inordinate number of more walkable characteristics may indicated an aptitude toward going curbless. Conversely, an inordinate number of utilitarian characteristics may indicate that service demands outweigh the ability to be an enjoyable street on which to linger.

The opposite page provides brief introductions to each street and its characteristics.

## Sydenham Street

**Length:** 400 feet
**Context:** A utility-oriented street, bound by high-density commercial streets (Walnut, 15th, and 16th streets).

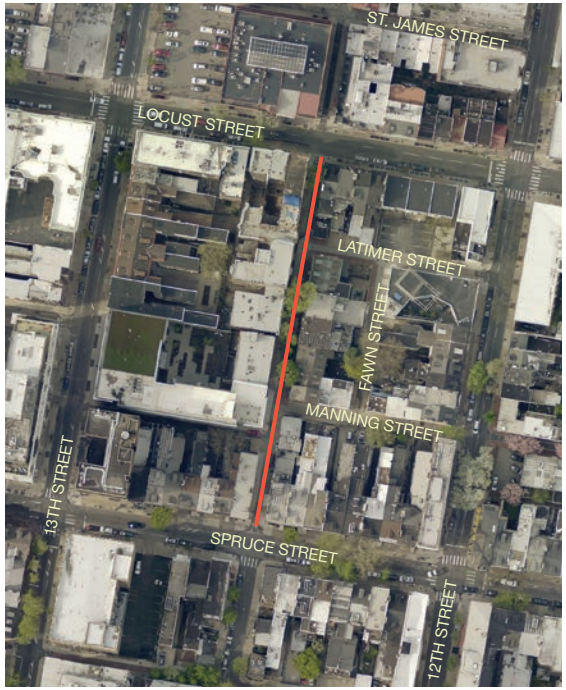



## Drury Street

**Length:** 270 feet
**Context:** A service alley transitioning to more pedestrian-friendly uses (e.g., outdoor seating). Adjacent to 13th Street commercial corridor.


## Camac Street

**Length:** 430 feet
**Context:** A quiet, narrow street with both residential and commercial uses; connects with residential alleys and a commercial corridor.




*Not to scale*

*source for aerials and photos:* Google Maps

## WALKABILITY

In selecting candidate sites for the purposes of enhancing the aesthetic and improving pedestrian friendliness, streets with existing walkability and place-making potential are typically well suited to redesign.

In order to measure these qualities, the following physical characteristics of the street and the adjacent properties affect the level of interest along streets. Each street is evaluated for the following criteria: frontages, transparent windows, public-access doors, sense of enclosure, and street trees. Based on these characteristics, the atmosphere and function of the street trends toward either service orientation or place orientation.

The spectrum of service- or place- oriented streets, shown below, is used as a qualitative estimation of the street to determine the likelihood or suitability of becoming a curbless or shared street.

*Qualitative street characteristics spectrum*


### Frontages

Curbless streets aim to create a safe and attractive experience for pedestrians. The frequency of active frontages plays an important role in how the street is used and perceived, and is a design factor empirically linked to increased time spent on the street.[44]

In general, curbless street candidates in commercial environments should accommodate frequent, engaging frontages. *Figure 20* depicts the frontages on the three example streets. Shown in the section, Sydenham's few windows, infrequent frontages, and limited accesses create an environment that is less engaging than the consistent stoops, windows, street trees, and access points on Camac Street.

While Drury Street accommodates many of the same service functions as Sydenham Street, the inclusion of outdoor seating and street-facing restaurant frontages improves the aesthetic of the street as another measure for the amount of frontage interest pedestrians might enjoy.

To evaluate frontages, buildings along the street were measured. The average frontage length was calculated and serves to illustrate the frequency of articulated frontages.

### Transparent Windows

Transparency of buildings at the street level provides interest and a sense of safety for pedestrians.[45] This report uses the methodology of previous studies in which transparency is measured by determining the percentage of first-floor properties with windows.

On each example street, the fenestration was measured by tallying the number of properties with first-floor windows that are transparent. This was divided by the total number of properties to establish a percentage of fenestration on each street.

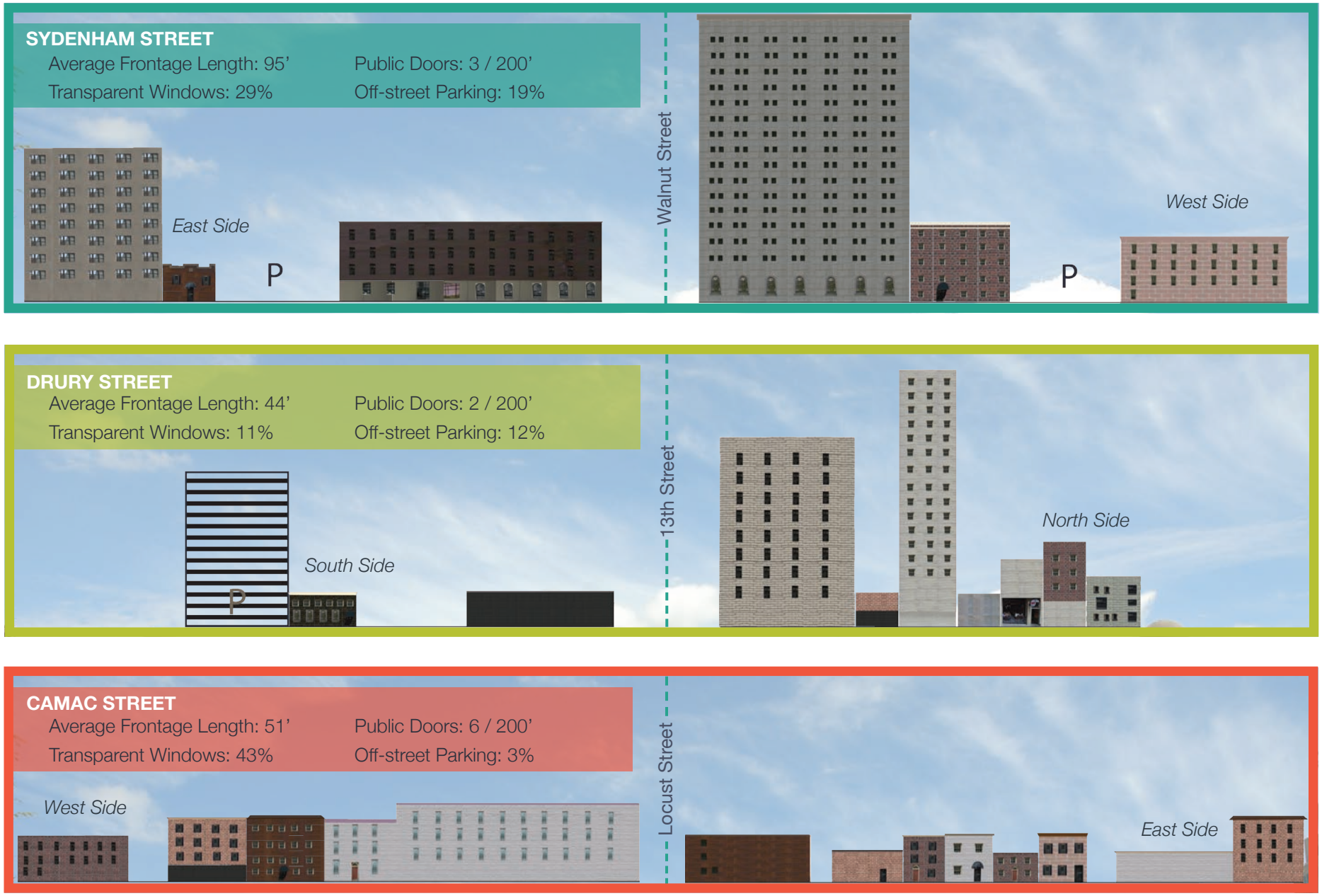
### Public-Access Doors

Similar to the effects of transparency and fenestration, streets with active frontages are generally more engaging and attractive than more utilitarian streets that typically host fewer active frontages.

To account for discrepancies in street length and to account for private-access service doors (which are not inviting for pedestrians), this study calculated active frontages and doors by counting the number of public-access doors and established frequencies per 200-foot segments.

*Figure 20*, shown on the opposite page, illustrates the walkability metrics observed along each of the example streets, and notes the average frontage lengths, transparent windows, public doors, and off-street parking.

**Figure 20. Example Street Frontages and Walkability Metrics**



## Sense of Enclosure

For this study, candidate streets are one block in length, and smaller—both physically and in carrying capacity—than the surrounding network. All candidates are one-way, one-lane streets.

The right-of-way widths for the example streets vary from 20 feet (Drury and Camac streets) to 35 feet (Sydenham Street). On Sydenham this width is shared by a parking lane, travel lane, and sidewalks. On Camac Street the right-of-way accommodates a travel lane and sidewalks. All examples use bollards to delineate travel paths.

The sense of enclosure refers to the height of surrounding buildings relative to the width of the right-of-way. Streets on which this relationship is more proportionate may provide a more comfortable feeling of enclosure for pedestrians than streets on which the buildings are exceptionally tall or streets that are disproportionately wide. To ensure that the surrounding built environment is comfortable and attractive to pedestrians, building height to right-of-way width should tend toward lower ratios. Those around the 1.6:1—1:1.6 "golden ratio" have been noted as particularly welcoming.

In Philadelphia, these ratios are impacted by the city's historically narrow rights-of-way, resulting in ratios higher than similar streets in peer cities. Center City likewise hosts most of the city's height and density, and as a result the ratios below reflect much higher ratios than case studies referenced in Chapter One (the average ratio of case studies is 1:2).

*Figure 21* depicts each example street's cross-section or surrounding built environment. Measuring the sense of enclosure relied on determining the average or representative height of the street's surrounding buildings and measuring the right-of-way width. From these measurements, a ratio of height-to-width was established.

## Trees

Another streetscape factor that can lend itself to a sense of enclosure is the presence of street trees. On streets on which the height to right-of-way ratio skews higher, street trees can provide a defined canopy that crafts a human-scale perspective for pedestrians. In addition, street trees can create a more aesthetically appealing environment.

Street tree coverage serves as the metric for assessing trees on the example curbless streets. It is presented as a percentage of the total street area, and is calculated in the following four steps.

First, establish the area of an average street tree's canopy. This study assumes an average canopy diameter of 25 feet, which equates to a coverage area of 78.5 square feet. This average is multiplied by the number of trees on the street - this is the coverage area. Next, the street's length is multiplied by its full right-of-way (building face to building face) to determine the total street area in square feet. Dividing the total coverage by the total street area produces a percentage of tree canopy coverage.

**Figure 21. Building Height to Right-of-Way Width Ratio**




*source:* Google Maps

On each of the three example streets, the street tree coverage was determined using this method. Streets with lower coverage are assumed to be less appealing and provide less of a sense of enclosure than streets with greater numbers of trees. Based on the research of Maco and McPherson (2002), an average of 15 percent was set as the appropriate curbless target for tree coverage.

**SYDENHAM STREET** Tree Coverage: 1%

**DRURY STREET** Tree Coverage: 4%

**CAMAC STREET** Tree Coverage: 11%

A review of each of these walkability factors and how each street fares is provided *Figure 22*. Based on these metrics, Camac Street is the least service-oriented street, scoring favorably in frontage activity (fenestration and public doors), sense of enclosure, parking, and trees.

On the other end of the spectrum, Sydenham Street has a more utilitarian environment. Although Drury Street has fewer doors and windows than Sydenham and shares many utilitarian qualities, the greater frequency of frontages and sense of enclosure make it a more favorable route and a less utilitarian street. This is complemented by the availability of outdoor dining on Drury, with open seating on the north side of the street and a seasonal pop-up garden comprising nearly a third of the frontages on the south side.

**Figure 22. Walkability Factors to Weigh Service Demand versus Walkability**

| *Metric* | | *Appropriate Curbless Target* | SYDENHAM STREET | DRURY STREET | CAMAC STREET |
|---|---|---|---|---|---|
| **Frontages** | Average length of street frontage per property | **60' or less** | 83' | 44' | 51' |
| **Fenestration** | Percentage of first-floor fenestration/transparency | **40% or higher** | 29% | 11% | 43% |
| **Public Doors** | Number of public doors per 200' | **5 / 200' or more** | 3 / 200' | 2 / 200' | 6 / 200' |
| **Sense of Enclosure** | Building height to right-of-way width ratio | **2:1 - 1:1** | 4:1 | 3:1 | 2:1 |
| **Street Tree Coverage** | Percentage of the right-of-way area with tree coverage | **15% or more** | 1% | 4% | 11% |

*source:* DVRPC

*These targets help to establish an evaluation of candidate streets strengths and weaknesses but are qualitative in nature and should be used as guiding, but not exclusionary, metrics.*

## TRAFFIC AND UTILITY DEMANDS

### Street Redundancy

Candidate sites that feature redundancy within the surrounding street network are more likely candidates for curbless redesign, as the adjacent streets may serve as alternate routes for displaced vehicles and provide greater connection for pedestrians and other modes.

Street redundancy is calculated through a mapping process. The example street segment serves as a center for a .1 mile walkshed. For all streets within this walkshed, the length of streets operating in each direction (i.e., southbound) is added up. This sum is used to determine the percentage of street redundancy by dividing the length of the example street by the total sum of streets traveling in the same direction.

The resulting percentages are noted below in *Figure 23*; streets that are more utilitarian likely have lower redundancy, whereas higher redundancy percentages are better candidates for redesign.

*Maps below depict a .1-mile walkshed from the center of each example street. The line thickness corresponds to street vehicle volume per PennDOT classification:*

- *Principal arterial*
- *Major collector*
- *Minor arterial*
- *Local/other street*

**Figure 23. Example Streets' Street Redundancy**


**Street Redundancy: 75%**

**Sydenham Street** is one of two southbound access routes within an eighth-of-a-mile radius. It serves as an access route for deliveries and other utilitarian uses.

**Street Redundancy: 89%**

**Drury Street** is one of several alleys and minor connector streets that establish a somewhat duplicative network in this area.

**Street Redundancy: 93%**

*source:* DVRPC

**Camac Street** extends several blocks beyond this segment and is close to many other narrow alleys. To the east, 12th Street provides a more comfortable route for southbound vehicles.

## Waste Generation

Waste generation and service needs associated with commercial corridors are considerations in siting curbless streets. As waste generation—and number of dumpsters—increases, the street appears more service oriented.

To determine where the example streets fell along the service-versus-place spectrum with regard to waste generation, the number of dumpsters present on each street were tallied. Dumpsters that were enclosed or otherwise not easily visible from the street were not counted. Based on this metric, Camac Street is the most place-oriented street, with a single dumpster along the right-of-way. Drury Street has the highest waste generation, with more than twice as many dumpsters as Sydenham Street. Drury Street primarily serves the backs of properties but is increasingly accommodating frontages and cafe seating; the significant dumpster presence is one obstacle to this transition. The property owners, in collaboration with Center City District (the local BID), have focused on the reimagining of Drury Street through pedestrianization of the alley.

A major component of this pedestrianization is rethinking the current waste management. To reduce waste generation and the frequency of waste removal, surrounding businesses would rely on composting, recycling, and dumpster-sharing programs.

## Off-Street Parking

Off-street parking is often associated with underutilized space and inactive frontages. In this section, each street is assessed for the percentage of the frontages dedicated to off-street parking. Streets with higher percentages are assumed to be less pedestrian friendly and more service oriented.

## Freight Generation

Freight trip generation is estimated utilizing the National Establishment Time Series employment data at the block level. Based on employer sizes and industrial classification, a rough estimate of daily freight trips is modeled. For planning purposes, this data provides a foundation for understanding the anticipated volume and appropriate measures to accommodate these freight deliveries.

Freight generation, coupled with waste generation, parking, and street redundancy, serve as factors for determining utility demand for a candidate street. These factors are reviewed in *Figure 24* to demonstrate which example streets are more service-oriented.

**Figure 24. Traffic and Utility Demand Factors to Weigh Service Demand versus Walkability**

| *Metric* | | *Appropriate Curbless Target* | SYDENHAM STREET | DRURY STREET | CAMAC STREET |
|---|---|---|---|---|---|
| **Street Redundancy** | Percentage of street redundancy within a .1-mile walkshed | **90% or higher** | 75% | 89% | 93% |
| **Waste Generation** | Total number of dumpsters on the street | **2 or fewer** | 7 | 18 | 1 |
| **Freight Generation** | Anticipated number of daily freight trips (block-level analysis) | **100 or fewer** | 335 | 157 | 47 |
| **Off-street Parking** | Percentage of street frontage dedicated to off-street parking | **5% or less** | 19% | 12% | 3% |

*source:* DVRPC

*These targets help to establish an evaluation of candidate streets strengths and weaknesses but are qualitative in nature and should be used as guiding, but not exclusionary, metrics.*

# CHAPTER FOUR

## Designing Curbless Streets



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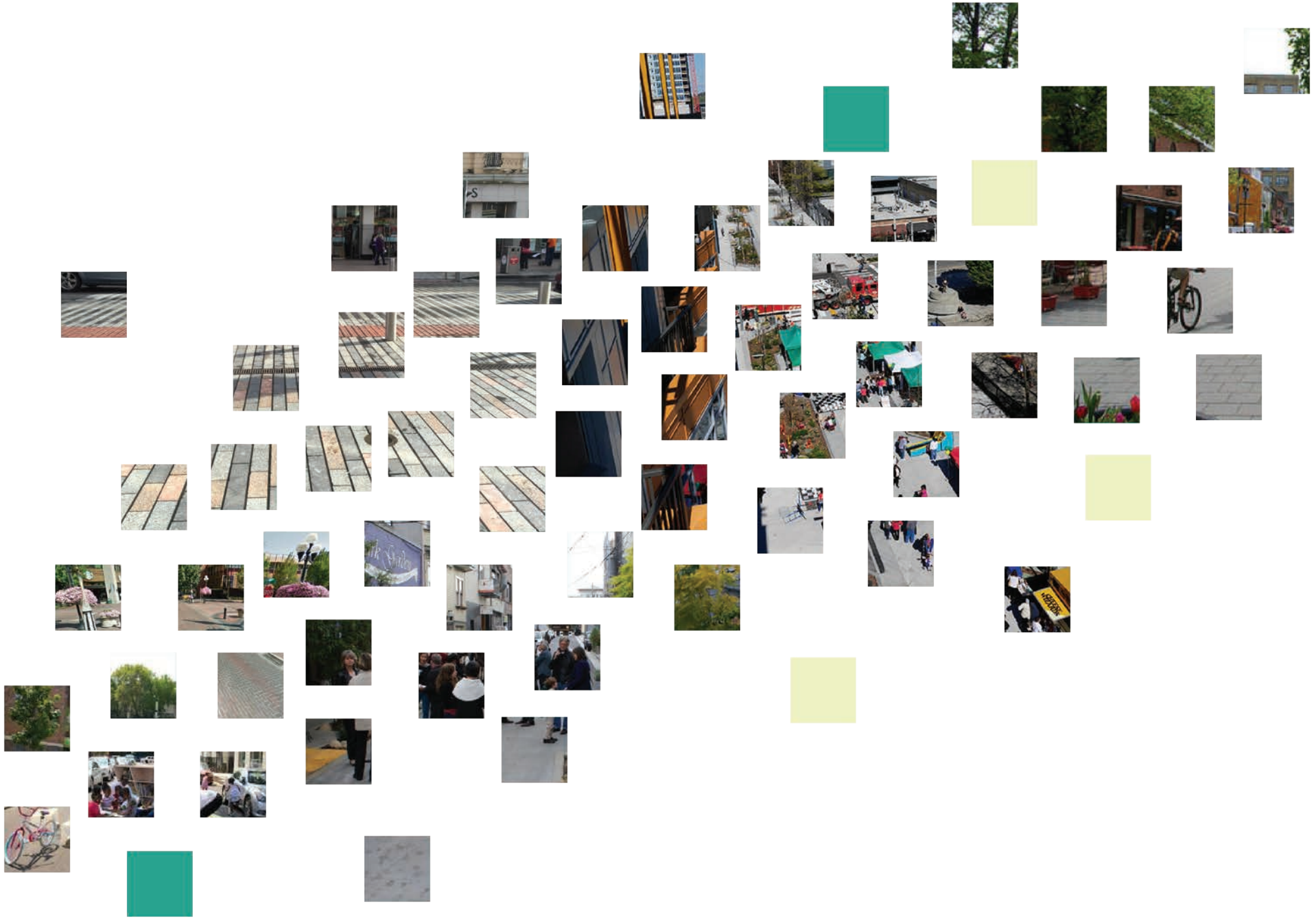


# 4.1 Curbless Street Design Toolbox

Through the use of design elements, such as paving and strategically placed vertical elements, curbless design cues drivers to behave differently from how they do on conventional streets.

Curbless design concepts must consider the surrounding context and meet location-specific characteristics and goals. Unlike other street treatments that rely on prescribed regulations, curbless streets are less defined by "one-size-fits-all" designs or necessary components. Rather, curbless streets necessitate unique strategies that respond to a project's goals and site.

Many cities are adopting their own guidelines that reduce vehicle dominance and incorporate pedestrian priorities, similar to values reflected in curbless design. San Francisco's *Better Streets Plan* and Philadelphia's *Complete Streets Design Handbook* provide guidelines for prioritizing all modes and introduce curbless streets (festival or shared streets) as potential design strategies.

Other guides, such as, Rutgers University's *Home Zone Concepts for NJ*, note best practices for curbless streets without mandating specific design elements. In countries where curbless streets have been in practice longer, established guidelines help planners design effective layouts. For example, the United Kingdom's Department for Transport developed publications of best practices, such as residential-specific *Home Zone Design Guidelines*.

Based on guides and research, there are six design elements common to many curbless streets:

- high-quality paving materials;
- non-linear travel path;
- well-defined entrances and gateways;
- on-street parking;
- speed limit and designation; and
- stormwater management.

## ❶ Paving Materials

Special paving treatments establish the street as a unique area, prompting drivers to operate differently from how they do on typical streets. Bricks, pavers, or stamped asphalt are common treatments for curbless streets, as they set the street apart visually from auto-centric streets, are comfortable for both vehicle and foot traffic, and create an aesthetically appealing surface. They are not always preferred by cyclists, so they are best used on casual cycling streets rather than on commuting routes. *Figure 25* provides examples from around the world that depict a variety of high-quality and unique paving treatments.

Whereas most streets rely on curbs to delineate areas, curbless streets use paving designs to either designate paths or lend ambiguity to the space. Designers often use paving treatments of contrasting colors and textures. High contrasts allow all users, especially those with vision impairment, to better navigate the space.

On streets with higher vehicular volumes where all modes are not intended to share the cartway, ADA law requires an unobstructed pedestrian route and for tactile warning strips to be placed where this route borders a vehicular path. Implementations vary, but guidelines advise the use of truncated domes or rolling curbs (of two inches or less) to discourage pedestrians from entering the cartway outside specific crossings or intersections.[46] Most case studies used color- or texture-contrasting pavers to meet compliance.

Streets with lower vehicular volumes (less than 100 vehicles per hour) may take a more radical curbless approach and deliberately blend the design treatment of pedestrian and vehicular space. This shared space design treatment encourages the cartway to be shared among users. In many instances, such design is coupled with a policy that protects pedestrians from being liable for being in a vehicular travel way: pedestrians are thus allowed anywhere.

**Figure 25. Unique Paving Treatments**

1) Patrick Street—Cork, Ireland

2) Cady's Alley—Washington, District of Columbia

3) Willamette Street—Eugene, Oregon

4) Burdick Street—Kalamazoo, Michigan

5) Bell Street Park—Seattle, Washington

6) New Road—Brighton, United Kingdom

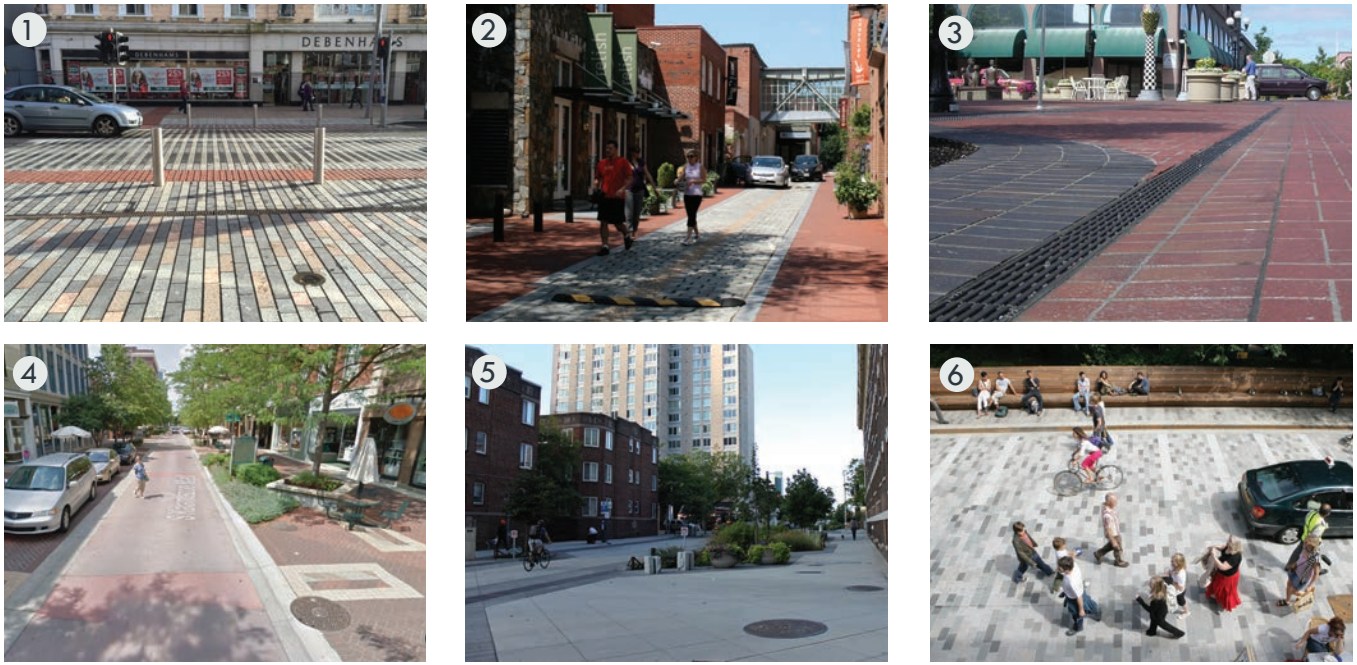



*photo sources:* 1. Orla Pease; 2. Eric Fidler via Flickr (CC BY-NC 2.0); 3. NACTO via Flickr (CC BY-NC 2.0); 4. Google Maps; 5.Bruce Englehardt via Flickr (CC BY-SA 2.0); 6. NACTO via Flickr (CC BY-NC 2.0)

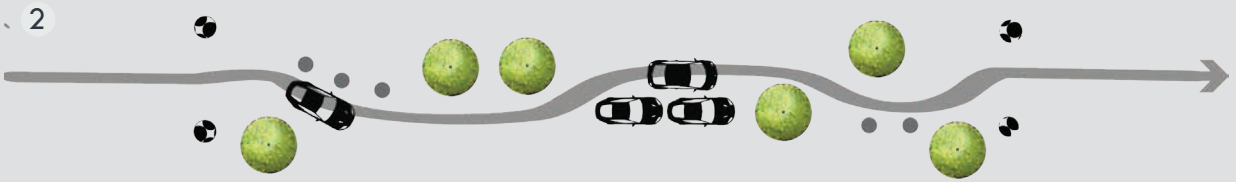
## ❷ Travel Path

On many curbless streets, streetscape features and furniture are placed strategically to force vehicles to maneuver slowly. This practice, a traffic-calming measure known as *chicaning*, diverts the travel path and shortens the line of vision. Studies recommend a maximum of 100 feet between traffic-calming measures in order to maintain vehicles operating at pedestrian-level speeds. *Figure 26* shows a sample travel path.

The chicaning effect and separation of pedestrian-only space (per ADA standards) is typically achieved through the use of vertical elements such as bollards, planters, trees, or other equipment such as bike parking structures, as seen in *Figure 26*. Shared or festival streets may use movable bollards at entrances to limit vehicular access.

Similar design practices can be used on curbless traditional streets, on which conventional channelized travel paths remain, but their separation is reinforced by vertical elements. The dotted lines drawn on each street represent the projected travel path for vehicular movement.

**Figure 26. Constructing a Travel Path through Design Elements**



1) Fort Street—Auckland, New Zealand

2) Example of a chicaning travel path established through the placement of vertical elements

3) Cameron Road—Normanton Home Zone, Derby, United Kingdom

*photo sources:* 1. Greater Auckland; 2. DVRPC; 3. Derby City Council

## ❸ Entrances and Gateways

Where curbless streets intersect with traditional streets, it is critical to alert drivers to new street conditions and behaviors. This is achieved by incorporating visual elements at the entrance to the street, such as gateways, signs, and street narrowing, as shown in *Figure 27*. Changes in pavement style, color, or texture may also identify the entrance to a new street.

**Figure 27. Gateway Designs**


*photo sources:* Altamanu, Inc.; Google Maps

## ❹ Parking

On-street parking is an important factor when developing a curbless street design plan; many case studies claim on-street parking spaces for new uses. To complement the chicaning travel path used in many designs, shown in *Figure 28*, some guidelines place limits on the number of cars that may be included in any street parking cluster. For example, Seattle's Terry Avenue North Street Design Guidelines do not allow more than five consecutive parking spaces. On curbless traditional streets, intermittent parking lanes may add protective barriers between areas.

**Figure 28. Parking as a Design Strategy**

*photo sources:* David Vega-Barachowitz for NACTO via Flickr (CC BY-NC 2.0); Jarrett M. via Flickr (CC BY-NC 2.0)

## ❺ Speed Limit and Designation

Through physical design strategies, street planners can control the speed at which most drivers feel comfortable. A more direct approach for controlling speed is to mandate speed limits for curbless and shared streets. Peer city sites sometimes use memorable speed limits to gain attention and inform drivers of the street's priority. For example, on a German spielstrasse or "Play Street," the speed limit is set at "walking speed" (roughly translating to 3.1 MPH) to demonstrate the equal priority of all users. *Figure 29* provides examples of signage on curbless streets.

**Figure 29. Shared Street Signage**

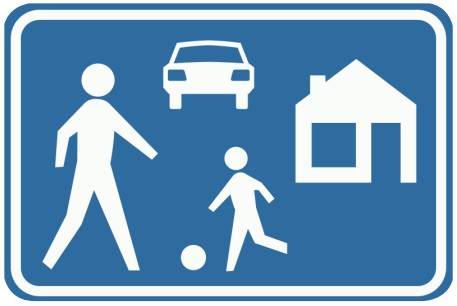



*photo sources:* Jarrett M. via Flickr (CC BY-NC 2.0); Reglement verkeersregels en verkeerstekens 1990 (RVV 1990)

## 6 Stormwater Management

Adjusting the surface of a street can adversely affect existing drainage patterns, and it is critical to design from the start with stormwater management in mind. Some alleys and narrow curbless streets are engineered to drain to inlets in the center of the street; other streets maintain their traditional crowned design and use channels or trench grates. Redesigning the street or installing new pavement can be an impetus for making enhancements to stormwater infrastructure; some narrow curbless streets may be able to handle all stormwater through pervious paving and green stormwater infrastructure. *Figure 30* shows a Chicago alley before and after curbless redesign and implementation of stormwater management features.

Many cities incorporate bioswales, stormwater management, or other green streetscaping and landscaping in areas used to designate the travel path. The green infrastructure may be employed to serve as an encroachment into the vehicular path, producing a chicaning quality to the space.

Discussions of stormwater management and its connection to curbless street design are wholly contingent on the ownership of the street. For alleys, which are often privately owned in Philadelphia, PWD will not invest in green stormwater infrastructure without first acquiring an agreement and an easement.

**Figure 30. Stormwater Management**

*Chicago, Illinois*

*photo source:* Chicago Department of Transportation
*note: Chicago's alleys are privately owned

*Chicago, Illinois*

*photo source:* Chicago Department of Transportation

*Above*: Before and after photos of a private alley following retrofit through the Green Alley Project.

*At Left*: Also in Chicago, stormwater management is integrated within a tree planter along Argyle Street. This street serves as a pilot project site for Smart Green Infrastructure, in which sensors collect data on stormwater management performance. This data can be applied toward analyses of best practices and most effective infrastructure, and used to inform future investments and strategies. The Smart Green Infrastructure is a collaborative pilot featuring City Digital and the UI LABS Innovation Center with the City of Chicago, Microsoft, Senformatics, Opti, and AECOM.

## 4.2 Designing Curbless Streets

The benefits and the challenges of curbless streets stem from their unique design and the degree to which the right-of-way is shared by all modes. In many implementations, curbless design and policy concepts diverge from traditional notions of street use, function, and design, and may not align with existing ordinances, codes, or practices.

Working to address these variances is a key aspect of the curbless street design, site selection, and implementation process. This report provides recommendations to serve as a guide for the street design process.

For practitioners interested in the concepts and benefits of curbless streets, and for those aiming to bring curbless streets to their city or town, the following sections serve as a reference to jump start design ideas.

## RESIDENTIAL STREETS

Philadelphia's residential streets represent a vast opportunity to create shared, curbless streets. Most of these streets fit into one of the Complete Street typologies that are most fitting for curbless streets: Local, Low-Density Residential, Shared Narrow, and City Neighborhood. Typically these have slow-moving cars and are comfortable for bicyclists and pedestrians. In particular, streets with a strong history of receiving a Play Street designation are ideal candidate shared streets (see Chapter Three, "Presence of School-Aged Children," for more on Play Streets). To attain this designation, blocks have to demonstrate a desire for safe play areas for children in the street. Making these streets shared affords residents an extension of their property as a shared area in which to convene, play, and enjoy.

Shared, curbless, residential streets support many of the City of Philadelphia's sustainability, safety, and livability goals, including:

***Complete Streets:*** An initiative, supported through the *Philadelphia Complete Streets Design Handbook* and staff within OTIS, that ensures city streets accommodate all users of the transportation system.

***TreePhilly:*** An initiative of PPR to increase the city's tree canopy coverage by 30 percent.

***Vision Zero:*** An Action Plan created in response to an Executive Order that recognizes that traffic deaths are preventable and unacceptable and identifies steps to reduce traffic deaths.

***Greenworks:*** A vision for a sustainable Philadelphia that sets targets for air quality; healthy and affordable access to food and water; reducing carbon imprint; and benefiting from parks, trees, and stormwater management.

***Rebuilding Community Infrastructure (Rebuild):*** A public-private partnership being considered by City Council to revitalize parks, recreation centers, and libraries.

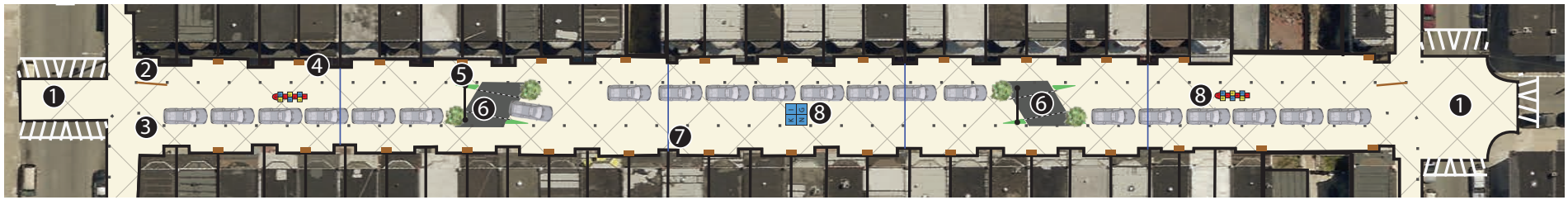
***Green City, Clean Waters:*** Philadelphia's plan to reduce stormwater pollution through the use of green infrastructure.

Design and construction to support a shared, curbless residential street could range in intensity. At one end of the spectrum, less intensive design treatments can help create a shared environment similar to a Play Street. *Tactical urbanism* is a term used to describe low-cost, temporary changes to the built environment. These types of strategies could use paint and movable planters to encourage more sharing of the street but would not be able to remove the curb without more significant resources.

At the other end of the spectrum, curbless design and construction could be stitched together with larger infrastructure projects like green stormwater, resurfacing, or utility work. These larger efforts could be more impactful in their scope and would yield a greater sense of permanence but at a greater cost.

The following conceptual plan, shown in *Figure 31*, and the legend that accompanies it on the next page demonstrate some of the design tools that could be used to create a shared, curbless residential street.

**Figure 31. Residential Curbless Street Conceptual Design**

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❶ **Raised Intersection:** A raised intersection slopes the street height up to the sidewalk elevation, similar to a speed hump or table. Placed at both ends of the street, raised intersections can slow drivers and act as a gateway treatment or redirect stormwater.

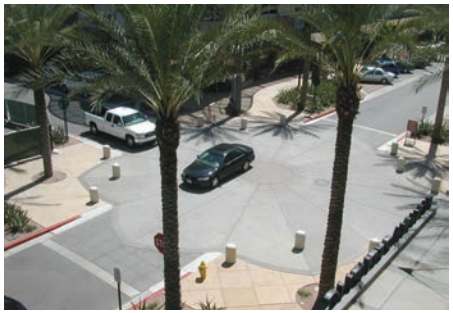

*photo source:* NACTO via Flickr (CC BY-NC 2.0)

❷ **Swing Gate:** A gate placed at each end of the block could lock into an open position most of the year, and close during Play Street hours in the summer when the street is closed to through-traffic.

*photo source:* Betsy Mastaglio

❸ **Paving and Bollards:** Continuous, potentially pervious, paving material from building front to building front gives the perception of a larger play or convening area for residents. Bollards or other vertical elements help define a car-free area immediately adjacent to residences.

*photo source:* Joel Mann via Flickr (CC BY-NC 2.0)

❹ **Trash and Rain Barrel Corral:** Corrals placed at the street level in front of the property line to discreetly store trash and recycling curtail storage of trash on private porches. Philadelphia's RainCheck program provides residents with downspout planters to intercept rain gutters inside the corral, as shown below. Program a community or Play Street activity to paint.

*photo source:* Philadelphia Water Department

❺ **Dynamic Cross Bar:** A permanent trellis-like cross bar that spans the street width allows for mounting activities during street closures; for example, bounce-back netting, basketball hoop, hammock, rings, or swings.


*photo source:* Altamanu, Inc.

❻ **Pockets for Diverting Cars:** Position permanent fixtures within the cartway to divert the drivers' path. Diverting the drivers' path slows cars. Within these permanent pockets, place site benches, landscaping, or play areas.

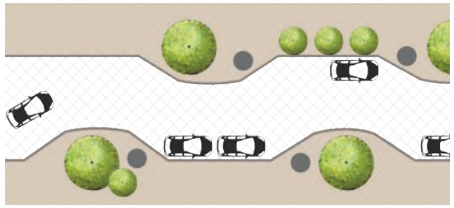

*photo source:* DVRPC

❼ **Swags across the Street:** The space above the groundplane can create a sense of place with string lights or community- or child-based artwork displayed on a string like prayer flags. Currently not allowed on public streets; private streets only.

*photo source:* Google Maps

❽ **Permanent Play Space:** Create opportunities to engage in play and learning along the street with things like games painted on paving or Little Free Libraries.

*photo source:* Joel Mann via Flickr (CC BY-NC 2.0)

## COMMERCIAL AND MIXED-USE STREETS

Opportunities abound for Philadelphia's commercial and mixed-use streets to convert to shared, curbless streets. Many streets in Philadelphia already operate like a shared street, such as Drury Street in Center City between Juniper and 13th streets. In these streets that sometimes seem more like alleys, car traffic is very slow and infrequent and bicyclists and pedestrians walk in the middle of the cartway. Properties along the street may front (access on the street is the building's primary entrance) or back up to (access is secondary, usually for staff or occupants only) the street. Where there is an abundance of backs of properties facing the street, utilitarian or "back-of-the-house" eyesores like those identified below may need to be addressed.

**Solid Walls:** Public art, such as banners or murals, are often used as a means of activating walls despite limited windows or doors. In some instances, curbless design has been complemented by development of new entrances and spaces for retail or other purposes, such as Cady's Alley, Wall Street, Linden Street: service alleys turned retail streets.

**Darkness:** Improving lighting helps enhance a sense of place and perception of an area (i.e., safety). Overhead or string lighting may be used in plaza-like settings or in narrow alleys.

**Dumpsters:** Many commercial candidate streets have a significant dumpster presence. Shared, curbless streets can address this in three ways: reducing the need for as many dumpsters through policy or regulation changes, incorporating design elements to consolidate dumpsters in a protected area, and reducing the visual impact (i.e., improving aesthetic) of dumpsters through beautification approaches. Owners and building occupants along Drury Street have previously undertaken a process to explore centralized, shared refuse areas to improve the visitor experience.

**Mismatched Fences, Fire Escapes, and Security Bars:** Mismatched fences, extensive fencing (e.g., barbed wire), fire escapes, and security bars can all detract from the design of a street and influence a pedestrian's perception of safety. These impacts can be mitigated, without removing the fences/bars, through murals and green fencing. If replacement of window bars is possible, new designs can add to the area's identity or branding.

**Deliveries:** Delivery and repair services trucks can frequently park within the cartway, blocking traffic for other modes or uses along the street. A designated parking spot, temporal restrictions, and enforcement can allow access to these services without undue delay from parked trucks.




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❶ **Centralized Trash and Recycling:** Situate trash outside of the right-of-way, on private property. Create shared trash and recycling facilities, keep trash inside the property, and conceal trash with art or green (vertically landscaped) walls.

*source:* McGillin's Olde Ale House

❷ **Building Edge Buffer:** Define a buffer of at least 32 inches adjacent to building facades using alternative paving, vertical streetscape elements, or green gutters to prevent parking or driving too closely to buildings. Vertical elements may include trees, bike racks, bollards, benches, or planting areas.

*photo source:* DVRPC

❸ **Swags across the Street:** Use the space above the groundplane to create a sense of place with string lights or rotating artwork. Currently not allowed on public streets; private streets only.

*photo source:* DVRPC

❹ **Groundplane:** Use pervious or decorative pavers to visually differentiate the street from other streets and, where traffic is somewhat heavy, help define discrete spaces for through-traffic versus sedentary visitors.

*photo source:* DVRPC

❺ **Building Facade:** Open windows and doors for public access and transparency. Where there are limited fenestrations in buildings, use art, living walls, and paint to reflect the character of the street.

*photo source:* DVRPC

❻ **Stormwater:** Use visually expressive strategies to manage green stormwater facilities. Incorporate roof drains, permeable paving, green gutters, and planters when possible.

*photo source:* Louis Cook for PWD

## TINY PHILADELPHIA STREETS

Residents and visitors alike enjoy the quintessential, historic, and narrow streets of much of the City of Philadelphia. In many locations these streets already operate as shared streets due to the narrowness of the cartway. Some streets may be designated officially as historic or have culturally important cobblestone finishes or wooden foundations; these streets are unlikely to change to remove the curb. In the last year, the National Trust for Historic Preservation deemed that all of Philadelphia's neighborhoods rank as a "National Treasure," as part of a larger campaign to promote, protect, and preserve Philadelphia's culturally and historically significant neighborhood fabric. The streets that connect and serve these neighborhoods are an invaluable component of that fabric, and a component of the designation.

However, although preservation is important, many of these tiny streets would benefit from addressing the accessibility restrictions of narrow and bumpy sidewalks. Where that is the case, a cartway that is a single height, either with pervious paving or specialty pavers, could enhance accessibility for many, including those in wheelchairs, on bikes, or even for cars with bigger wheel widths than fit within existing curbs. These streets typically need very few design changes to enhance their already delightful sense of place.

Some suggested strategies for historic, tiny Philadelphia streets are identified in the conceptual cross-section and in the corresponding descriptions on the next page.

❶ **Signs of Life:** Treat back entrances as you would front entrances by adding planters, painting murals on driveways or garage doors, and removing fencing and bars where possible. Address dark and walled-off properties individually or through a community- or block-based beautification or safety program.

*photo source:* DVRPC

❷ **Paving:** Remove the curb to provide a single elevation cartway. Consider pervious paving with a smooth-finish, 48-inch-wide path in the middle of the street to ease wheelchair use and bicycle riding. Include contextually appropriate cobblestone or brick adjacent to properties and under the wheel bed of cars, to slow driving.

*photo source:* NACTO via Flickr
(CC BY-NC 2.0)

❸ **Building Edge Buffer:** Define a buffer of at least 32 inches adjacent to building facades using alternative paving, vertical streetscape elements, or green gutters to prevent parking or driving too closely to buildings. Vertical elements may include trees, bike racks, bollards, benches, or planting areas.

*photo source:* DVRPC

❹ **Swags across the Street:** Use the space above the groundplane to create a sense of place with string lights or rotating artwork. Currently not allowed on public streets; private streets only.

*photo source:* Darlo Alvarez via Flickr
(CC BY-NC 2.0)

# CHAPTER FIVE

## Next Steps



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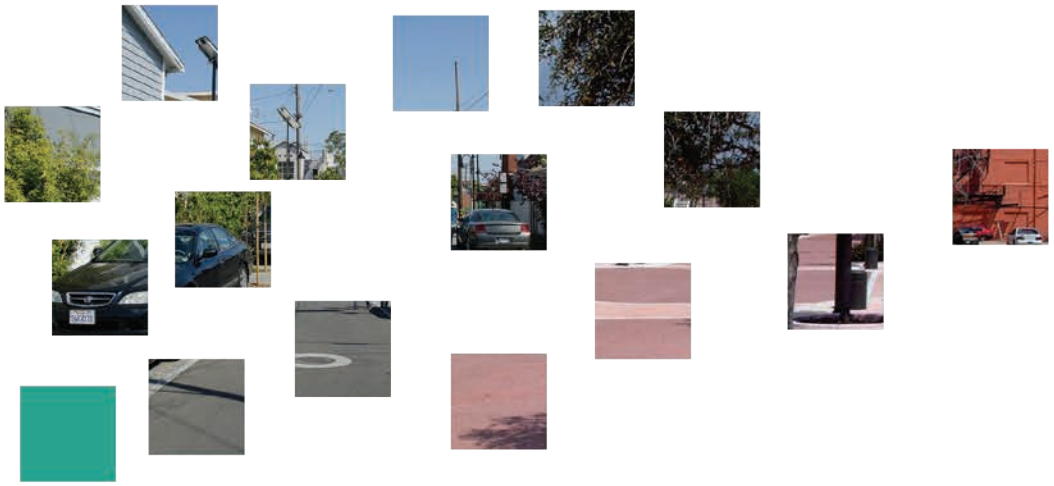


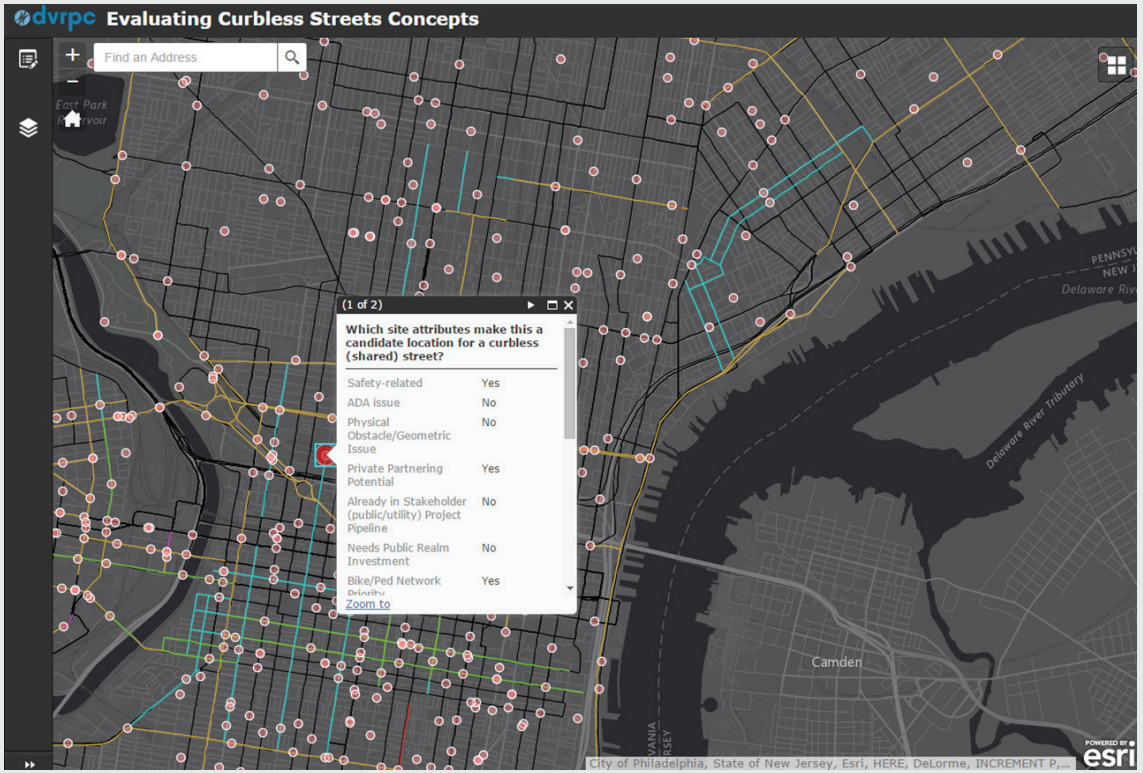
# 5.1 Recommended Actions

Implementing curbless streets into Philadelphia's street network will require coordination between the public and private sectors, ingenuity, and a willingness to experiment. This report should be used to understand and evaluate opportunities as they arise or are proposed. There are few absolutes in determining the appropriateness or design of either shared or curbless streets. Rather, as each project has its own unique context, set of goals, and resources to put toward design, each will have to stand on its own merits to be approved for construction or to be considered a success once built. This report will help navigate the nuances involved in approving and designing curbless streets.

Setting clear expectations about goals, design, and public support requirements will help ease the process by which shared and curbless street proposals are assimilated into the City of Philadelphia. The following actions are suggested for consideration as a means of legitimizing curbless streets as a design option. Just as curbless streets can be a public, private, or public-private partnership project, so too can these actions.

- Experiment with curbless street implementations on a variety of street types—both by the adjacent land uses as well as by their width and vehicular volumes. Use performance measures to assess outcomes.
- Evaluate publicly- and privately-led proposed streetscape projects for their appropriateness to be curbless using the information provided in this report and summarized in the *Appendix A-2: Curbless Street Checklist.*
- Go live with a webmap to catalogue proposed curbless street locations. An interactive webmap could be used by City of Philadelphia staff to document or propose locations, or it could be open-sourced to allow the public to propose, comment on, and potentially vote for locations. An example of a webmap designed to collect feedback on curbless street design and siting is shown in *Figure 32*.
- Track Play Street, Block Party, and Pedestrian Plaza application locations for consideration as a future curbless street design.
- Integrate specific language about shared and curbless streets in the Philadelphia Streets Department's *Complete Streets Design Handbook* checklist.
- Review city and state ordinances whose definitions of liability and right-of-way as defined by curbs limit shared, curbless streets. Adapt so that the streets are suitable for pedestrians to walk in the cartway and for right-of-way to be defined without a curb in curbless situations, or create new ordinances specifically for shared, curbless streets.
- Contract with waste removal systems that pick up frequently and that centralize and conceal trash facilities in a manner that is fitting for surrounding land uses.
- Develop a strategic loading zone plan that identifies specific locations and temporal restrictions for loading. Enforce measures once they are implemented.

**Figure 32. Webmap Used for Stakeholder Input on the Current Project**




Stakeholder feedback on project goals, priorities, and potential candidate sites collected through the use of a live webmap. Map layers may include objective-related categories, such as:

- Safety: bicycle, pedestrian, and vehicle crash sites;
- Street Type: preferred street types (City Neighborhood, Local, Shared Narrow, and Low-Density Residential);
- Transportation: the existing bicycle network, SEPTA transit routes and stops; and,
- Land Use: existing land uses and boundaries of planning districts.

Using the operational layers as reference, stakeholders can identify locations for curbless street design by drawing line segments directly on the map. Once a candidate site is located, the nominator receives a prompt to select the characteristics of the site that make it a preferable location, and to provide their own rationale and goals for the street.

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# APPENDIX A

## Additional Resources and Guides

## Chicago City Council Ordinance 9-12-045

**BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHICAGO:**

**SECTION 1.** Chapter 9-12 of the Municipal Code of Chicago is hereby amended by adding a new Section 9-12-045, as follows:

**9-12-045 Shared street pilot program.**

(a) *Definitions*. For purposes of this section, the following definitions shall apply:

"Shared street pilot program" means the shared street pilot program established pursuant to this Section.

"Shared street" means a public right of way which can be shared at the same time by pedestrians, bicyclists, motor vehicles, and other legal conveyances, and where pedestrians have the right of way over all other traffic.

(b) *Authorization*. The commissioner is authorized to establish a shared street pilot program on the following roadway:

| Street | Segment | | Coordinates | |
|---|---|---|---|---|
| | From | To | From | To |
| Argyle | Broadway | Sheridan | 1200W | 1000W |

(c) *Rules*. Notwithstanding any other provision of law to the contrary, the following rules shall apply in a shared street:

(1) Pedestrians may enter, walk along or cross a shared street at any time or point. Nothing provided in this subsection shall relieve a pedestrian from the duty of exercising due care.

(2) Pedestrians entering or within a shared street shall have the right-of-way over vehicles, bicycles or other traffic. The operator of a vehicle shall stop and yield the right-of-way to a pedestrian within a shared street when the pedestrian is upon the half of the roadway upon which the vehicle is traveling or when the pedestrian is approaching so closely from the opposite half of the roadway as to be in danger.

(3) The operator of a vehicle or bicyclist approaching an intersection within a shared street shall yield the right-of-way to a vehicle or bicycle which has entered the intersection from a different roadway.

(4) Subject to Section 9-24-020, when two vehicles or bicycles enter an intersection from different street sat approximately the same time, the operator of the vehicle or bicyclist on the left shall yield the right-of-way to the vehicle or bicyclist on the right.

(d) *Signs and markings*. The commissioner is authorized to add or remove signs and markings, as needed, within or near a shared street in order to implement the shared street pilot program. All traffic-control signs and marking shall conform to the Manual on Uniform Traffic Control Devices.

(e) *Expiration*. This section shall expire and be repealed of its own accord, without further action by the City Council, on December 31, 2018. Upon such repeal, the commissioner shall remove and replace signs and markings as appropriate, and take such other action as needed, to return the affected area to its former status as a standard public right-of-way.

**SECTION 2.** This ordinance shall take effect upon its passage and approval.

## Curbless Street Checklist

The following checklist helps planners and engineers inventory some of the considerations for potential curbless street locations.

Street Name _____ Project Sponsor _____

Reviewer Department, Name, e-mail address _____

**Siting Issues**: The following traits and supportive indicators suggest the appropriateness of a curbless design solution.

*Universal Traits: These traits are almost always characteristic of the existing street condition.*

**Y/N** *IF YES, DESCRIBE*

___ High bicycle/pedestrian volume, low vehicle volumes _____
  ___ Is it a City Neighborhood, Local, Shared Narrow, or Low-Density Residential Street, as identified in the Philadelphia Complete Streets Design Handbook?
___ Safety and accessibility needs _____

*Supportive Indicators: these indicators strengthen the case for converting a street to curbless.*

___ Private partnering potential _____
___ In implementing agency's project pipeline _____
___ Supports commercial uses/economic development _____
___ Needs public realm investment _____
___ Presence of school-aged children _____
  ___ Does it have a history of being a designated Play Street by the Department of Parks and Recreation? _____
___ Open space/tree canopy desert _____
___ Community programming opportunities _____
___ Operates as a shared street already _____
___ Access to, but not on, a transit route _____
___ Architecturally or culturally significant _____

**Weighing Service Demand versus Walkability:** Some streets are generally more service oriented, others more place baced. Generally, the higher the walkability measures and the lower the Traffic and Utility demand measures, the greater the appropriateness of a curbless design solution.

*Walkability:* *Suggested curbless range*

Frontages (average length of buildings along the street) _____ *60' or less*
Fenestration (the percentage of first-floor properties with transparent windows) _____ *40% or higher*
Public-access doors (number of public-access doors per 200') _____ *5/200' or more*
Sense of enclosure (ratio of average building height to right-of-way width) _____ *2:1 -1:1*
Street tree coverage (the percentage of street tree coverage compared to full right-of-way area) _____ *15% or more*

*Traffic and Utility Demand:*

Street redundancy (ratio of length of street to total street length within a .1-mile radius operating in the same direction) _____ *90% or higher*
Waste generation (total number of dumpsters on the street) _____ *2 or fewer*
Freight generation (estimated daily freight-related visits) _____ *100 or fewer*
Off-street parking (percentage of face block with surface, or structured, parking) _____ *5% or less*

**Special Considerations:** Curbless streets can require unique approaches to street design. The following are a few critical issues to address.

**Y/N** *IF YES, DESCRIBE*

*Accessibility*

___ Is the design sensitive to vulnerable users, including the visually impaired? _____

*High-Vehicle-Volume Streets*

___ Are drivers expected to reroute to other network streets? Is it clear that pedestrians are expected to walk within a pedestrian area and cross at intersections? _____

*Culturally important sites*

___ Are historic and culturally important aspects of the street preserved or highlighted in some way? _____

*Liability*

___ Are pedestrians encouraged, and legally protected, to cross the street or walk within the cartway? _____

*Responsibility*

___ If maintenance is shared within the street, are there clearly visible markings to indicate limits? _____

*Services*

___ Can all maintenance and emergency vehicles access the entire street? _____

*Funding*

___ Has the project explored all partnering opportunities? _____

**Design Toolkit:** The following design strategies are used on many curbless streets to cue users that the street is unique from the rest of the street network.

*Paving Materials*

___ Are high-quality paving materials included in the design? _____

___ Could pervious paving be incorporated? _____

___ Does the paving differentiate space differently for cars, pedestrians, and bicyclists (higher volume streets)? _____

___ Is the paving pattern similar across the cartway so that space for cars, pedestrians, and bicyclists is indistinguishable (lower-volume streets intended to share space)? _____

*Travel Path*

___ Are vertical elements, paving patterns, or landscaping used to divert the drivers' path? _____

*Gateways*

___ Are there visual cues at either end of the curbless street that set it apart from adjacent streets? _____

*Parking*

___ If there is on-street parking, is it positioned to serve a purpose, such as to slow cars or separate pedestrians from car traffic? _____

*Stormwater Management*

___ Is stormwater addressed without the curb in the flowline? _____

___ Are green stormwater infrastructure strategies incorporated into the design? _____

*Speed Limit*

___ Is the speed limit, or curbless designation, posted? _____

**Designing Curbless Streets within the Philadelphia Context**

*Residential Streets*

Consider Play Street opportunities
Include community gathering areas
Designate areas to store garbage cans

*Commercial and Mixed-Use Streets*

Centralize and conceal trash
Activate building frontages
Program public events

*Tiny Philadelphia Streets*

Accentuate historic and cultural characteristics

## Peer City Case Examples

This report is informed by curbless and shared streets around the world, incorporating large-scale projects, such as the woonerven of the Netherlands and the nationwide Home Zone project in the United Kingdom, to small-scale neighborhood projects like California's Linden and Longfellow streets.

The tables below note key findings from U.S. case studies in peer cities, including physical characteristics as well as financial and contextual notes.

| Site | **Argyle Street** Chicago, IL | **Burdick Street** Kalamazoo, MI | **Bell Street** Seattle, WA | **Cady's Alley** Washington, DC | **Flanders Street** Portland, OR | **Linden Street** San Francisco, CA |
|---|---|---|---|---|---|---|
| Project Goal | Safety/Economic | Economic | Open Space | Economic | Open Space/ Economic | Open Space |
| Land Use | Mixed Use | Commercial | Mixed Use | Commercial | Mixed Use | Mixed Use |
| Length (Feet) | 1,350' | 1,045' | 1,056' | 500' | 240' | 100' |
| Right-of-Way (Feet) | 66' | 65' | 66' | 20' | 60' | 35' |
| Building Height to Right-of-Way Width Ratio | 1:2–1:3 | 1:2 | 1:1–1:2 | 1:1–1.5:1 | 1:2 | 1:1 |
| Speed limit (MPH) | 15 | 25 | 25 | 20 | 20 | 15 |
| Cost per square foot (based on 2016 USD rates) | $40 | $77 | $71 | N/A | $187 | $78 |
| Primary Sponsor/ Funding | Chicago Department of Transportation | "Project Downtown" | Parks and Green Spaces Levy | Private Developer | Portland Bureau of Transportation | Neighborhood Parks Council, Department of Public Works |
| Year | 2016 | 1998 | 2014 | 2002 | 2006 | 2010 |

| Site | **Longfellow Street**<br>Santa Monica, CA | **Palmer Alley**<br>Cambridge, MA | **River Street**<br>Batavia, IL | **Wall Street**<br>Washington, DC | **Willamette Street**<br>Eugene, OR | **Winthrop Street**<br>Cambridge, MA |
|---|---|---|---|---|---|---|
| Project Goal | Safety | Safety (ADA) | Economic | Economic | Economic | Safety (ADA) |
| Land Use | Residential | Commercial | Commercial | Commercial | Commercial | Commercial |
| Length (Feet) | 446' | 350' | 450' | 740' | 300' | 333' |
| Right-of-Way (Feet) | 40' | 25' | 50' | 35' | 60' | 25' |
| Building Height to Right-of-Way Width Ratio | 1:2 | 1:1.5 | 1:2 | 1.5:1–1:1.5 | 1:2 | 1:1 |
| Speed limit (MPH) | 25 | 10 | 20 | 15 | 20 | 10 |
| Cost per square foot (based on 2016 USD rates) | $95 | $158 | $161 | $76 | $152 | N/A |
| Primary Sponsor/ Funding | Capital Improvement Project | Partnership: City of Cambridge, Property Owners | Parks and Green Spaces Levy | Partnership: City of Asheville, Private Developer | City of Eugene, Commercial Revitalization | City of Cambridge |
| Year | 2012 | 1998 | 2013 | 1970s | 2000/2006 | 2010 |

# Curbless Streets: Evaluating Curbless and Shared Space Concepts for Use on City of Philadelphia Streets

***Publication Number:*** 16044

***Date Published:*** January 2018

***Geographic Area Covered:*** City of Philadelphia

***Key Words:*** Curbless, shared space, woonerf, place-making, urban design, mobility, festival street, flex space

***Abstract:*** Curbless streets, shared space, flex space, and *woonerven* (or the singular, *woonerf*) stem from a concept in which typically narrow streets with low vehicle volumes are designed without a curb and with high-quality streetscape materials, enabling the street to function like a plaza or a paved yard. This report summarizes the traits common to curbless streets in peer cities within the United States, the benefits of their use and special considerations, and offers suggestions on selecting potential sites and design tools for use within candidate streets.

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