FOREST PARK GREAT STREETS STUDY

PREPARED FOR THE CITY OF ST. LOUIS, FOREST PARK FOREVER AND EAST-WEST GATEWAY COUNCIL OF GOVERNMENTS
APRIL, 2018

ACKNOWLEDGEMENTS

TO THE STEERING COMMITTEE, TECHNICAL ADVISORS, PARK INSTITUTIONS AND NEIGHBORS...

THANK YOU for sharing your knowledge, stories and critical input.

TO THE PUBLIC THAT PARTICIPATED IN THIS STUDY...

THANK YOU for sharing your experiences as a Park visitor.

THANK YOU for sharing your knowledge of critical issues and opportunities.

THANK YOU for taking the time to ensure the recommendations in this study represent the needs and desires of all St. Louisans.

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CONTENTS

DATA SOURCES

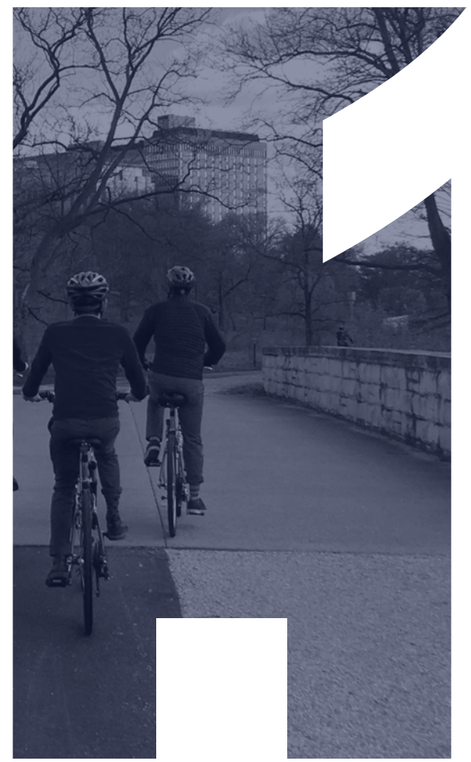
In addition to data collected by the design team, data in this report was collected through the following sources:

- *Arcis Golf*
- *BJC Healthcare*
- *City of St. Louis*
- *East-West Gateway Council of Governments*
- *FEMA*
- *Forest Park Forever*
- *Great Rivers Greenway*
- *Jacobs*
- *Missouri Spatial Data Information Services*
- *Metropolitan Sewer District (MSD)*
- *St. Louis County*
- *St. Louis Zoo*
- *St. Louis Art Museum*
- *St. Louis Science Center*
- *Trailnet*
- *Washington University St. Louis and Washington University Medical Center*

THE STUDY

The Forest Park Great Streets Study is a collection of project concepts and operational recommendations developed with input from focus groups and the community. Some of these recommendations will be implemented after further detailed study, while others will not. Like all other capital projects in Forest Park, any decision to undertake a project originating from this Great Streets Study will be subject to a deliberate 9-step review process with the Forest Park Advisory Board.

The Study document is organized first by summarizing recommendations for Park-wide "systems," followed by a list of location-specific implementation projects through the lens of Great Streets.



EXECUTIVE SUMMARY

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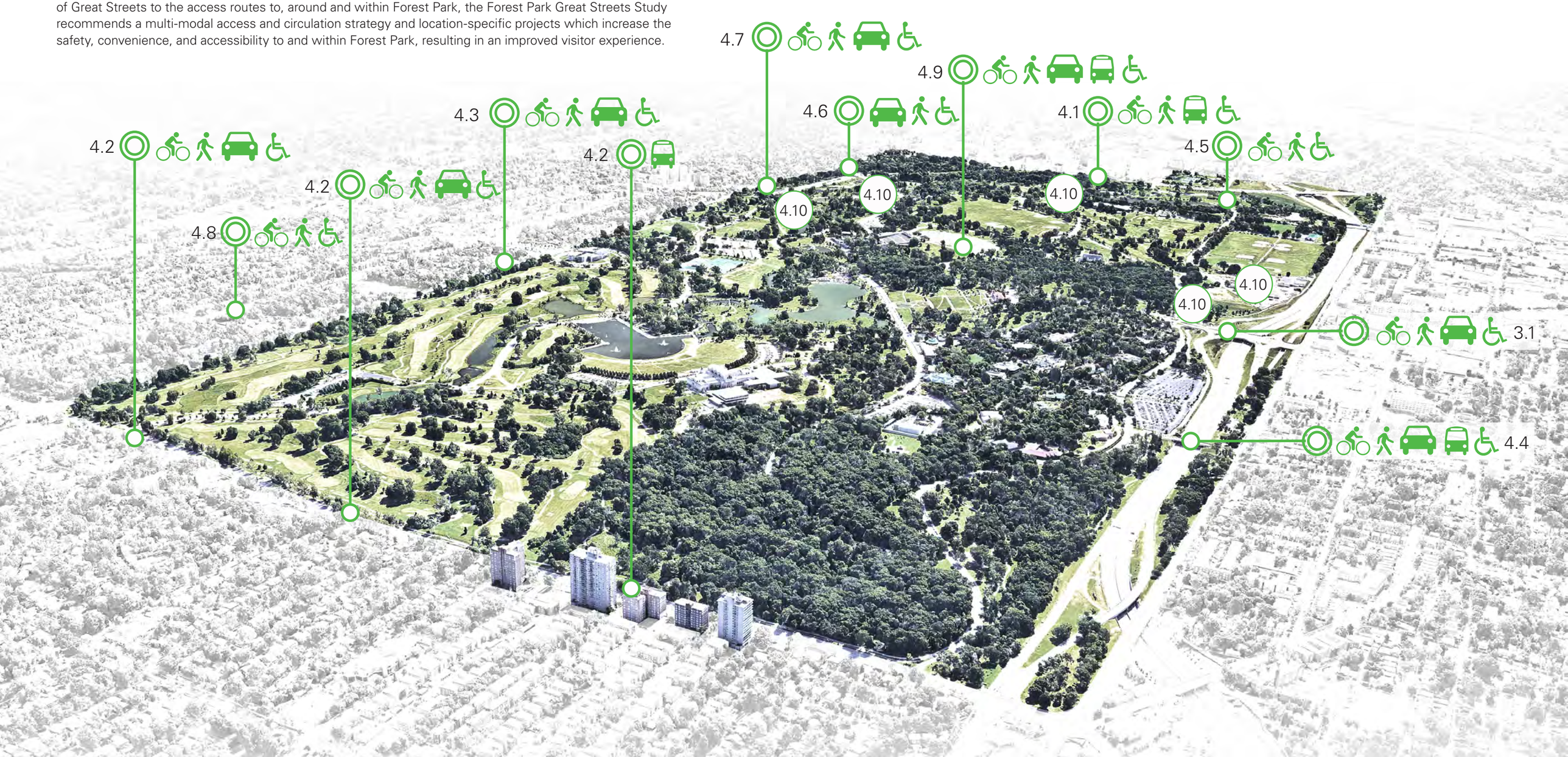
STUDY INTENT

The St. Louis Great Streets Initiative was established in early 2006 to expand the way communities think of their streets. Rather than viewing a roadway project as solely a way to move more cars and trucks faster, the goal of the initiative is to trigger economic and social benefits by centering communities around interesting, lively and attractive streets that serve all modes of transportation.

Forest Park attracts approximately 13 million visitors annually. The anchor institutions within the Park track attendance, which was recorded at just under six million in 2016. The City of St. Louis oversees permitting of Park events and festivals, which attracted an estimated 941,000 attendees in 2016. By applying the principles of Great Streets to the access routes to, around and within Forest Park, the Forest Park Great Streets Study recommends a multi-modal access and circulation strategy and location-specific projects which increase the safety, convenience, and accessibility to and within Forest Park, resulting in an improved visitor experience.

- PROVIDE SAFER ACCESS INTO, OUT OF AND THROUGHOUT FOREST PARK FOR PEDESTRIANS AND CYCLISTS
- ALLEVIATE HAMPTON AVENUE CONGESTION; IMPROVE OVERALL PARKING ACCESS AND INFORMATION
- OFFER MORE AVAILABLE AND ACCESSIBLE PARK TRANSIT
- IMPROVE CONNECTIONS AND TRANSITIONS BETWEEN DIFFERENT MODES OF TRAVEL
- EXPAND USES OF SELECT EXISTING FOREST PARK FACILITIES



STUDY BACKGROUND AND EXISTING CONDITIONS

OVERVIEW

Forest Park is a 1,300 acre historic civic Park located 5 miles west of Downtown St. Louis. The Park primarily offers the public a variety of cultural and educational attractions, natural areas such as forests and prairies, and an extensive network of walking and biking trails connecting to regional recreational networks. The Park is also home to popular Saint Louis attractions like the Zoo, Missouri History Museum, the Municipal Opera Theatre (The Muny), St. Louis Art Museum and St. Louis Science Center.

With over 13 million annual visitors, the Trust for Public Land lists Forest Park as the 7th most-visited City Park in the United States. The Park has also been recognized as "One of America's great public spaces" by the American Planning Association, as "#1 City Park in the United States" by readers of USA Today, as "Best City Park in America" by Thrillist, and as one of the most beautiful city parks by Fodor's Travel.

First opened to the public in 1876, the Park has served as a nexus for activity in the region, hosting events such as the 1904 Louisiana Purchase Exposition and the 1904 Summer Olympics, as well as a wide range of popular festivals and events today. Notable for its wide range of recreational opportunities as well as its history, Forest Park attracts visitors from surrounding neighborhoods, the city of St. Louis, and the county at large, as well as from around the country and world.

Programming of the Park is primarily passive and maintaining this condition is a principle objective of the 1995 Master Plan. The Park's founders highlighted the vision that St. Louisans wanted a park that *"the rich and poor, the merchant and mechanic, the professional man and the day laborer, each with his family and lunch basket, can come and enjoy his own ... all without stint or hindrance ... and there will be no notice put up to 'Keep off the grass.'"*

The Park is operated, maintained & sustained through an innovative public/private partnership between the City of St. Louis Department of Parks, Recreation & Forestry and Forest Park Forever, a private nonprofit conservancy.

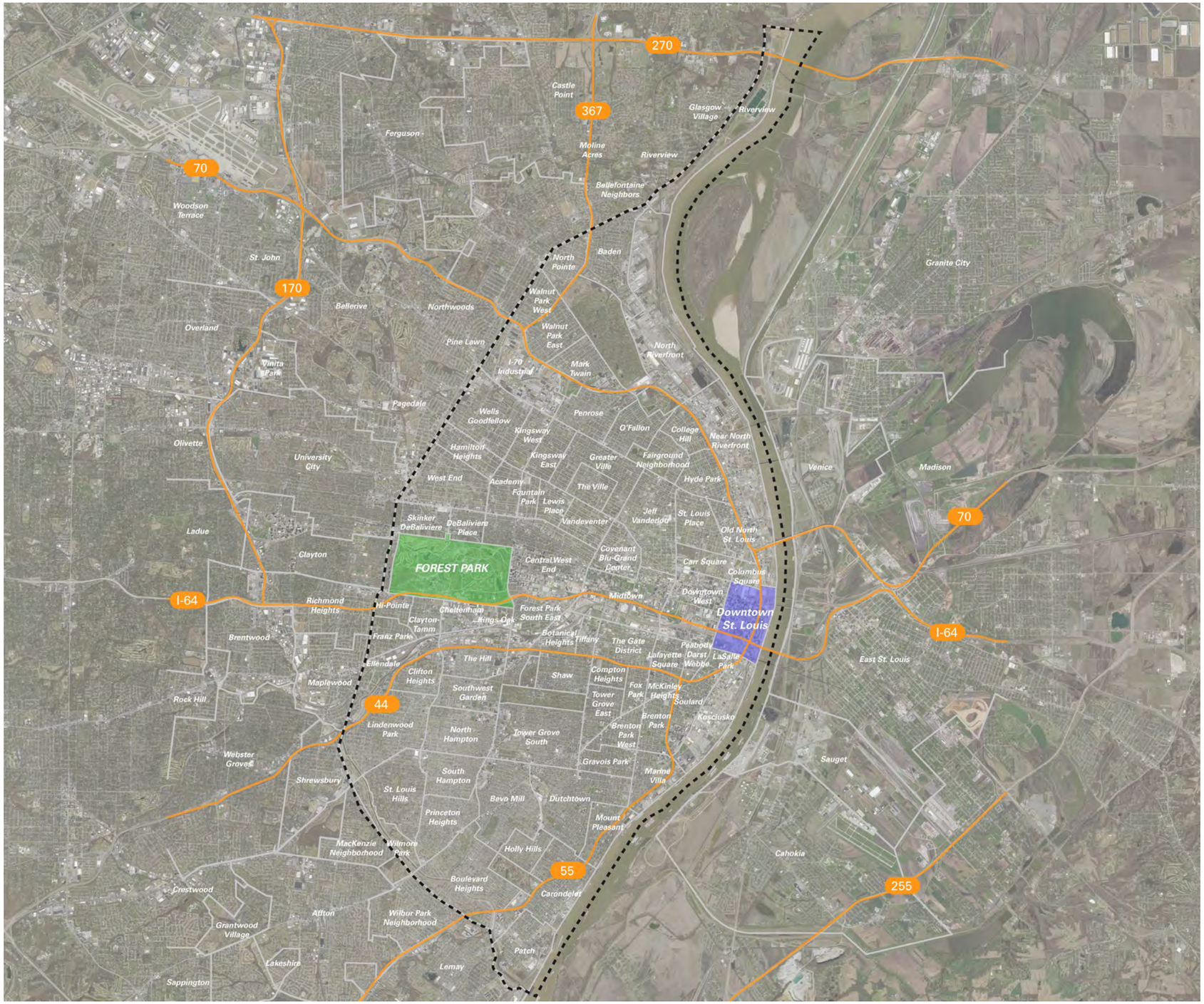


Figure 1: Regional context of Forest Park

PREVIOUS AND RELATED STUDIES

1995 FOREST PARK MASTER PLAN

The Master Plan, completed in 1995, serves as a guide for this study. It is not the intent of this study to replace or create a new Master Plan, but to develop implementation priorities around the specific areas of circulation, access and safety. The Forest Park Advisory Board can use this study as a reference document for ongoing implementation of the 1995 Forest Park Master Plan. The vision statement from the 1995 Master Plan reads:

A Vision of Forest Park's Future

Forest Park is a gathering place for St. Louisans and our guests, an urban Park that is the home for attractions, events and activities that reflect our interests, culture, and history. It is a place to experience wonders great and small, natural and man-made. An inspiring vista, an endangered species, an Old World masterpiece, real world technology, or a shady glen that offers a moment of tranquility. It is a place we share, and a place for which we share responsibility.

Forest Park provides us with settings to appreciate the world around us, and within ourselves. ***It is easily accessible, yet free of the constant intrusions of daily life****. Here we may walk barefoot in the grass, hear the sweet song of a migratory bird, watch young children catching their first fish or neighbors enjoying a summer's day. We may contemplate a piece of art or architecture, float on the lakes amidst falling autumn leaves, walk silently through a forest on freshly fallen snow, or lie in the fields of wildflowers as spring arrives.*

As home to many of our finest cultural institutions, Forest Park is a place to come face-to-face with a baby chimpanzee, take a journey through the heavens or back in time, hear the stars sing at night, or uncover the secrets of a pharaoh's tomb. It is a place of learning and discovery, of unique experiences that bring us back again and again.

As a center of recreational activity, Forest Park teems with athletes and sports enthusiasts at all levels, ages, and skills. Its paths, fields, courses and courts allow those involved in each activity the freedom to enjoy the Park without limiting the enjoyment of others.

As a focal point for special events, Forest Park gives us reasons to celebrate our heritages, our hopes, and our happiness. Our gatherings here help define our community and demonstrate the warmth, wonder, and friendship that we share.

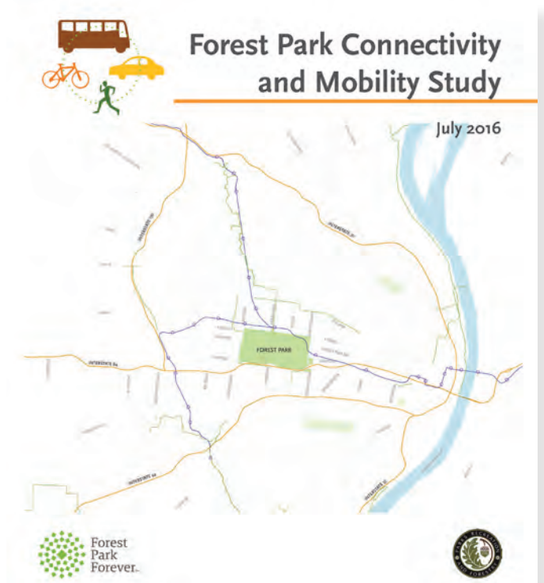
Nowhere else can we share the variety and totality of experiences that Forest Park provides. The strength of the Park flows from that sharing, from our willingness and ability to protect the Park for all of us in all of our uses. *Forest Park is more than a symbol of the beauty and tradition of St. Louis; it is a place where we define our community and celebrate our pluralism every day.*

2008 FOREST PARK ACCESS, CIRCULATION, AND PARKING STUDY

This study is a part of the long term planning commitment by Forest Park and was undertaken to 1) assess how the improvements that have been constructed have impacted its access, circulation, and parking systems; 2) determine if there have been any unintended consequences from projects that have been built; and 3) assess the implementation value for the remaining projects. This study undertook a comprehensive and holistic view of the Park's access, circulation, and parking facilities. The resulting recommendations promote what is best for the Park as a whole, while taking into account the specific needs and issues of individual institutions and activities within the Park.

2016 FOREST PARK CONNECTIVITY AND MOBILITY STUDY

With emerging technologies and shifts in societal trends presenting new challenges and opportunities, the St. Louis City Department of Parks, Recreation & Forestry and Forest Park Forever embarked upon a strategic evaluation of connectivity and mobility for all visitors to Forest Park. In 2015, these entities commenced this visionary framework study to explore and identify how visitors connect to and move around the Park. The Forest Park Connectivity and Mobility Study was an initiative intended to build upon the projects and visions set forth in the 1995 Forest Park Master Plan addressing mobility and the total park experience. The Study identified short, intermediate, and long-term ideas to improve connectivity and the overall visitor experience. The ideas identified in the Study range from recommendations for policy changes to identifying future projects that balance people, culture, and nature.



EXISTING NEIGHBORHOOD PLANS

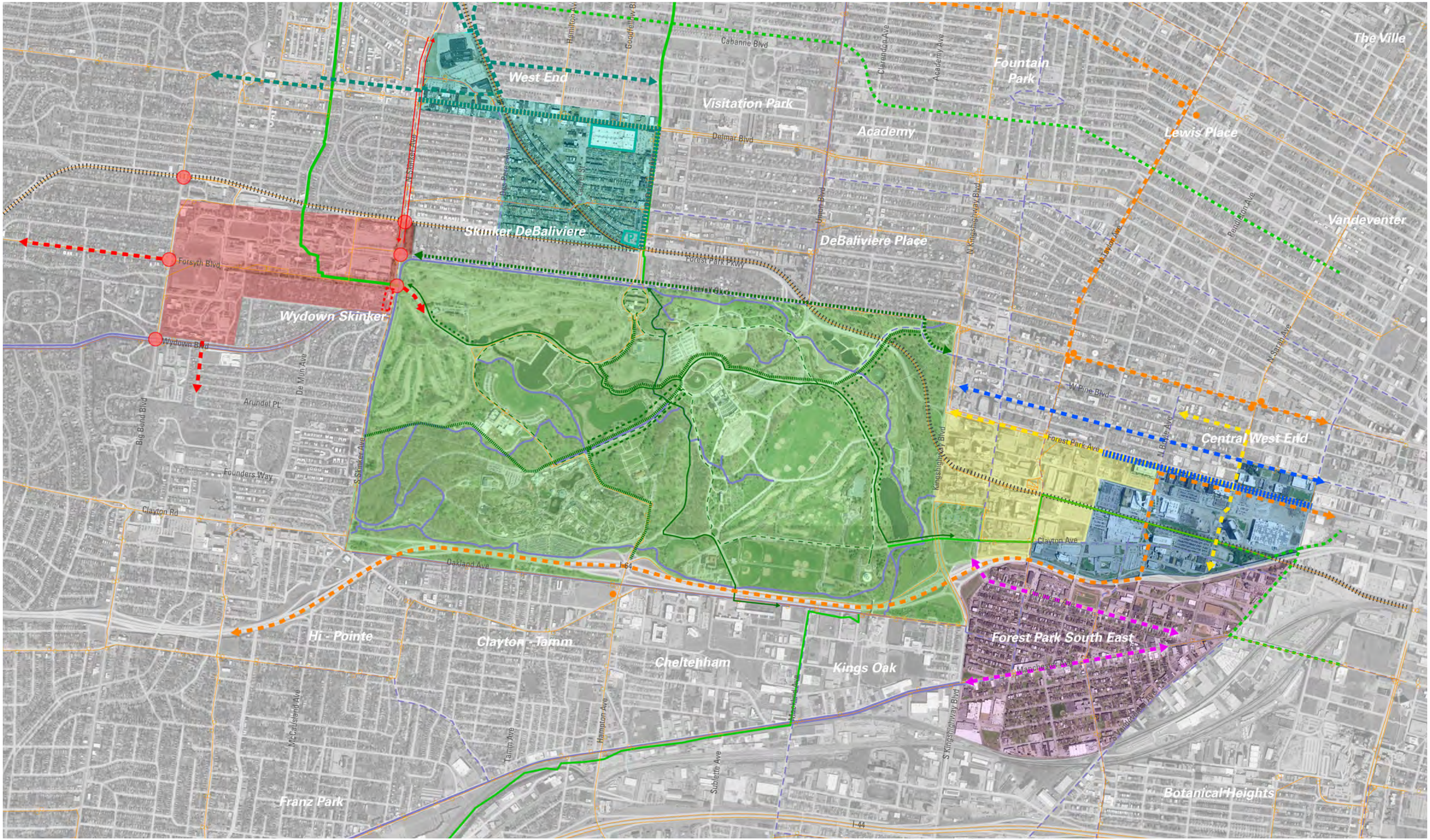


Figure 2: Existing planning context

LEGEND

- Existing Bus Route
- Existing Bus Stop
- Existing Bike Trail
- Bike St. Louis Proposed Trail
- Great Rivers Greenway (GRG) Trail
- Proposed GRG Trail
- Existing Railroad Line

PLANNING STUDY ANALYSIS

The design team analyzed a series of planning documents that provided baseline knowledge as to how the community imagines the area evolving in the future. Using this information, the team will be able to integrate existing concepts into the Great Streets study to create a seamless, implementable plan for Forest Park and ultimately provide better accessibility to Forest Park.

FOREST PARK CONNECTIVITY AND MOBILITY STUDY, 2016

- Suggested commuter bike routes
- Proposed Cycleway
- Suggested street bulb-outs/Traffic calming
- Suggested future transit lines
- Removal of on-street parking
- Suggested time-limit parking

The Forest Park Connectivity and Mobility Study was vital in informing the partners and the community about the connectivity issues of the Park. Nine strategies were derived from this study to improve pedestrian and transit level mobility.

- Improve connectivity with surrounding neighborhoods for pedestrians and bicyclists
- Strengthen east-west and north-south connections through the Park for cyclists
- Improve the dual path system
- Reduce conflicts for on-street cycling
- modes of transit
- Improve connections with other modes and destinations for pedestrians and bicyclists
- Improve parking function within the Park
- Enhance real-time communications

Using these principles to inform and guide the initial planning of the Great Streets study, the design team can now prioritize the areas of greatest concern and create a plan that responds to the concerns raised in the mobility study while layering in findings from stakeholder and public meetings.

The study suggests areas for improved pedestrian circulation as well as introducing commuter bikeways to allow direct travel through the Park. Vehicular parking was another key concern within this study which aimed to remove or limit on-street parking to encourage more transit users and reduce congestion caused by large events.

FOREST PARK SOUTHEAST NEIGHBORHOOD VISION, 2015

- Suggested pedestrian connectivity improvement locations
- Desire to introduce bikeshare, transit shuttles and greenway

The Southeast Neighborhood is currently being revitalized as an up and coming district adjacent to Forest Park. As this area continues to develop, there is a desire to introduce bicycle share programs, transit shuttles, and greenways to further connect the neighborhood past Interstate 64 with the Cortex District and Forest Park.

Moving forward with the Great Streets Study, it is important to note this increased mobility interest and to integrate pedestrian infrastructure along the southeast corner of the Park.

URBAN PLANNING ROUNDTABLE COMPREHENSIVE TRAFFIC & MOBILITY STUDY, 2015

- Bike Route for Future Consideration

The important takeaway with this Mobility Study is the importance of Forest Park Avenue as a key pedestrian street for the Cortex area. With this in mind, there needs to be stronger connections from this street into Forest Park. Bikeways were also proposed in order to better serve those in this node.

WASHINGTON UNIVERSITY MOBILITY STUDY, 2016

- Suggested satellite campus bicycle connector
- Suggested pedestrian crossing improvements
- Suggested street bulb-outs/Traffic calming

This mobility study aimed to connect the north and south portions of the Danforth Campus using a pedestrian corridor as well as separated bicycle paths. The plan also promotes the implementation of strategic bicycle crossings across Skinker Boulevard towards Forest Park.

This plan creates an opportunity to work with Washington University to meet mutual goals of this Great Streets study and the campus planning study.

RAPID TRANSIT CONNECTOR STUDY, 2015

- Suggested bus rapid transit line
- Suggested bus rapid transit stop

The goal of this connector study was to work closely with the residents of St. Louis to determine where a Bus Rapid Transit (BRT) line should be implemented to serve those commuting or visiting downtown and the surrounding suburbs.

Two of the planned BRT lines run near Forest Park on the northwest side near the Cortex District as well as Interstate 64. Integrating the planning of these BRT lines can help inform where these stops should and should not be as well as the routing of the line itself. The integration of this transit system with other existing modes would result in stronger connections into Forest Park from the entirety of St. Louis.

CORTEX DISTRICT TRANSIT ORIENTED DEVELOPMENT STUDY, 2012

- Preferred bike route location
- Road perceived as unfriendly to pedestrians
- Lack of district-wide parking strategy

The Cortex TOD study recognizes a district wide parking issue which could lead to increased parking in Forest Park. Interestingly, the Cortex study claims that Forest Park Avenue is perceived as unsafe to pedestrians and recommends a east-west bicycle crossing along Laclede Avenue to resolve these concerns of pedestrian safety.

DELMAR LOOP / FOREST PARK - DEBALIVIERE TRANSIT ORIENTED DEVELOPMENT PLAN, 2013

- Suggested Bike Connection
- Metro Bus Garage to be relocated Potential Future Parking
- Existing Bike Trail

The Delmar Loop & Forest Park -DeBaliviere Transit Oriented Development Plan (TOD) looks to revitalize the area between the two stations as a vibrant, mixed-use node to attract those using public transportation while enticing new riders.

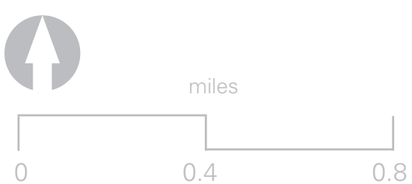
The TOD plan recommends an increase in both private and public parking as well as introducing more bicycle lanes to better serve the growing area. With Forest Park to the south, increases in parking could potentially allow for more regulated or even removal of congested on street parking near the Washington University Campus. The recommended bicycle connectors are intended to better connect the communities north of Delmar Boulevard, but can be combined with planned infrastructure for Forest Park to further link the area.

Figure 3: Neighborhoods surrounding Forest Park

OVERVIEW

Neighborhoods bordering Forest Park vary in character and composition, though they share close proximity to area employment centers, easy access from surrounding highways, and positive real estate and demographic indicators relative to the city. Though population loss in the city of St. Louis is well-documented—and persistent—the Central Corridor has been the site of most of the city's redevelopment efforts of the past several decades, with much of this activity occurring in the neighborhoods surrounding the Park.

Individually analyzing conditions in the neighborhoods surrounding the Park highlights their unique identities, while providing context to guide future land use and development strategies. Their diversity provides a snapshot of St. Louis as a whole, and the presence of these neighborhoods and their residents contributes to Forest Park's role as a neighborhood park, in addition to a cultural center and tourist attraction.



	POPULATION 2016	POPULATION CHANGE 2010-2016	MEDIAN HOUSEHOLD INCOME	MEDIAN HOUSING VALUE
Central West End	14,800	2.0%	$40,700	$342,000
Forest Park Southeast	3,100	7.4%	$31,300	$134,700
Highlands	1,100	31.8%	$44,400	$147,100
Dogtown	6,000	-0.2%	$48,200	$144,200
Demun	11,800	0.1%	$59,000	$467,500
Skinker Debaliviere	3,800	-0.9%	$41,600	$248,900
Debalivere Place	3,600	5.0%	$49,800	$189,800

Source: Esri, 2016

NEIGHBORHOOD SUMMARIES

CENTRAL WEST END

Despite citywide population decline of more than eight percent since 2000, the Central West End continues to thrive, growing by four percent over the same period. The neighborhood is one of the city's most diverse in terms of land use and density. The Barnes-Jewish Hospital and St. Louis Children's Hospital campus (BJC) occupies a large portion of the western edge of the neighborhood, while Euclid Avenue anchors the highly walkable commercial district, which is home to restaurants, bars, and local retailers. Residential uses include a combination of upscale rentals and large single-family homes concentrated in the Central West End's northern and eastern sections. Much of the recent development activity in the city has been located within the neighborhood, including four high-end apartment properties and several prominent first-floor retailers.

FOREST PARK SOUTHEAST

Forest Park Southeast has grown incrementally—but steadily—since the 1990s, and is anchored by a thriving commercial district along Manchester Avenue between Kingshighway and Vandeventer Avenue. After significant population loss and disinvestment throughout much of the middle of the past century, redevelopment of the storefronts along Manchester was championed by a number of LGBT-friendly bars and night clubs. Additional commercial and retail users followed, which enhanced the marketability for the rehabilitation of existing homes and development of new apartments over the past decade.

HIGHLANDS

Originally the site of the Checkerdome Arena, the area south of the Park between Oakview Place and Highland Drive was redeveloped as a mixed-use property with modern apartments, office space (conventional and medical), and retail. Immediately to the east, the campus of St. Louis Community College Forest Park occupies much of the former Forest Park Highlands amusement park site followed by the St. Louis Science Center and St. Louis University High School.

DOGTOWN

Located south of the Park, the area known as Dogtown consists of the three city neighborhoods of Hi-Pointe, Clayton-Tamm, and Franz Park. The neighborhood is predominantly residential and includes a large number of bungalows built in the 1920s and 1930s, small duplexes, and apartment buildings. Local retailers, bars, and restaurants are concentrated near the intersection of Clayton Avenue and Tamm Avenue, while auto-oriented commercial uses are located along of Hampton Avenue. Residents of the area include singles, families, and long-term senior residents.

DEMUN

Demun straddles the boundary between the city and county of St. Louis and is defined in large part by the presence of Washington University. Most of the institution's 15,000 students and 5,000 staff are concentrated on the 120-acre main campus located between Skinker and Big Bend boulevards at the northern edge of the neighborhood. Other institutional uses in the area include Fontbonne University and Concordia Seminary, while commercial uses are located along Clayton Road to the south. Historic, expansive single-family homes positioned along tree-lined residential streets occupy most of the central portion of the neighborhood, while condos and apartments are concentrated near DeMun Avenue and along Skinker facing the Park.

SKINKER DEBALIVIERE

The primarily residential Skinker DeBaliviere neighborhood bounds the northwest corner of the Park between its namesakes of Skinker Boulevard and DeBaliviere Avenue. MetroLink's Blue Line roughly bisects the neighborhoods diagonally between Forest Park Parkway in the southeast to Delmar Boulevard to the north, while Metro's bus depot occupies more than ten acres of the neighborhood's northeast corner. Two-story brick homes and two- to four-family apartment buildings constructed in the early 1900s are the most common building type. The area immediately north of Forest Park is known as the Catlin Tract, which consists of historic mansions with lots that extend to Forest Park Parkway. This tract creates significant pedestrian barriers to and from the heart of the neighborhood to the north.

DEBALIVIERE PLACE

Forming a portion of the northern border of the Park between DeBaliviere Avenue and Union Boulevard, DeBaliviere Place includes a large number of stately historic homes similar to the neighboring Central West End. Gated streets are common, and single-family residences along the landscaped boulevards of Kingsbury Place and Washington Terrace have recently sold for $700,000 or more. Several condominium buildings form the southern boundary of the neighborhood, while a small amount of retail, a private high school, and mixed commercial uses are located along the western boundary separating DeBaliviere Place from Skinker DeBaliviere.

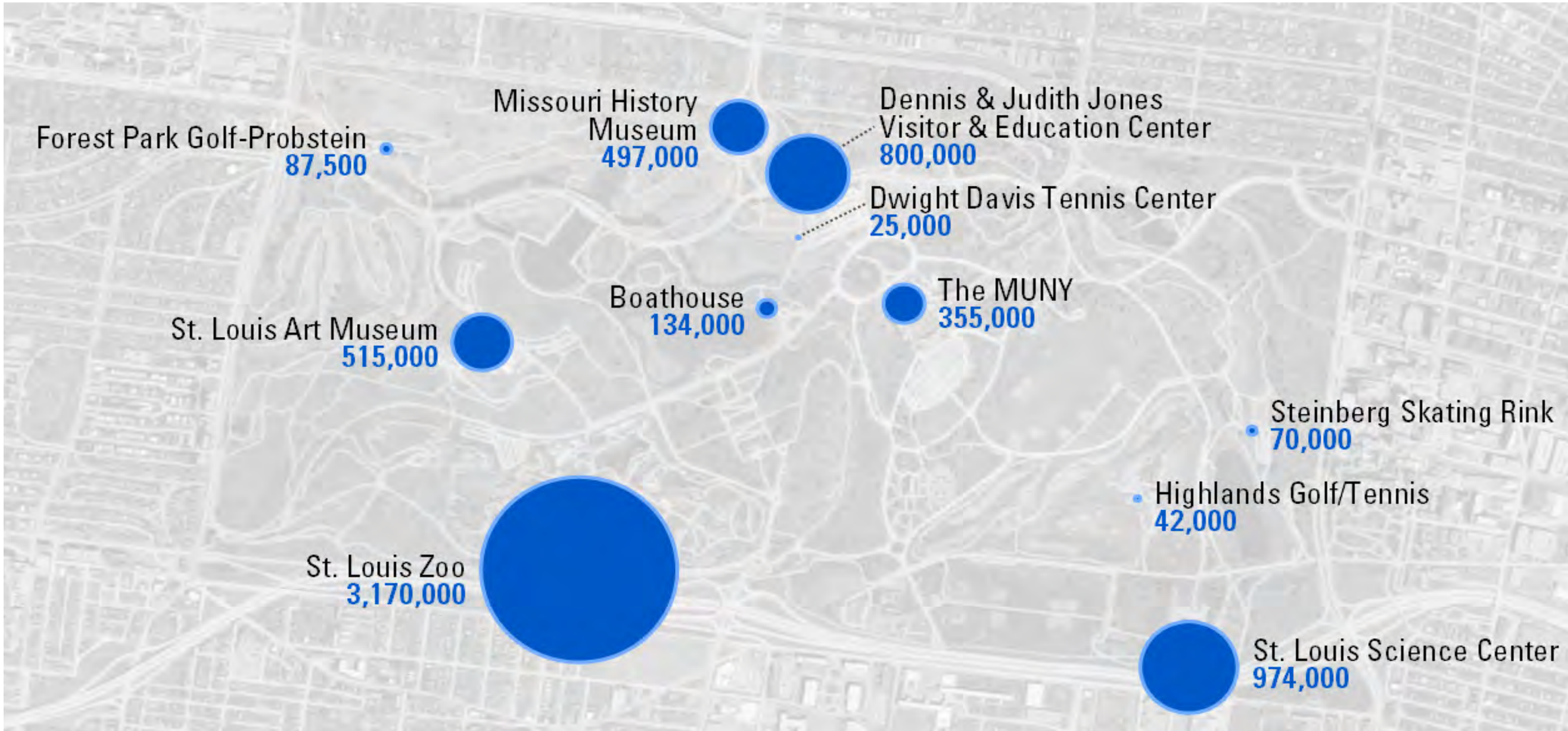


Figure 4: Visitation patterns as of September, 2017

OVERVIEW

Forest Park attracts approximately 13 million visitors annually. The anchor institutions and Park partners track attendance, which represented just under six million of these visitors in 2016. City of St. Louis oversees permitting of Park events and festivals, which attracted an estimated 941,000 attendees in 2016. Understanding the visitation patterns of the remaining six million visitors is more challenging given the limited availability of data. Historically, total visitation counts have been based on traffic volume and not necessarily counts of joggers, cyclists, and picnickers. However, given the lack of alternative sources, the following breakdown of visitors per "experience" is based on the best available data and reasonable assumptions.

VISITOR EXPERIENCE

ARTS & CULTURAL INSTITUTIONS (831,000 VISITORS)

The St. Louis Art Museum (SLAM) is one of the region's premiere cultural attractions and the $130 million expansion of its East Building in 2013 (aka "Modern Wing") has led to a increase in annual attendance. The Muny is an 11,000-seat amphitheater with performances running most nights from late-May to early-July that attract more than 350,000 spectators.

FAMILY AND EDUCATIONAL ATTRACTIONS (4,641,000 VISITORS)

Over one-third of the visitors to Forest Park come for its family and educational attractions, including the St. Louis Zoo, St. Louis Science Center, and Missouri History Museum. The St. Louis Zoo is often ranked as the top visitor attraction in the region and is one of the only zoos in the country with free admission.

SPECIAL EVENTS & FESTIVALS (941,000 VISITORS)

In addition to events hosted by the anchor institutions, there are dozens of events in Forest Park throughout the year that attract hundreds of thousands of visitors. These events include road races and walks, music festivals and concerts, movies, parades, and sports. It was estimated that in 2016, these events and festivals attracted just under 950,000 attendees. Approximately one-third of these visitors attended two multi-day events that included the Balloon Glow and Great St. Louis Balloon Race (est. 180,000 attendees) and Fair St. Louis and Fireworks (est. 150,000 attendees).

ACTIVE RECREATIONAL ACTIVITIES & SPORTS (4,304,000 VISITORS)

It is assumed that of the more than six million estimated visitors not included in the visitor counts of the anchor institutions/partners or events/festivals, approximately two-thirds engage in physical activity including team sports such as softball, baseball, cross country, and rugby as well as running, rollerblading or cycling. When including the visitor counts at Probstein Golf Course, Highlands Golf-Tennis, and Dwight Davis Tennis Center, there are an estimated 4,304,000 visitors that engage in active recreation annually.

PASSIVE RECREATIONAL ACTIVITIES (2,281,000 VISITORS)

Of the more than six million estimated visitors not included in the visitor counts of the anchor institutions/partners or events/festivals, it is assumed that approximately one-third engage in passive recreational activities, such as hiking, birdwatching, strolling, and picnicking. Additionally, the seasonal recreational visitors to the Boathouse (157,000) and Steinberg Skating Rink (70,000) brings the total estimated number of passive recreational visitors to 2,281,000, or just under 18 percent of all visitors to the Park.

SEASONAL ATTENDANCE

Based on monthly attendance reporting from the Park partners and institutions, and special event and festival schedule from the city of St. Louis, it is assumed that active and passive recreational visitors follow similar attendance patterns with the highest proportion of visitors in the summer months. Based on these assumptions, approximately 40 percent of all Forest Park visitors come from June through August. In June and July, the St. Louis Zoo alone attracts nearly a million visitors.

SPATIAL ATTENDANCE

Mapping the annual attendance of the Park partners and anchor institutions shows which portions of Forest Park are "weighted," putting a strain on road networks and circulation patterns. The southwest and central portions of the Park have the highest concentrations of visitors, whereas the northeast section has less activity given the lack of anchor institution. Most of the visitors to the southeast section are on the south side of Interstate 64 at the St. Louis Science Center or seasonal during winter at the Steinberg Skating Rink. There is no data available to inform spatial visitation patterns for active and passive recreational visitors.

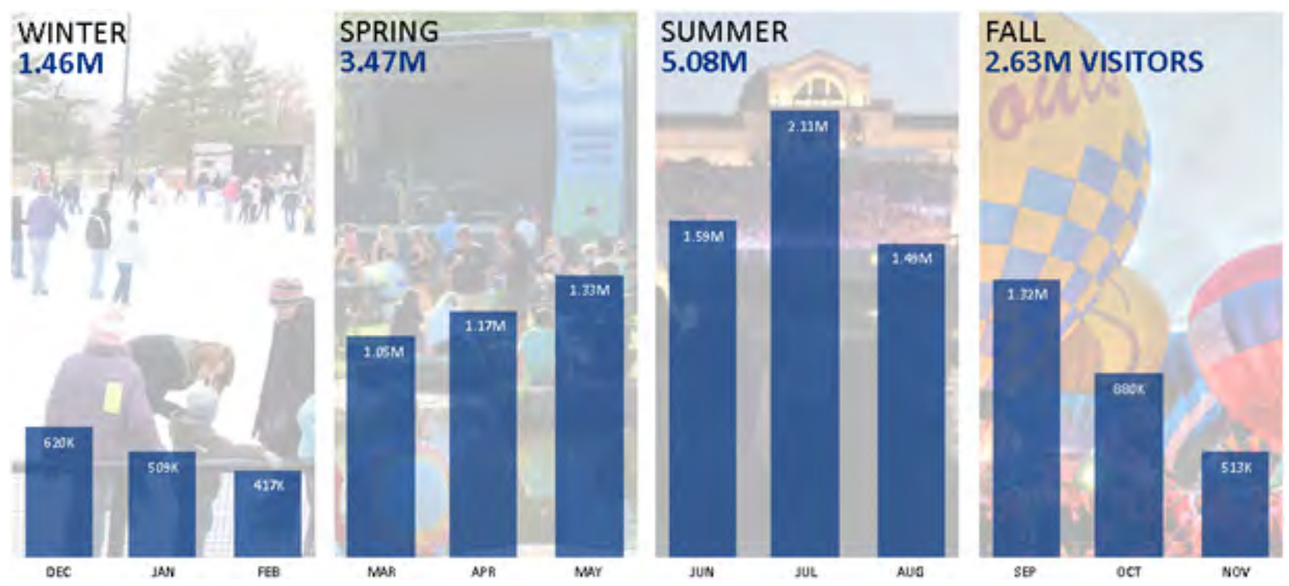


Figure 5: *Forest Park visitation by season*

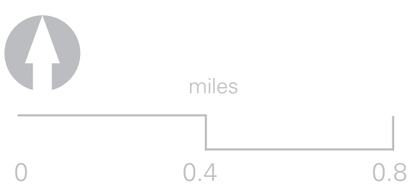


Figure 6: Existing retail districts and clusters

Legend

1 Delmar Loop (465,500 SF)
2 Skinker Station (18,000 SF)
3 DeMun (31,000 SF)
4 Clayton Road (330,400 SF)
5 Hi-Pointe (37,300 SF)
6 Dogtown (76,200 SF)
7 Hampton Avenue (62,200 SF)
8 Highlands (6,100 SF)
9 The Grove (266,500 SF)
10 Central West End (520,100 SF)
11 DeBaliviere (38,500 SF)

Areas requiring an in-depth study

St. Louis City Limits

miles

0 0.4 0.8

OVERVIEW

Though nearly two million square feet of retail space is contained within a number of distinct nodes close to Forest Park, limited pedestrian access and connectivity funnels Park users towards only a handful of easily-accessed retail destinations. While better-quality, walkable commercial districts in the Delmar Loop, Central West End, and Forest Park Southeast have performed well in recent years, difficulty accessing Forest Park directly from these areas creates a physical barrier between retail and Park experiences. Improved connectivity within the retail zones would reduce pressure on the Park without requiring improvements within the Park. Additionally, the highly seasonal nature of visitation in the Park suggests the need for more "pop-up" retail uses/amenities rather than permanent improvements.

PRIMARY RETAIL DISTRICTS

CENTRAL WEST END

Retail in the Central West End is largely concentrated along Euclid Avenue and Maryland Plaza. Though some retail storefronts are located throughout the neighborhood, bars and restaurants are predominant. Current average lease rates are some of the highest in St. Louis—more than $20 per square foot—and less than three percent of the current inventory of 700,000 square feet is vacant.

The highly desirable residential real estate in the neighborhood creates a built-in market of higher-end consumers. Upscale restaurants are common, as well as niche uses such as furniture store specializing in modern imports and a boutique pet store. The presence of the BJC campus, which includes more than 15,000 daily employees, creates a complimentary daytime retail demand pool. The city's only Whole Foods is located on the ground floor of the Orion apartment development, and the region's first Shake Shack is slated to be completed in 2017 in the first floor of the newly-built Euclid development.

DELMAR LOOP

The Loop commercial district stretches about 0.75 mile from Rosedale Avenue in St. Louis to Kingsland Avenue in neighboring University City. Originally the turn-around point for the street car line, The Loop is one of the region's most visible entertainment districts, and includes several concert venues as well as numerous bars and restaurants. Shopping along the corridor also includes a mix of boutique clothing stores, bookstores, and record stores.

The area is popular among Washington University students, while prominent venues such as The Pageant and Tivoli Theatre attract visitors from across the region throughout the week. The increasing popularity of this district has manifested itself most recently in the nearly-completed Loop Trolley, a two-mile street car line running between Delmar and Forest Park that will create a better connection between the Park and The Loop.

FOREST PARK SOUTHEAST

The stretch of Manchester Avenue between Kingshighway and Vandeventer Avenue forms a walkable commercial district anchoring the larger Grove neighborhood. A diverse collection of bars and restaurants lining the corridor are mixed with service-oriented commercial uses and office space occupied by community development agencies and design firms. Retail rents in the area remain relatively affordable—around $9.50 per square foot, on average—signaling additional opportunity for growth.

OTHER RETAIL CLUSTERS

HI-POINTE

A small neighborhood retail node along the western boundary of Dogtown includes the historic Hi-Pointe movie theater, several restaurants, and the Cheshire hotel.

DOGTOWN

Retail uses in Dogtown are centered on the intersection of Clayton Avenue and Tamm Avenue about two blocks south of Interstate 64 and two blocks west of Hampton Avenue. The early 1900s brick storefronts retain much of their century-old character, and commercial spaces are fully-occupied by a mix of bars, restaurants, and local services.

DEBALIVIERE

Retail uses along DeBaliviere Avenue vary significant in terms of quality and character. Streetfront retail facing the DeBaliviere Metrolink Station quickly turns to more auto-oriented uses moving north including a dialysis center and strip retail set back behind surface parking.

HIGHLANDS

Retail uses in the Highlands are located on the ground floor of the office buildings that were built on the site in the mid-2000s. Though somewhat institutional in appearance, an eclectic mix of a coffee shop, yoga studio, and Jimmy John's sandwich shop serve the residents of the adjacent apartment communities as well as daily employees of the surrounding offices and neighboring St. Louis Community College.

SKINKER STATION

A small node of mixed-use retail occupies the northeast corner of the intersection of Skinker Boulevard and Forest Park Parkway adjacent the Metrolink's Skinker Station. The building includes the popular Kayak's Coffee, and two small restaurants on the ground floor, with the second and third floors occupied by offices of Washington University.

DEMUN

A small neighborhood commercial node is located along DeMun Avenue between Northwood and Southwood avenues. Storefronts face Concordia Park—part of the Concordia Seminary campus—while the 1920s building stock is well-occupied for both commercial and residential uses.

HAMPTON AVENUE

Forest Park's primary gateway is defined by auto-oriented commercial development lining Hampton Avenue. Fast food, gas stations, liquor stores, and car dealerships are all present, and the six-lane roadway carries significant traffic during rush hour and weekends, limiting walkability.

CLAYTON ROAD

Similar to Hampton Avenue, auto-oriented uses dominate the portion of Clayton Road stretching from the park's edge to Big Bend Boulevard, including a large retail center anchored by Schnucks. The corridor serves a diverse market including portion of Clayton, Richmond Heights, and St. Louis.

EMPLOYMENT CENTERS

Figure 7: Existing employment centers

Legend

1 Washington University—North Campus (300 employees)

2 Washington University—Danforth Campus (4,200 employees)

3 St. Mary's Hospital (2,100 employees)

4 Highlands (800 employees)

5 St. Louis Community College (1,000 employees)

6 Barnes Jewish Hospital (15,000 employees)

7 Cortex (3,800 employees)

St. Louis City Limits

miles

0 0.4 0.8

OVERVIEW

About 28,000 daily non-retail employees work in five distinct employment centers surrounding the Park. The presence of these employees creates a large captive market for potential development along Forest Park's periphery and helps to maintain vibrancy and density throughout the week.

Two of the St. Louis region's five largest employers maintain some presence in the neighborhoods surrounding the Park, including the two primary employment centers for BJC Healthcare and Washington University. Often, the Park's main role for peopleis as a part of their daily commute or a free parking lot. While there are inevitable restrictions upon workday schedules that limit the ability of some employees to visit the Park before, after, or during the workday, facilitating access between employment nodes and the Park is key. Forest Park can function as a quiet midday respite from work, or a destination for lunch or after-hours events. Though at times underutilized, the green space of Forest Park provides indirect benefits to employers in the area that cannot be matched by suburban office parks or Downtown office buildings.

EMPLOYMENT SUMMARIES

WASHINGTON UNIVERSITY IN ST. LOUIS

The 169-acre Danforth Campus of Washington University in St. Louis is the institution's primary campus, home to the majority of the student body, and the bulk of academic programs. Washington University's north campus is located at Rosedale Avenue and Delmar Boulevard and houses a variety of additional administrative functions.

Since parking on-campus can be costly at Washington University, parking in the unregulated free spots within Forest Park is a possible alternative. Currently, Forest Park's parking management system does not prevent such spillover. However, regulations on neighborhood streets like Lindell Boulevard prevent student parking during the daytime hours. The easy pedestrian linkage between the western edge of the Park and Washington University's campus leads to market potential for some development types, though much of this space adjacent to the campus within the Park is occupied by the Probstein Golf Course.

CORTEX

In 2002, Cortex was founded by a partnership of Washington University, Saint Louis University, the University of Missouri-St. Louis, and the Missouri Botanical Garden with an initial investment of $29 million. The goal was to leverage the development potential of the St. Louis region's major higher educational, research, and health care institutions. Today, Cortex is an internationally recognized urban mixed-use center of research, innovation, and business growth that adds both jobs and wealth to the St. Louis region. Since its inception, Cortex has completed or has under construction 1.6 million square feet of new and rehabilitated space totaling $500 million of investment, generating 3,800 new jobs in the district.

ST. LOUIS COMMUNITY COLLEGE (STLCC)

St. Louis Community College Forest Park is the state's largest provider of health technology training, offering 13 medical programs and certifications. In addition to about 1,000 faculty and staff, the Forest Park location boasts a total enrollment of just over 8,000 students.

Although students and faculty at the community college can see the Park from campus, the campus is cut off from the Park by Interstate 64. Students who wish to access the Park from campus must travel west to Hampton or east to the pedestrian underpass near the Science Center in order to cross the highway—a significant detour.

HIGHLANDS

The offices at the Highlands include a variety of financial, marketing, and real estate firms, while a mix of commercial and retail users occupy some first floor spaces. The western building was constructed in 2001 during the initial redevelopment phase of the site, while a second building to the east followed in 2008.

Though employees in this area are located near Forest Park's southern boundary—particularly the Aviation Fields and, to a lesser extent, the Jewel Box—lack of immediate access points funnels potential visitors towards the highly trafficked Hampton entrance via car.

BARNES JEWISH CHRISTIAN HEALTHCARE (BJC)

BJC Healthcare is the largest employer in the St. Louis region and maintains its largest concentration of facilities and employees in the Central West End. Barnes-Jewish Hospital, St. Louis Children's Hospital, Goldfarb School of Nursing, and the St. Louis Rehabilitation Institute are all located in the area, in addition to numerous research labs, physicians' offices, and administrative services. The Washington University School of Medicine is immediately north of the main Barnes-Jewish building, while the Shriner's Children's Hospital is just east.

About half of all non-retail workers in the areas surrounding the Park are employed by BJC, with most immediately across from the Park's eastern boundary. Though these employees have the greatest potential to engage with the Park, the nature of their work affects this ability significantly. Administrative staff could likely access the eastern portions of the Park during a lunch break or after working hours. Most medical positions, however—doctors, nurses, and technicians—often lack the freedom to leave facilities during working hours, or work non-traditional 12 hour shifts. Nonetheless, a large captive market of nearly 15,000 employees could provide significant support for new commercial and retail uses around the Park's periphery.

EXISTING ROADWAY NETWORK

Figure 8: Existing roadway network

OVERVIEW

Effective Forest Park limits are Kingshighway Boulevard to the east, Lindell Boulevard to the North, Skinker Boulevard to the west and Interstate 64 and Oakland Avenue to the south. Kingshighway Boulevard and Skinker Boulevard are classified as primary streets by the City of St. Louis, while Lindell Boulevard is classified a secondary street, and Oakland Avenue falls in the tertiary streets group as classified by Metro St. Louis.

ROADS ADJACENT TO THE PARK

Kingshighway Boulevard (35 MPH) is a north-south primary street that connects I-70 to the north with Route 30 to the south. Its segment from Lindell Boulevard to Oakland Avenue is the eastern border of the Park, and separates it from Central West End, with the Barnes Jewish Hospital and Washington University School of Medicine. Designed as a bidirectional roadway, its section has three to four lanes per direction, with median and turning lanes (115 ft. curb to curb), and on-street parking permitted in some segments (See traffic volumes on pages 26-27). Bus routes run through it.

Lindell Boulevard (25 MPH) connects Skinker Boulevard with Kingshighway Boulevard to the north, and is populated by mansions that face the Park. Once part of the Park, it became part of the public street network after the World's Fair of 1904, and although it is open to motorized vehicles, bus routes cannot run through it. The road section consists of two driving lanes per direction, with on-street parking permitted in some of the segments.

Skinker Boulevard (35 MPH) is the western border of the Park and limits with Demun, a neighborhood that houses an extended residential area, with single family homes and apartment buildings, as well as the Washington University main campus. The road section has 2 lanes per direction, with a two-way left turn lane, and on-street parking permitted in several segments on both sides. Bus routes run along it.

Oakland Avenue (30 MPH) is a tertiary street and southern border of the Park. It has one lane per direction for motorized vehicles, plus buffered bike lanes on both sides and on-street parking on the southern side. Turning lanes occur west of Hampton Avenue with a median to the east. The exception to this is the segment west of the Skinker Boulevard intersection which has two lanes eastbound. Bus routes run along it.

Legend

- 1 Lane
- 2 Lanes
- 3 Lanes
- 4 Lanes
- 5 Lanes
- 6+ Lanes
- St. Louis City Limits

Data Source: City of St. Louis

Note: 1. Roads mapped only included 'through' lanes which excludes turning lanes.

Note 2. I-64 is two 4-lane sections.

miles

0 0.4 0.8

Interstate 64 is the closest interstate to the Park and represents the main access for regional traffic to the Park main attractions, including the Zoo and The Muny.

ROADS WITHIN THE PARK

The majority of roads within the Park are circuitous non-striped bidirectional, and are 30 to 40 feet wide curb to curb. Many allow on-street parallel parking, most of it unrestricted.

Lagoon Drive - Grand Drive provides a continuous east-west connection on the northern portion of the Park, and Wells Drive-Clayton Avenue give an east-west connection to the south. Government Drive-Theater Drive-Grand Drive draw a diagonal from the southwest corner to the northeast corner. Other shorter roads link these routes to improve accessibility to all destinations.

ANNUAL AVERAGE DAILY TRAFFIC VOLUMES

Average daily traffic volumes in 2012 vary significantly around the Park. Interstate 64 traffic loads surpassed 120,000 vehicles in the segment adjacent to the Park, while Kingshighway Boulevard traffic volumes varied from 60,000 vehicles from Forest Park Parkway to Interstate 64, to 40,000 vehicles from that point to Lindell Avenue. North of Lindell Avenue traffic volumes decrease to 30,000 vehicles.

Skinker Avenue average daily traffic was lower than 30,000 vehicles near Lindell Boulevard intersection, and increased slightly to the South north of Oakland Street intersection. Oakland Avenue carried 4,000 vehicles west of Macklind Avenue, and 8,000 vehicles from this point to Kingshighway Boulevard intersection.

Lindell Boulevard traffic loads ranged from 4,000 to 6,000 vehicles, and doubled east of Kingshighway Boulevard.

Note: This map will be updated with any further data gathered after the opening of Forest Park Parkway. In addition, traffic counts from the roudabout study will be incorporated.

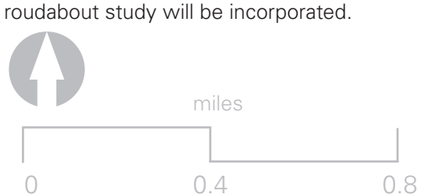


Figure 9: Existing traffic volumes

EXISTING TRANSIT

Figure 10: Existingtransit routes

LEGEND

- Metrolink
- MetroBus Routes that Directly Serve Forest Park
- Other MetroBus Routes
- The Loop Trolley

EXISTING TRANSIT ROUTES

The Metro Transit network surrounds Forest Park, but for the most part, buses do not enter the Park. The only mainline route that traverses the Park is Crosstown route 90, serving western attractions. Route 90 is rerouted to avoid congested Park roads on summer weekends when the Forest Park Trolley runs. While several other routes serve the Park perimeter, people who use these routes to reach the Park may need to cross arterial streets or travel circuitous routings to reach their destination. There are three rail stations a few blocks off the Park's perimeter; Central West End is a vibrant walkable district and Forest Park-DeBaliviere is the ad-hoc gateway to the Park, due to circulator connections. A new rail service (not operated by Metro) will soon connect the north central part of the Park (History Museum) to University City Delmar Loop, a neighborhood commercial district.

PARK CIRCULATOR

The Forest Park Trolley, operated by Metro, is the Park's primary circulator. It is a transit bus with a park theme livery. Two routes run from Forest Park - DeBaliviere rail station, serving western and eastern attractions respectively. Other than at the station, these routes do not reach outside the Park and do not approach Kingshighway Boulevard. or the Central West End. Metro reports that it is a challenge to maintain timely performance in the context of heavy Park attendance.

LEGEND

- Blue Trolley
- Green Trolley
- Metrolink

Figure 11: Existing Park circulator route

EXISTING BICYCLE INFRASTRUCTURE

Figure 12: Existing bicycle infrastructure

LEGEND

- Off-Street Bicycle Lane
- Bicycle Boulevard
- On-Street Bike Lane
- Sharrow Lane
- Great Rivers Greenway (GRG) Planned Trail
- GRG Completed/Active Project

Note 1. Chouteau Greenway and River Des Peres Greenways are currently in final planning/alignment.

BICYCLE CONNECTIONS

Existing bicycle infrastructure in and around Forest Park primarily serves the Delmar Loop (Northwest) and the Southeast Neighborhoods as well as Park users. Survey information from the Forest Park Connectivity and Mobility Study indicates that approximately 17% of respondents bike to Forest Park. Lindell Boulevard and Skinker Boulevard are both considered part of the bike network, and designed as sharrows.

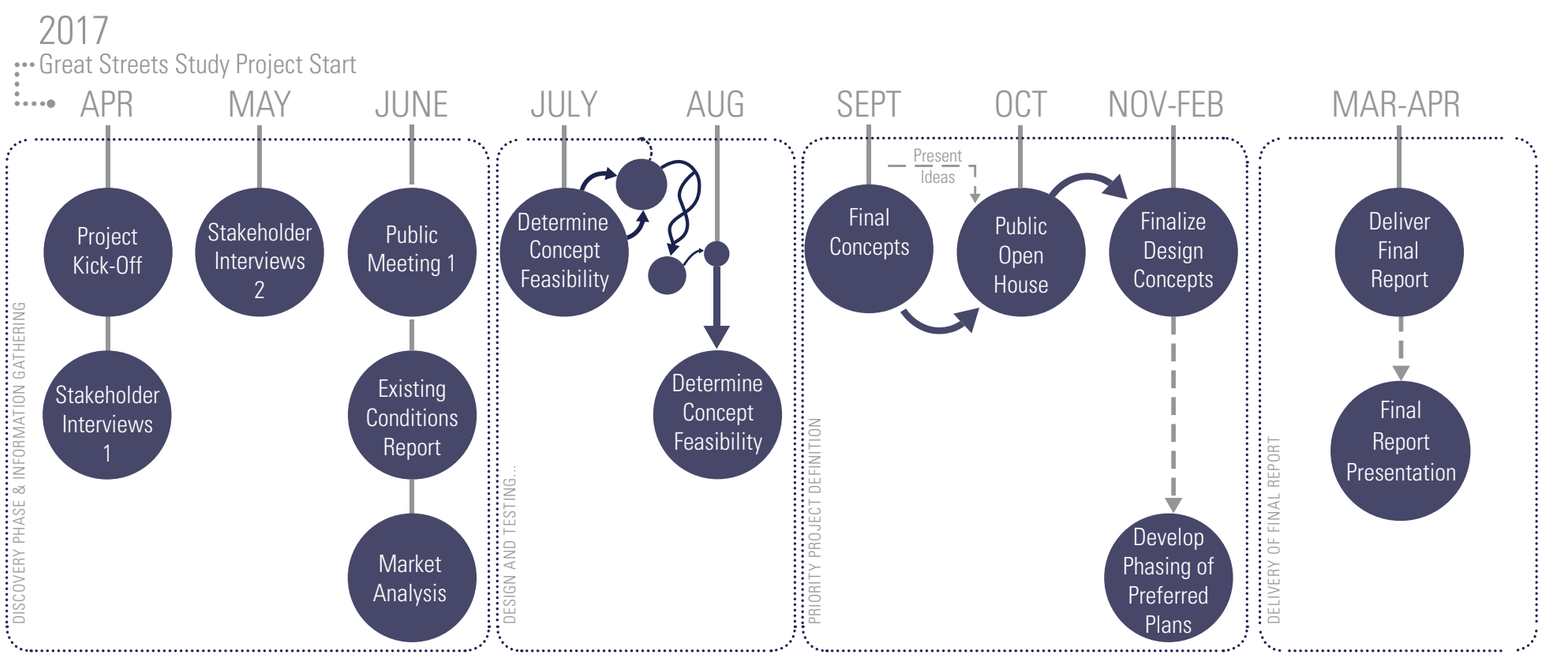
Great Rivers Greenway and Bike St. Louis have proposed additional routes to link Forest Park to already existing connections while also strengthening the regional network by creating new infrastructure. Specifically, past recommendations have proposed strengthening east-west and north-south connections, redesigning Clayton Road for 2-way bicycle access and studying the potential to implement a two-way protected bikeway on Lindell.

Even with the new connections proposed by these plans, gaps remain in connectivity. These gap areas are potential locations for implementing greenways, leisure bikeways and commuter routes to connect to and through the Park. The areas with gaps in connectivity also are adjacent to the least pedestrian oriented corners of the Park; the area bordered by North Kingshighway and Interstate 64.

The dual path network primarily runs around the perimiter of the Park but lacks service to the north east edge along Kingshighway Boulevard. The system lacks interior routes that would allow users to make smaller loops. Comments received from trail users have expressed that underpass connections are often undesirable because of lighting conditions in or around bike tunnels, which create a sense lack of safety. Some sections of the dual path system are dark at night and present challenges for navigation as well as safety for pedestrian or bike park users leaving evening events. Further study of trail lighting is recommended.

4 STUDY PROCESS

STUDY PROCESS



The Forest Park Great Streets Study greatly benefited from the community and stakeholder engagement feedback collected during the 2016 Connectivity and Mobility Study. As this study is a direct result of implementation items identified in the 2016 Study, the 2017 process began with the intent to develop specific projects for implementation, building on previous work .

The process for outreach and input for the Great Streets Study was consistent with the East-West Gateway Council of Governments adopted commitment to community engagement based on the following three tenets:

1. Citizens should know how decisions are made about the investment of tax dollars in public projects.
2. Individuals and communities affected by the outcome of regional decisions want to have their opinions and perspectives taken into consideration.
3. Planners cannot maintain current and relevant knowledge about regional problems without learning from citizens directly affected.

Early input included numerous interviews with key stakeholders, focus group work sessions and a public survey hosted online. In addition to a wide net of public input, the study was guided by an Advisory Committee made up of St. Louis City Department of Parks, Recreation & Forestry, Forest Park Forever and East-West Gateway Council of Governments. Stakeholder interviews included coordination with regional partners and leaders, such as Great Rivers Greenway, Metro, Board of Public Service, St. Louis Aldermen, the Civil Rights Enforcement Agency, Brightside, and Clayton Aldermen from Ward 1. In order to leverage existing social networks, the outreach process engaged a number of neighborhood associations, faith groups and non-profits. The diverse outreach and input methods were critical to ensuring the diverse user groups of Forest Park were well represented.

As input was gathered and synthesized, a clear set of implementable projects was drafted and refined. A public input meeting provided a range of input methods including key pad polling and hands-on exercises to understand the issues and opportunities to improve safety, access and convenience for Park users. As these issues and opportunities became draft "projects," a public open house provided an opportunity for one-on-one input from the community to review the draft projects.

4 STUDY INTENT

STUDY INTENT

As the neighborhoods and institutions that surround Forest Park thrive and the institutions within it expand, access to and within the Park is strained. Visitors to Forest Park arrive mostly by automobile for a range of activities, from leisurely strolls to formal theater productions. Bicyclists enjoy improved regional access due to the expanding regional greenway and bicycle route network. Pedestrians and runners from the adjacent neighborhoods and campuses use the Park daily. Transit access to the Park is provided directly by multiple bus lines and the soon-to-open Loop Trolley, and through three nearby light rail stations. Despite operation of a bus trolley, circulation throughout the Park and adjacent places relies significantly on the use of personal automobiles, which compounds congestion and parking problems and creates numerous conflicts with pedestrians and bicyclists, particularly on peak days and during events. This Study will begin to implement specific projects recommended in the 2016 Connectivity and Mobility Study.

The St. Louis Great Streets Initiative was established in early 2006 to expand the way communities think of their streets. Rather than viewing a roadway project as solely a way to move more cars and trucks faster, the goal of the initiative was to trigger economic and social benefits by centering communities around interesting, lively and attractive streets that serve all modes of transportation.

Forest Park attracts approximately 13 million visitors annually. The anchor institutions and Park partners track attendance, which was recorded at just under six million in 2016. The City of St. Louis oversees permitting of Park events and festivals, which attracted an estimated 941,000 attendees in 2016. By applying the principles of Great Streets to the access routes to, around and within Forest Park, the Forest Park Great Streets Study recommends a multi-modal access and circulation strategy which increases the safety, convenience, and accessibility to and within Forest Park, resulting in an improved visitor experience.

STUDY VISION: THE FOREST PARK GREAT STREETS PROJECT WILL DEVELOP A MULTI-MODAL ACCESS AND CIRCULATION STRATEGY WHICH INCREASES THE SAFETY, CONVENIENCE, AND ACCESSIBILITY TO AND WITHIN FOREST PARK RESULTING IN AN IMPROVED VISITOR EXPERIENCE.

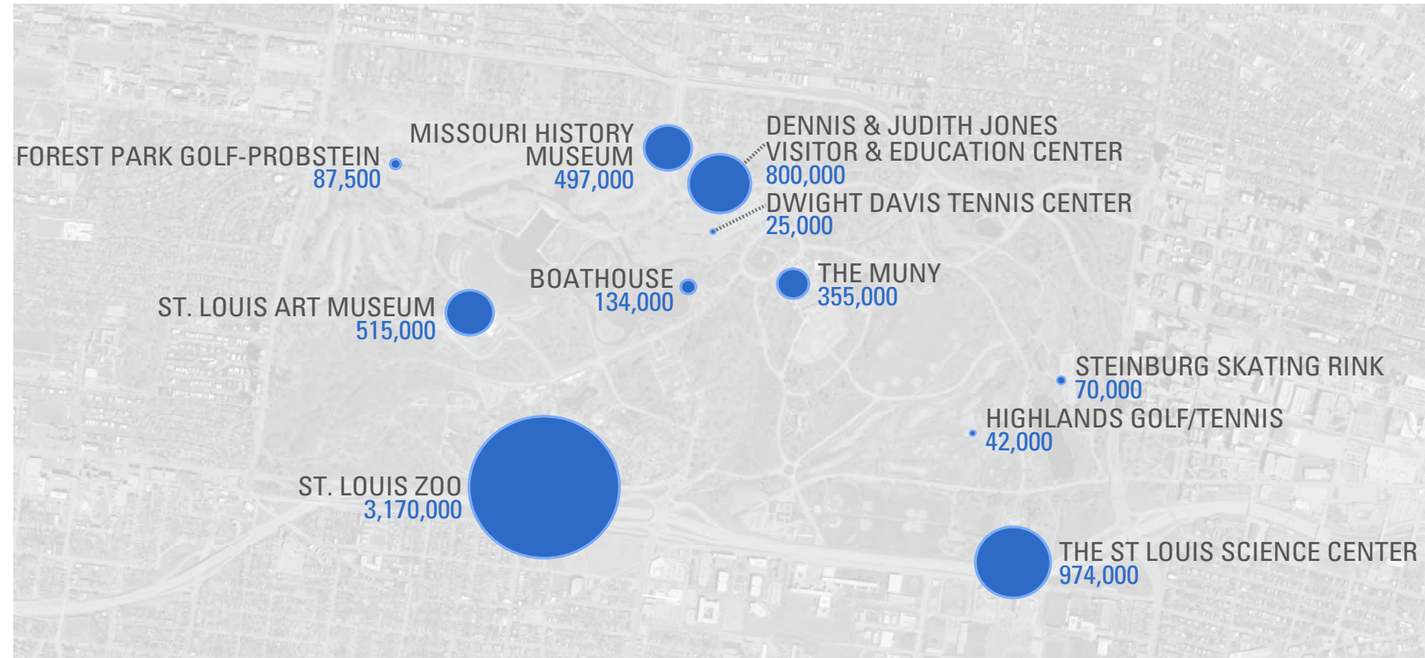


Figure 13: Visitation patterns at Forest Park: see Appendix A for additional detail.

2

SUCCESS FACTORS

Definition: Client Critical Success Factors (CSFs) are the features or results that must be accomplished in order for the client to consider the project a success. Client CSFs should be evaluated through the course of the project and it may be necessary to revise the list as the project evolves. Client CSFs may or may not be described in the scope of work so it is important to help the client team define them.

METRICS

CRITICAL SUCCESS FACTORS

COMMUNITY

1. 13 million people visit Forest Park annually and all Park users should have the opportunity to participate in the visioning process to ensure political buy-in of the process. Stakeholder engagement and public meetings should be accessible, both economically and logistically, for all impacted users. Targeted outreach will focus on Park Partners - within the Park, and adjacent or nearby institutions, as well as key community leaders, recognizing the Park user groups are very diverse and their needs are very diverse.
2. The 25 members of the Forest Park Advisory Board should be invited and updated throughout the project.
3. Recommendations should embrace the many cultures of St. Louis and their diverse needs.
4. Recommendations should result in clear recommendations for improved multi-modal access from all points of the St. Louis Region. The plan should address safety and ease of movement of pedestrian, bicycle, roadway, bus transit, Metro Link transit and internal Park circulator transit and meet ADA.
5. Recommendations should improve opportunities for increased Park user education and access to information including improved signage and wayfinding.
6. Recommendations should result in an equitable experience within the Park for the diverse user groups.
7. Recommendations should lessen the negative impact of cars in the Park.
8. Recommendations should increase the ability of residents from all zip codes to access the Park.
9. Recommendations should encourage surrounding neighborhoods to walk to the Park.

a **Diversify Park users (zip codes).**

b **Engage community leaders – representative of Park users and potential users.**

c **Increase mobility (walkability, circulator ridership, light rail ridership, bus ridership, bicyclists).**

d **Increase safety and reduce accident rates.**

e **Improve Park user education (signage/ wayfinding, media, digital information, data access).**

f **Obtain Park Partner support of the plan recommendations.**

g **Improve coordination with adjacent institutions to address the "insulation layer" on the edges of the Park to make the edges more "permeable."**

h **Reduce parking turnover.**

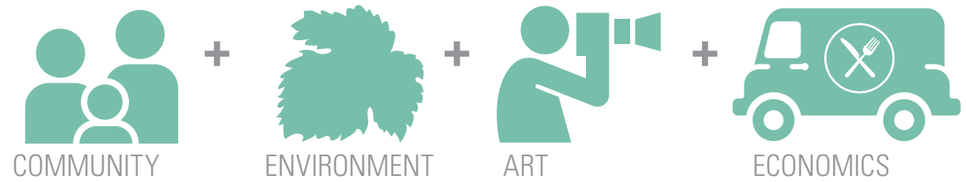
ART

1. Art in the context of the Forest Park Great Streets Study refers to the Park itself being a work of art. The historic character and natural character of the Park is art - the historic vision for the Park and adjacent roadways and boulevards should therefore be respected and recommendations should be timeless in their style and materiality. The way people move about the Park should be artful and poetic, not just utilitarian.
2. Recommendations should respect the original design intent and history and follow the vision set forth in the 1995 Forest Park Master Plan.

a **Consider identity and authenticity as a historic designed landscape/cultural landscape in any intervention.**

b **Improve entry and arrival experiences.**

METRICS



CRITICAL SUCCESS FACTORS

ENVIRONMENT

1. Recommendations should merge transportation planning with natural systems planning to provide strategies that encourage stormwater infiltration and mitigate urban heat island within the Park.
2. Environmental recommendations should address the immediate watershed, open spaces and greenways.
3. Recommendations should result in reduction of energy usage (carbon footprint) and result in improved air quality through a more efficient vehicular circulation.
4. Recommendations should result in reduction of car traffic to and through the Park.
5. Recommendations should result in no net loss of open space, per the 1995 Master Plan.

a. **Reduce stormwater runoff.**
b. **Consider habitat connectivity in the definition of connectivity.**
c. **Reduce overall carbon footprint (Reduce energy usage, number of miles driven in the Park, # times a user parks per visit).**
d. **Improve air quality.**
e. **Increase Tree Canopy.**
f. **Increase bank of "No net loss of open space."**

ECONOMICS

1. The study should provide a clear picture of market capacity including all factors that impact Forest Park and can inform development opportunities within and near the Park. The recommendations should expand the "total Park experience" by capturing opportunities for retail, concessions and dining options.
2. The recommendations should provide clear recommendations for improvement to Park revenues or leverage development opportunities.
3. Recommendations should define economic development the complements, not competes with, nearby commercial / dining areas.
4. The study should improve access to the Park and as a result, improve property values adjacent to the Park.

a. **Identify development opportunities for revenue generation within and adjacent to the Park.**
b. **Improve "services" to Park neighbors.**
c. **Increase participation in the Park from all areas of the City.**
d. **Increase property values for the community around the Park.**
e. **Identify capital partner opportunities for future funding.**
f. **Net positive impact to revenue for Park Partners.**
g. **Increase enjoyment and use of the Park by broad section of the community.**
h. **Improve the seasonality and "total park experience" through increase in capture rate for concession/ dining options in the Park.**

PARK SYSTEMS

This section of the Study outlines recommendations to overarching "systems" both within the Park's physical environment as well as operational aspects. Immediate, short and long-term "action items" were established through focus group input and work sessions with Park Partners and adjacent institutions.

3

ACCESS DEMAND MANAGEMENT

ACCESS DEMAND MANAGEMENT

Interstate 64 is the main access for regional traffic to many of the Park attractions, including the Zoo and The Muny. The majority of vehicles (60%) entering the Park enter at Hampton Avenue. During peak weekends and events, traffic can back up on Hampton Avenue all the way onto the highway exit and travel lanes. Regardless of Park traffic, drivers typically experience regular congestion on Hampton Avenue given it connects Interstates 64 and 44. The following recommendations for management strategies would balance access demand and reduce congestion at choke points like Hampton Avenue.

Increasing accessibility to other vehicular entry points to the Park will lessen the burden of Hampton Avenue to handle the majority of the Park's vehicular visitors. With enhancements to signage and wayfinding (see 3.4 Signage), other primary entry points with additional capacity such as DeBaliviere Avenue, Union Boulevard, Lagoon Drive, and West Pine Boulevard can be more fully utilized.

A broad base of access demand management strategies is needed to solve congestion and access issues in the Park, which both Park institutions and the public at large have identified as priority mobility challenges. With both adjustments to the way that personal vehicles move around and navigate the Park (see 3.3 Parking, 3.4 Signage, 3.5 Data, and 3.8) as well as enhancing alternate modes of travel such as an improved Park circulator (see 3.2 Circulator) and increased bicycle and pedestrian connectivity to the Park (see 3.6 Bicycle System and 3.7 Pedestrian System), access to the Park by all modes will be made easier, more efficient, and safer.

ZOO FOCUS AREA

Stakeholder feedback and on-site observation indicates that a particular focus on vehicular congestion around the St. Louis Zoo is needed. The full suite of strategies to reduce congestion and enhance the visitor experience of the Park is deployed at this location (see Zoo Focus Area on the next page). A fully coordinated Park parking strategy should be deployed to reduce parking-induced congestion on peak visitation days. The proposed Transit Hub at the Festival & Parking Plaza at the Upper Muny (see 4.9 Transit Hub) should be made available as an alternative parking location and point of access to the Zoo on peak visitation days. The use of the Upper Muny lot should be promoted during the daytime, when the Zoo is in high demand and the Muny lot is underutilized. Added provisions of better walking and biking connections, bikeshare, and a Park circulator hub would make the lot more attractive and usable. Marketing and communicating this option through signage and online information will ensure success.

The proposed adjustments to the Park circulator (see 3.2 Circulator) are also intended to alleviate congestion in the southwest portion of the Park by connecting visitors to expanded parking opportunities throughout the Park. In addition, bus-only lanes will allow the circulator to avoid specific congestion pinch points, which have been identified through stakeholder feedback and on-site observation. Additional speed and flow traffic data is needed to verify these recommendations.

Pedestrian and bicycle connectivity to Park from the southwest neighborhoods will be made easier and safer through a reconfiguration of the existing Tamm Drive bridge over Interstate 64 (see 4.4 Tamm). An opportunity for regulating traffic leaving the Zoo on Tamm Drive could be created through a new 3-way stop at Tamm Drive and Oakland Avenue, allowing vehicles exiting the Zoo to make protected right and left turns and preventing backups along the bridge.

Dynamic parking availability signs can be installed at entrances to the Park to allow visitors to make a route decision before entering into potentially congested areas (see 3.4 Signage).

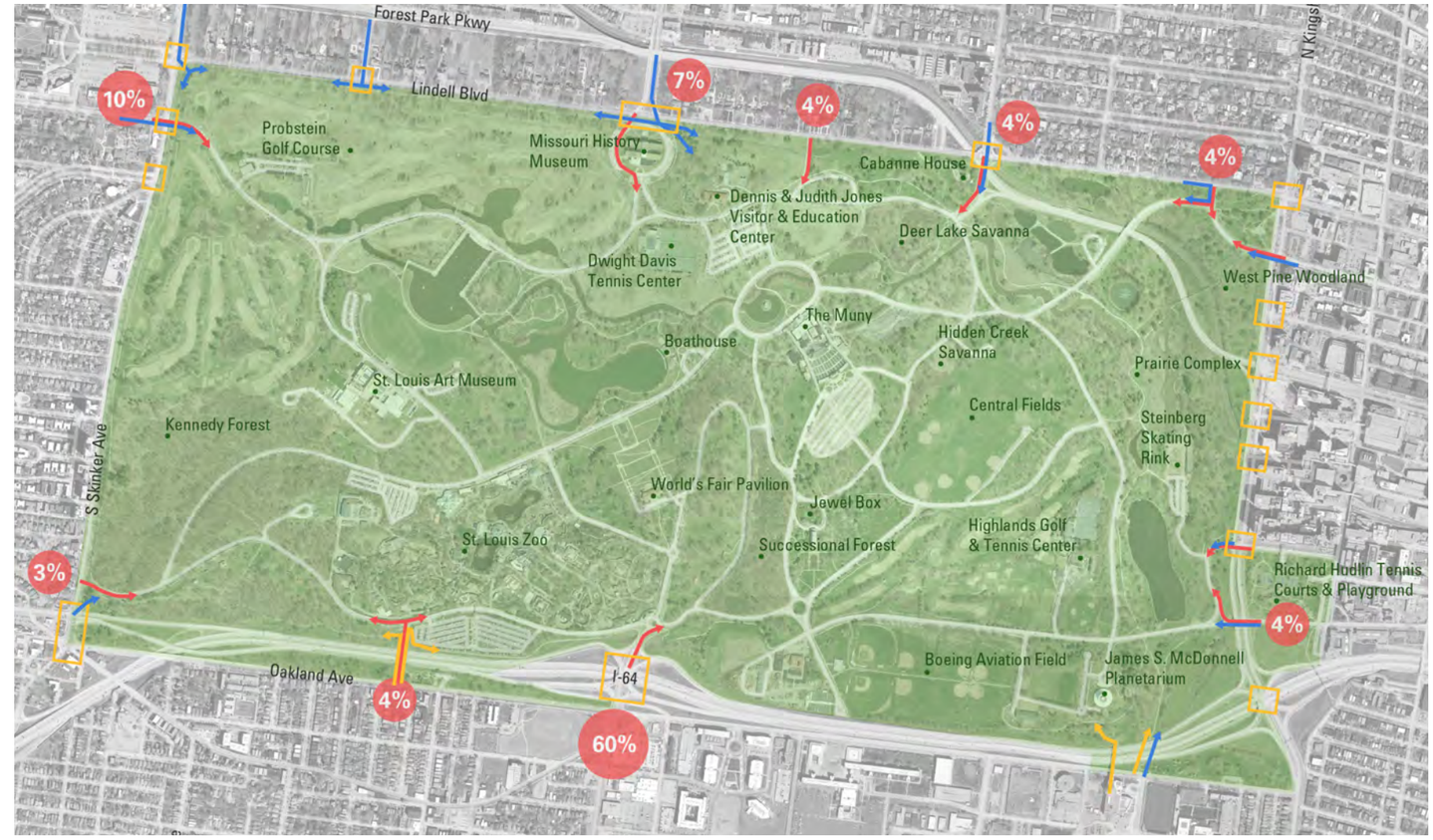


Figure 1: Existing Condition: Park entries by type and percent of vehicles entering Park. 60% of vehicles enter the Park at Hampton Avenue.

LEGEND

- Signalized Crosswalk (Pedestrians/Cyclists)
- Pedestrian Connection
- Great Rivers Greenway Bicycle Directed Entry
- Vehicular Entry
- X% Percentage of Vehicles Entering Park

ACCESS DEMAND MANAGEMENT: ZOO FOCUS AREA

IMMEDIATE STRATEGIES

- Tamm and Oakland Stop Sign/Signal Feasibility Study
- Ⓐ Ⓑ Parking Lot Vehicle Processing Strategies, such as processing vehicles at lot exit.

SHORT-TERM STRATEGIES

- 3-way stop at Tamm and Oakland
- Circulator Parking Lot Loop
- Ⓓ Upper Muny Mode Shift Facility
- Dynamic Parking Availability Signs
- Walkway connecting Upper Muny and Zoo
- Improved Signage + Lane Markings

LONG-TERM STRATEGIES

- Circulator routes Purple + Orange
- Event park + ride extension
- Bus-only lane 'Queue Jump'
- Ⓒ New parking construction (St. Louis Zoo)
- Tamm Drive bridge reconfiguration
- I-64 exit to new parking (further study needed)

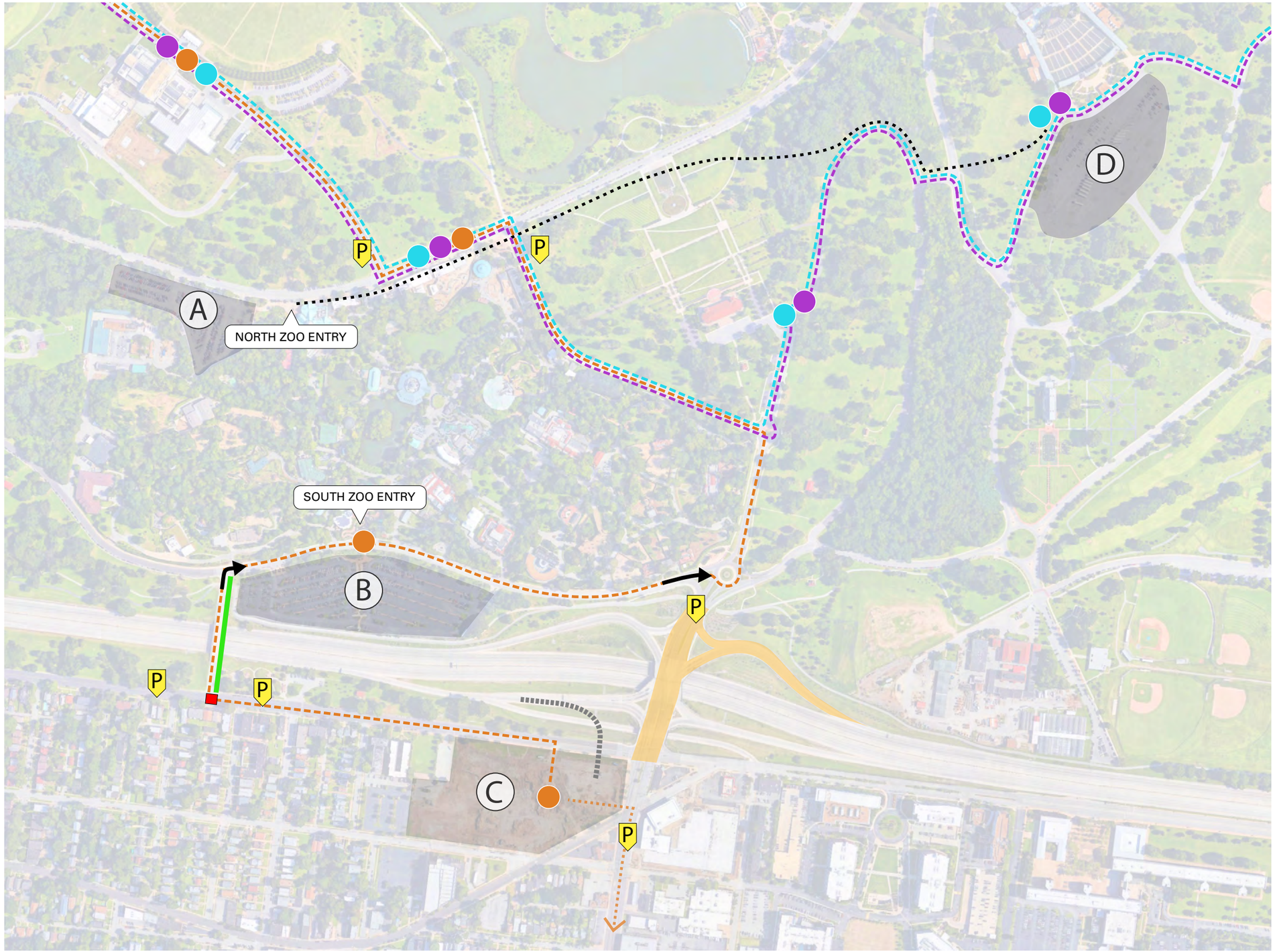


Figure 3: Traffic demand management strategies for the southwest corner of Forest Park

ACCESS DEMAND MANAGEMENT

IMMEDIATE ACTION ITEMS

a. **Conduct a traffic study for Park streets to determine congestion points in further detail.**

b. **Bus-only lane and right turn improvements at Tamm Drive entry for northbound circulator.**

c. **Bus-only priority left turn lane at west approach to Hampton Roundabout for eastbound circulator.**

d. **Implement circulator route changes (see circulator section).**

e. **Establish an action-plan with the Zoo for future parking garage construction.**

f. **Coordination with MODOT and City of STL to establish signage locations and verbiage.**

g. **Obtain traffic data at the Tamm Drive - Oakland Avenue intersection to inform signalization vs. stop sign.**

SHORT-TERM ACTION ITEMS

h. **Implement real-time parking count/signage for both Zoo parking lots. Make data available for app/parking management.**

i. **Implement real-time parking count/signage for the Festival & Parking Plaza. Construct the Festival and Parking Plaza Transit Hub.**

j. **Implement real-time parking count/signage for Twin Lots at the Visitor Center.**

k. **Construct the proposed sidewalk to connect the Transit Hub at the Festival & Parking Plaza to the Zoo entry.**

LONG-TERM ACTION ITEMS

l. **After construction of the Zoo south parking garage (proposed south of I-64), pilot test reconfiguration of the Tamm Drive Bridge right-of-way to introduce dedicated bike lanes.**

m. **Execute the construction documentation of the Tamm Drive bridge reconfiguration if pilot test is successful.**

PARK CIRCULATOR

CIRCULATOR

WHY A NEW FOREST PARK CIRCULATOR?

An expanded, high-frequency circulator will offer an improved connection between Forest Park and its adjacent districts, beyond walking and biking, and in a way that is far more space-efficient than parking, taxis, or transportation network companies like Uber or Lyft. While the current Forest Park Trolley has provided an important seasonal transportation option for Park visitors throughout the years, there are several key opportunities for improving and expanding this service moving forward both in the short and long terms. Circulator system enhancements could include expanded service times and seasons, improved ease of use, increased operational consistency, and lower wait times. In addition, route and stop adjustments could improve connections between institutions within the Park and surrounding neighborhoods. The proposed enhancements build on the existing Forest Park Trolley system to create a Forest Park circulator with fast, frequent, and integrated mobility for the Park and its venues.

The proposed circulator enables universal access to Forest Park venues as well as new connections to adjacent districts such as the Central West End. The new system will also integrate seamlessly with other modes of travel such as cars, bicycles and pedestrian systems through strategically-located stops, new routes, and clear branding and messaging. The new service will be branded as part of the "Forest Park Experience." The mobility experience should provide customers with information, a sense of place, and an understanding and appreciation for Forest Park. This could be accomplished through service design, vehicle and stop branding, and operator announcements and narrative. Operational data gathered by the service provider should be shared freely with Metro, Forest Park Forever, and its operational partners in order to integrate with other relevant data (parking, congestion points, ridership trends, etc.). This will allow integrated decisions regarding overall Park operations as well as refinement of service and coordination with regional transit operations.

A parking loop route will allow visitors to park once in a lot of their choice, and travel inexpensively, quickly, and reliably between all of their favorite Forest Park destinations. The circulator will offer connections between Washington University's Danforth campus, Washington University Medical School and BJC Healthcare, helping to position Forest Park as an easily-accessible, world-class amenity in these institutions' front yards. By offering a compelling alternative to reaching Forest Park destinations by car, the circulator can help to relieve parking demand at congested facilities such as the Zoo parking lots or the Art Museum parking lot. Above all, an expanded circulator is an unmatched opportunity to enhance the Forest Park brand and visitor experience.

CONGESTION AVOIDANCE

A principal attribute of a new circulator system is that it must provide an efficient and timely alternative to other modes of transportation. In Forest Park, this means that the circulator must be able to compensate for the high levels of congestion in the Park during peak visitation times. There are a number of strategies the circulator system will employ to address this (see specific locations on the circulator Route Map, next page):

- Bus Stop curb extensions: Bus Stop curb extensions allow the circulator to stay within the primary travel lane while making a stop. This prevents stop-and-start delays that occur when the circulator needs to exit and re-enter the primary travel lane for every stop.
- Bus-only right turn lanes: Also known as Queue Jumps, the bus-only right turn lanes allow the circulator to bypass the line of personal vehicles waiting to turn right at a stop sign or traffic signal. Additional speed and flow traffic data is needed to verify these locations.
- Transit Signal Priority: Transit Signal Priority (TSP) uses technology to reduce the waiting time at traffic signals for circulator vehicles by shortening red lights or extending green light times along the path of circulator travel.
- Peak-time headways: The number of circulator vehicles in use at any time is scalable depending on the projected peak traffic times to allow for consistent headways, or passenger wait times. See Figure 4 for more information. Vehicle deployment should be coordinated with the TDM Coordinator (see 3.3 Parking).
- Park-and-ride options: The orange circulator line includes an option for peak-time park and ride extensions to the south outside of the Park. This is a flexible option to provide expanded access to the Park and reduce vehicular congestion during peak visitation times, which could be employed during special events.
- Parking restricted zone: Remove on-street parking between Concourse Drive and Summit Drive to allow the circulator to pass through unimpeded by on-street parking.
- Convert road to two-way: Convert Concourse Drive to a two-way street to allow the circulator to travel the route described in the map on the following page.

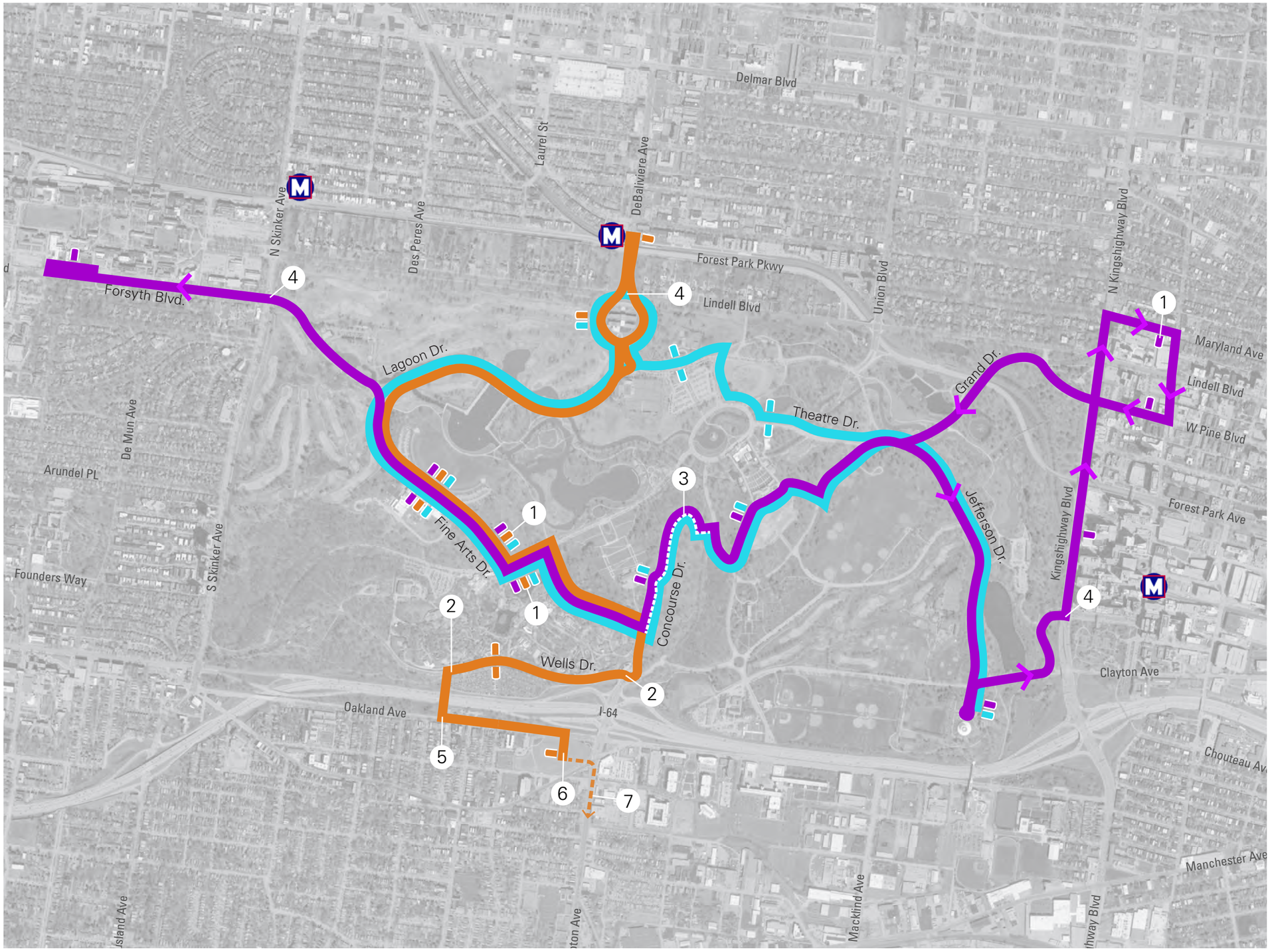
DAYS	ROUTE	TIME	FREQ	VEHICLES
Winter [1] **Operations** M-F		9am-6pm	30 min	2
		9am-6pm	30 min	2
		9am-6pm	30 min	2
Winter [1] **Operations** SAT, SUN		9am-6pm	20 min	2
		9am-6pm	20 min	3
		9am-6pm	20 min	2
Summer [2] **Operations** M-TH		8am-8pm	20 min	2
		8am-8pm	20 min	3
		8am-8pm	20 min	2
Summer [2] **Operations** FRI		8am-9pm	20 min	2
		8am-9pm	20 min	3
		8am-9pm	20 min	2
Summer [2] **Operations** SAT, SUN		8am-9pm	15 min	3
		8am-9pm	15 min	4
		8am-9pm	15 min	3

Figure 4: Recommended Circulator Operating Configurations

1 | Labor Day through Memorial Day

2 | Memorial Day through Labor Day

CIRCULATOR



Purple Line (East-West)

Orange Line (North-South)

Blue Line (Parking Loop)

Bus Stop

1 Bus Stop Curb Extensions

2 Bus-Only Right Turn Lane

3 Convert Concourse Drive to 2-way

4 Transit Signal Priority for Buses

5 Study Signalization of Tamm/Oakland

6 Coordinate with Zoo on potential transit stop inside expansion site

7 Potential extension to event park + ride and Dogtown shops and restaurants

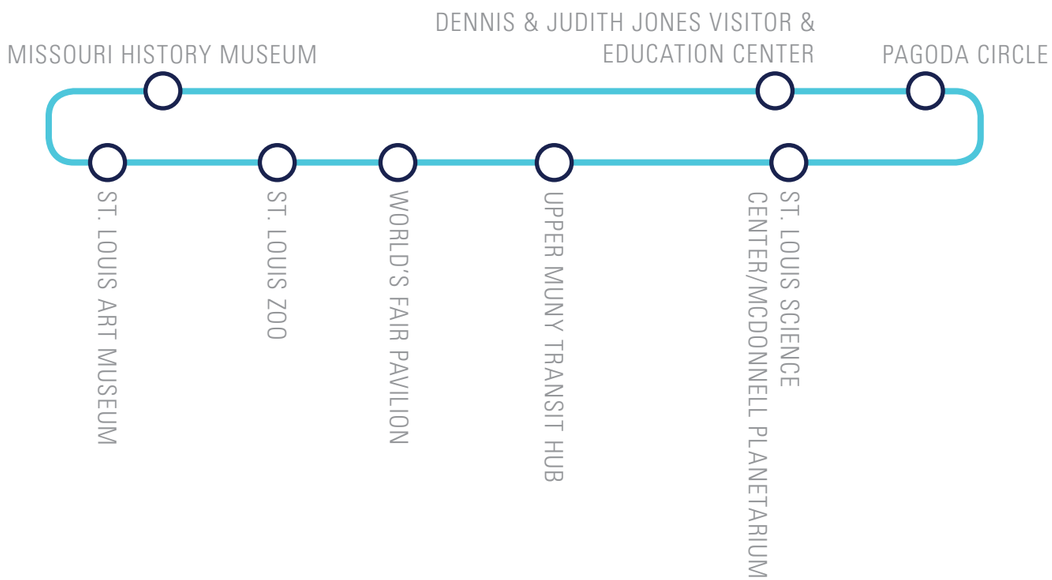
0 1000 feet 2000

CIRCULATOR

ROUTE DESCRIPTIONS

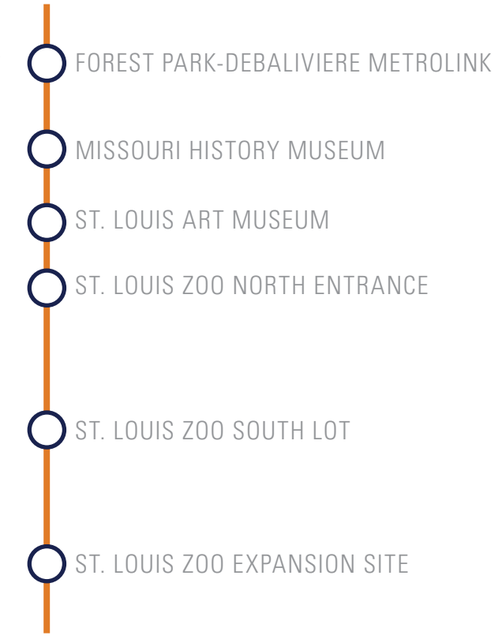
INTERNAL PARKING LOOP

The parking loop will provide a short, efficient service connecting all major Forest Park venues as it avoids potential congestion points on the periphery of the Park. The parking loop is bidirectional and will operate only during periods of peak parking demand (e.g. major events within the Park, summer weekends, etc).



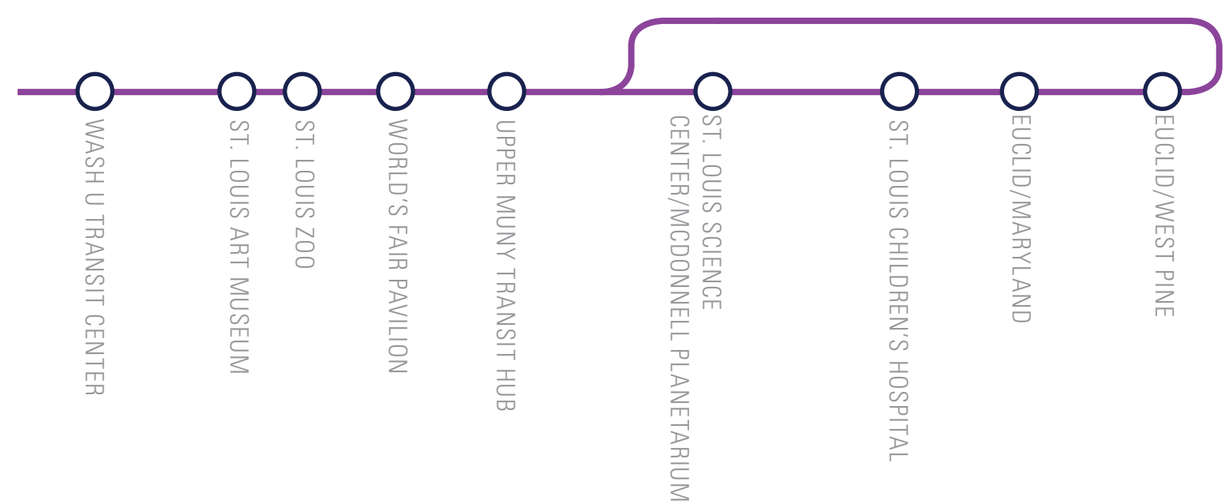
NORTH > SOUTH ROUTE

This route will connect the Park's most popular venues with the Forest Park Metrolink station to the north as well as the Zoo's expansion site to the south of the Park. In the long-term, this route may ultimately connect with retail destinations near Clayton-Tamm and event-based park-and-ride facilities to the south.



EAST > WEST ROUTE

This route will connect Forest Park to the thriving, transit-oriented destinations at either end: Washington University to the west, and Central West End to the east. While the orange route will serve the Park on a north/south axis, the purple route is intended to provide an east/west complementary service. This route creates the strongest connections between the Park and major retail districts (e.g. Euclid Avenue corridor) and employment centers (e.g. Wash U, BJC) while reinforcing the circulator's objective to be a viable transit alternative for employees, students, and visitors of nearby neighborhoods with the added benefit of offering connections between internal Park venues and parking facilities.



CIRCULATOR

RECOMMENDED VEHICLE

Throughout the focus group discussions and public input regarding the future circulator, the consensus is that the future vehicle needs to have an entirely distinct image to the current one. Park visitors feel the circulator looks much like a City bus, creating uncertainty as to where one might end up after boarding. Park visitors also feel that the circulator ride should be an experience in and of itself, creating something unique to the region.

The recommended vehicle type for the Forest Park circulator is a double decker bus. Though height clearance could be an issue, this can be overcome by selecting a "lowbridge" vehicle, such as Alexander Dennis Enviro 500 (13'6") or Enviro 500 SuperLo (12'-10"). In addition, modifying the road cross section under the Zoo overpass to clear 15' would allow more standard height double deckers such as the Wrightbus "New Routemaster" (14-6"). An example of a double-decker serving as a circulator is in operation at the University of California, Davis.

Customized, high-quality exterior wraps are recommended to showcase Forest Park branding. These bus models are already present in Metro's fleet, enabling fast implementation. They have a higher-capacity than other vehicle types evaluated, including "club cars," sprinter vans, cutaway van chassis, or body-on-frame buses.

Alexander Dennis Enviro 500 SuperLo.
Image source: www.alexander-dennis.com

FARE PAYMENT

It is recommended that the circulator service be provided at no fare, to reduce the circulator's dwell time at stops and remove barriers to ridership. In the event that it is determined that fares must be charged, an off-board or mobile payment system would be preferable to maintain efficient running times.

OPERATIONS/MANAGEMENT

Metro-operated service is recommended to reduce risk in the short-term because of the agency's existing expertise in fixed-route transit operations and availability of a large vehicle fleet.

- Metro could retain control of the circulator service, fare payment, vehicle fleet, staffing, and vehicle maintenance. However, because of these factors and the variability of demand, as well as the significant capital cost of double decker buses, Metro may not be ideally positioned as an operator. These factors could be overcome by contracting with a third party operator.
- The connections between Forest Park and the surrounding neighborhoods through the three proposed circulator routes also fulfils the agency's citywide service mandate.
- The extended boarding time exacerbates dwell times.

SERVICE ORIENTATION

Fixed-route operations are recommended instead of on-demand operations in the near-term. Fixed-route operations provide a higher presence of service with fixed schedule and stop locations, offering a more predictable experience for riders.

- Larger, fixed-route vehicles offer greater flexibility, allowing service to adapt to surges in demand.
- Fixed-route operations, as compared to on-demand operations, typically have a lower cost-per-ride, higher ridership, comply fully with Title VI regulations for riders without smartphones, comply with ADA regulations, and are able to adapt to surges in rider demand.

IMMEDIATE ACTION ITEMS

a **Perform a feasibility study for installing a network of smart mobility kiosks to provide Forest Park visitors with a unified, branded wayfinding experience.**

Additionally, real-time information displays should be placed within the building interiors of key Forest Park venues. The same information should be available via online/data application.

b **Test free circulator and study improvements in ridership, dwell time at stops and run-time efficiency.**

SHORT-TERM ACTION ITEMS

c **If test yields positive results, permanently implement free circulator, and leverage other funding opportunities.**

d **Modify circulator route to an internal parking loop, a north-south route and an east-west route.**

e **Connect circulator routes to Tamm/Oakland, Wash U and the Central West End.**

f **Provide distinctive, identifiable, and accessible stop locations.**

LONG-TERM ACTION ITEMS

g **Contract with third-party operator to provide circulator service with attractive vehicle type unique to Forest Park.**

h **Ensure circulator operator integrates data/analytics with Park-wide information system.**

PRELIMINARY OPINION OF COST

Capital and operating opinion of costs provided in the figure below assume fixed-route operations using a 30' transit bus (lower capital cost range) or 60' articulated transit bus (higher capital cost range). Vehicle service hours assumes the highest frequency of operations recommended for summer weekends and the Capital cost estimates assume a single extra vehicle not in regular service.

ROUTE	VEHICLES	ANNUAL VEHICLE SERVICE HOURS	CAPITAL COSTS LOW ($600,000)	CAPITAL COSTS MEDIUM ($700,000)	CAPITAL COSTS HIGH ($800,000)	OPERATIONS COSTS LOW ($60/HR)	OPERATIONS COSTS MEDIUM ($80/HR)	OPERATIONS COSTS HIGH ($100/HR)
Internal Parking Loop	3	7,600	$1,800,000	$2,100,000	2,400,000$	$454,000	$606,000	$757,000
East-West Route	4	9,500	$2,400,000	$2,800,000	3,200,000$	$568,000	$758,000	$947,000
North-South Route	3	7,600	$1,800,000	$2,100,000	2,400,000$	$454,000	$606,000	$757,000
Total	**10**	**24,700**	**$6,400,000**	**$7,500,000**	**8,500,000$**	**$1,475,000**	**$1,970,000**	**$2,461,000**

CIRCULATOR

VEHICLE ALTERNATE: ON-DEMAND ELECTRIC CABS

A fleet of smaller electric vehicles is an attractive option to explore for Park circulator service. Running on a defined route and able to deviate on demand for direct service to passengers' destinations, this type of service could be both reliable and convenient for Park visitors. Passengers could hail rides physically along the defined route or through a smart device application. In addition, a smaller vehicle can allow for flexible operation by scaling the number of vehicles to demand during seasonal visitation spikes and events.

Six-passenger electric club car service is currently being pilot tested in Downtown St. Louis, and similar services are operational in other urban markets, such as Austin, Texas. In the short-term, a pilot test of a smaller vehicle of this kind should be implemented. The pilot test should follow a similar fixed route as described but allow for deviation.

The Park circulator will need to accommodate all passengers, including those with disabilities. Access to both the vehicles and stops along the route is required. If full ADA accessibility is not possible through microtransit options in the short term, a more established, accessible vehicle type may be used in tandem operation with the microtransit system.

In order to ensure that service can quickly scale up for seasonal weekends or events, a reserve fleet would be activated as necessary. The system operator (likely a third party vendor) should provide the flexibility to make such service adjustments.

Electric Cab Microtransit in Downtown St. Louis. Image by DowntownSTL.org

EMERGING PLATOONING TECHNOLOGY

Emerging, though currently unavailable technologies allow vehicles to operate in a "platoon" manner (the lead vehicle operated by a driver with a train of additional vehicles electronically tethered behind it), allowing the service to scale up for events or seasonal weekends with minimal additional personnel. Though not a realistic short-term option for Park transit, a pilot study should be considered when this technology is made available. This would be the later phases of a longer term strategy.

The autonomous technologies that are developed enough to be considered for a pilot test include Navya, Olli, and EasyMile. However, none of these provide electronic tethered platoning a this time.

FARE PAYMENT

It is recommended that the circulator service be provided at no fare, to reduce the circulator's dwell time at stops and remove barriers to ridership. Providing this service free to Park visitors also eliminates the cost of collecting fare, which would be typically be through app-based purchases supplemented by a kiosk or cash box transaction system to accommodate those without access to technology. In the event that it is determined that fares must be charged, an off-board or mobile payment system would be preferable to maintain efficient running times.

SERVICE ORIENTATION

Provide fixed-route operations with some measure of route-deviation, demand-responsive service, or dynamic routing. A fixed schedule does not respond particularly well to episodic demand, and has often resulted in bus bunching and service delays. A fixed route deviation model should operate as a hybrid of fixed route and microtransit, and could be hailed at designated stops or summoned via a mobile app.

Some parking spaces may need to be removed and/or utilized for circulator vehicles to dwell and recover headways at designated locations throughout the route. These locations will be determined in coordination with the circulator operator.

OPERATIONS/MANAGEMENT

The operator would likely be a third party vendor under contract with Forest Park Forever. Metro transit, the City of St. Louis Department of Parks, Recreation, & Forestry, and City of St. Louis Streets and Traffic would need to participate in defining operational requirements and details. The funding partnership, advertising revenues, and fare structure will need to be determined to pay for operations. A third party vendor has benefits over the current operational structure including the ability to scale the operation to demand, as well as the ability to serve as Park docents to promote events and destinations within the Park.

a

IMMEDIATE ACTION ITEMS

Continue to track emerging technologies through relationships with mobility organizations as well as conversations with vendors.

b

SHORT-TERM ACTION ITEMS

Implement a microtransit pilot study within the park, using a similar fixed route as the prior circulator, with deviations from the route as needed.

c

LONG-TERM ACTION ITEMS

Finalize contract with selected microtransit vendor based on lessons learned from pilot test.

AN ASPIRATIONAL FUTURE

Key stakeholders have expressed significant interest in implementing an autonomous bus/train hybrid transit system as an alternative to a fixed-route transit circulator service. Also known as "autonomous rail rapid transit," such a system consists of an articulated locomotive that operates without rails, but rather by following specialized painted lines on the pavement, like a bus would. The entire train has a low-floor design and is built as a bi-directional ("double-ended") vehicle, with driver's cabs at either end allowing it to travel in either direction at full speed.

As of late 2017, the only known implementation of this type of modular tram exists in Zhouzhou, China. According to CCRC, the manufacturer of the units, the bus/train hybrid has a capacity of about 300 persons in a three-car unit. The cars are modular, making a one-car or two-car unit also feasible. However, no local manufacturer of this vehicle exists in the United States. Implementation of this vehicle type remains unlikely until a manufacturer capable of assembling and shipping vehicles to St. Louis is identified.

Significant regulatory hurdles at the state and/or federal levels must also be cleared before the autonomous rail rapid transit vehicle typology can be legally operated in St. Louis. Please refer to the Existing Conditions analysis in the Appendix p.49 for further reading on regulatory frameworks around autonomous vehicles.

Autonomous rail rapid transit would require significant reallocation of roadway space from general traffic lanes to exclusive transit lanes to achieve the highest quality of service. There is no precedent for operating such a transit system in mixed-vehicle traffic conditions. Other challenges include:

- Difficulty in maneuvering on certain roadway segments with roundabouts
- Requirement for specialized striping throughout its route
- Inability to make sharper turn radii within the Park, making some streets inaccessible

On-street Autonomous or Driver-controlled Transit

RECOMMENDATIONS FOR FURTHER STUDY

1. Continue to understand emerging technologies and trends regarding Park circulator vehicles and systems through resources such as the Federal Transit Administration or non-profit mobility organizations.
2. Continued coordination between all interested Park partners and neighbors, including but not limited to Washington University, Washington University Medical Center, and BJC Healthcare, is essential for the effective implementation of any recommendation.
3. Explore opportunities to extend the North/South (orange) circulator route farther south from its southern terminus at the Zoo's South Expansion Site. Possible additional destinations along this route may include the intersection of Clayton/Tamm, a popular retail corridor, or the St. Louis Marketplace on Manchester Avenue, a proposed transit-oriented development site (see #7 on the Circulator Route Map).
4. Study the feasibility of signalizing the intersection of Tamm/Oakland to facilitate faster circulator travel and ensure protected left turns from Tamm onto Oakland. This signalization would also make the proposed Tamm Drive Bridge vehicular/bicycle/pedestrian adjustments possible (as seen in Chapter 4.4).

TECHNOLOGY - IMMEDIATE ACTION ITEMS

a Determine the feasibility of installing a network of smart mobility kiosks to provide Forest Park visitors with a unified, branded wayfinding experience.

These kiosks can be equipped with the following features:

- Real-time circulator information
- Real-time transit information (other Metro bus and light rail routes)
  - Note: Requires coordination with Metro's existing real-time information system, provided by a General Transit Feed Specification (GTFS) feed. Metro already offers an Interactive Voice Response system that tells riders the next upcoming 3 arrival times based on their bus stop number. Web-based real-time info is also available. Smart mobility kiosks could be integrated with these tools with Metro's assistance.
- Walking and biking directions (e.g. to/from parking facilities)
- Real-time parking availability
- Park venue information
- Emergency calls
- Free public Wi-Fi
- Phone-charging ports
- Direct visitors to payment methods for park venue tickets, transit tickets, etc

Note: Smart mobility kiosks typically cost about $50,000 - $100,000 per unit to install, with periodic maintenance and operations costs of about $10,000 per year. However, internal and external advertising can help to defray these costs. Ideally, smart mobility kiosks will be placed near entrances of major Park venues and at each of the proposed circulator stops.

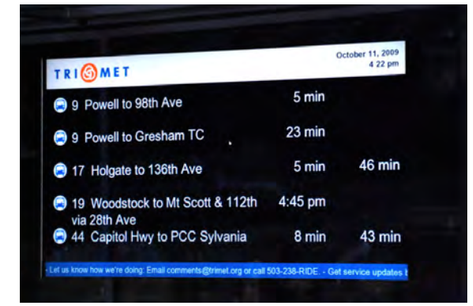
Smart mobility information kiosk

b Locate real-time information displays within the building interiors of key Forest Park venues.

These displays, equipped in a similar manner to LCD TV screens, are much less costly to install and maintain than the smart mobility kiosks. Vendors such as TransitScreen and Roadify provide installation assistance as well as subscriptions to area transit information and could be expanded to show circulator real-time arrivals. Technology requirements include Automatic Vehicle Location (AVL) in all Metro and circulator vehicles and some ongoing maintenance (e.g. battery charging of units, periodic replacement, database management). The cost for AVL is about $1,000 per vehicle.

Venues that might be appropriate for interior real-time information displays include:

- Dennis & Judith Jones Visitor and Education Center
- St. Louis Art Museum
- Missouri History Museum
- St. Louis Zoo – North and South Entrances
- St. Louis Science Center/Planetarium
- Muny Theater



Real-time transit information display.

c Implement a real-time parking availability mobile app to reduce driver frustration from the amount of time spent "hunting" for a space.

Real-time parking availability apps typically source their data from occupancy sensors, which can be installed in-pavement or via camera image detection. The highest-demand parking facilities should be the first to implement real-time parking availability apps, so that drivers can be routed to other facilities when they are full. In-pavement occupancy sensors cost about $200-500 per space to install. Alternatively, for lots/garages occupancy can be estimated using ground induction loops at parking facility entrances and exits. Loop counters typically cost about $500 per loop. The capital cost of physical real-time availability displays ranges from $25,000-$50,000 per unit. Annual operating and maintenance costs are typically $500 per unit.

Signage with real-time parking availability.
Photo by Rudy Herman.

3E

PARKING

PARKING STRATEGY

Figure 5: Existing parking systems

LEGEND

- Unrestricted On-Street Parking
- Time-Limited On-Street Parking
- Off-Street Parking (with supply)
- Building/Area of Interest
- Entry Point to Building/Area of Interest
- Park Walkways

0 0.2 0.4

Forest Park currently has 7,812 parking spaces on-site, sited primarily adjacent to major Park institutions. 3,941 of those spaces are off-street. All on-street parking facilities are free of cost and most are unregulated by time limits. Most off-street parking facilities are free to the public with the exception of the four paid parking areas at the St. Louis Art Museum, the St. Louis Science Center and the St. Louis Zoo. Each of these lots typically charges between $10-15 to park for the day. During events and on peak weekends, parking and queuing for parking can create congestion choke points near major institutions and access points. There are over 1,250 parking spaces on the streets that bound the edges of the Park. Many of these spaces are regulated by day of the week and/or time of day. For example, parking is not allowed on a large part of the south side of Lindell Boulevard west of the History Museum on weekdays and some parking on the north side is time-limited to one hour of parking at certain times.

FINDINGS:

- Parking on both sides of the street causes congestion in some areas.
- More than 50 percent of Zoo visitor survey respondents report parking on-street during their visit.
- 34 percent of Zoo survey respondents report experiencing traffic congestion getting into the Zoo parking lots.
- According to past study data, only 40 percent of parking facilities are utilized during peak season Saturdays and during Muny events. This means that, even though facilities directly adjacent to facilities may be full during an event, there may be thousands of empty parking spaces elsewhere in the Park.
- There can be as many as 1,250 employees at Park institutions on a daily basis, most of which do not have dedicated parking areas.

PARKING STRATEGY

Many visitors choose to visit Forest Park by car. Most parking spaces are free of cost which makes driving appealing, and many of the Park visitors are arriving from outside of St. Charles County. Therefore, driving will continue to be a desired way of accessing the Park. More than half of the Park's 7,812 parking spaces are located in off-street parking lots. On an average day, streets and lots near premium destinations like the St. Louis Zoo and St. Louis Art Museum are typically full but thousands of parking spaces lie empty in other areas of the Park. Parking enforcement is tasked to the Park Rangers, however it is currently not prioritized. Moving foward, in order to enforce the existing parking restricted areas, Forest Park Forever should work with the City to determine responsibility for a dedicated enforcement officer. Enforcement should begin as an educational campaign focused on issuing warnings for violations in existing time-restricted zones.

In order to better communicate parking options and balance parking crunches, the following should be executed: 1) Provide better information about parking location options, including parking availability information before one makes their trip and as one enters the Park using real-time parking availability signage, 2) Facilitate better connections between parking lots and destinations. The primary shared-use parking lot is the Festival and Parking Plaza at the Upper Muny which is largely empty during prime Zoo hours (See Transit Hub 4.9), 3) Improve the Park circulator to create opportunities to park once and ride, along with the confidence and convenience of direct connections and real-time operations, 4) Stripe parking spots on "Priority Lane/Parking Striping Zones" (see Figure 6 and 3.8 In-Park Streets). Striping is recommended on targeted congestion zones only, due to the maintenance required by the City. 5) Provide space for circulator to dwell and recover headways at designated locations throughout the route, which may require the removal of some on-street parking. These locations will be determined in coordination with the circulator operator, and are not displayed on the adjacent map.

Real-time parking occupancy will require determination of the appropriate techology. A "lean" technology typically has counters on all entry and exit lanes. Some lean technologies estimate occupancy based on typical use patterns - based on just a few sensors. Based on the fact that all lots have defined entry and exit points this approach is approprate for use in Forest Park. (See implementation chapter for further information.)

In addition, Forest Park Forever should consider hiring a Parking and Transportation Demand Management coordinator to manage and leverage parking availability, create solutions for managing peak demand and events, and ensure parking policies are considered and enforced. The position of TDM coordinator should be managed by FPF for the Park as a whole. The job description would need to include weekend and evening hours with staffing to be organized on shifts. The cost would be largely self-funded by FPF with financial support from institutions. The position will require coordination with the Zoo parking coordinator. (Currently the Zoo has a parking coordinator on staff, but the position does not have weekend support). The position will be expected to coordinate with the following entities: the facilities manager of each institution, the Park Rangers, the Department of Revenue, the TDM coordinator at City Streets and with the proposed FPF Data Manager.

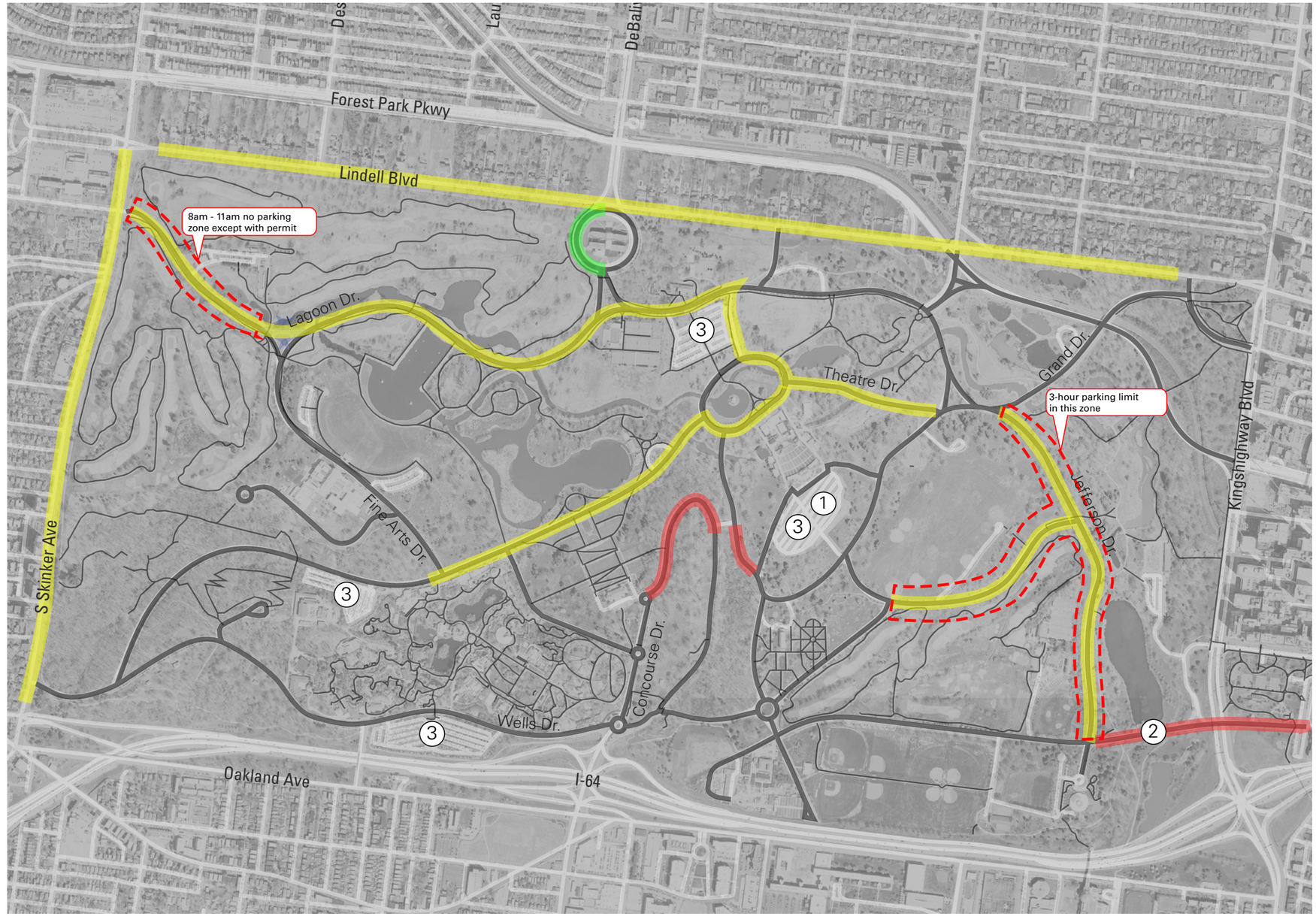


Figure 6: Proposed parking recommendations

- Priority Lane/Parking Striping Zone (See 3.8)
- Parallel Parking Removal Zone (See 4.5)
- Add Parking (The Missouri History Museum is currrently underserved.)
- Time-restricted Parking Zone

Notes:

1. Proposed Transit Hub (See 4.9)
2. Remove Parking
3. Provide Real-Time Parking Availability

0 1000 feet 2000

IMMEDIATE ACTION ITEMS

a **Identify a dedicated parking enforcement staff. Begin with a soft roll-out of enforcement by issuing warnings focused on pockets of enforcement where there is documented, overlapping parking activity by both Park visitors and commuters. There is no immediate need to enforce beyond these impact zones.**

b **Provide improved striping on-street to better define parking and increase efficiency.**

c **Work with the Zoo to accelerate implementation of planned pay-on-exit sequence to avoid congestion at entry points.**

SHORT-TERM ACTION ITEMS

d **Hire a Parking, Mobility and TDM Coordinator who would oversee parking and mobility management and implementation. This position would also work with institutions to leverage parking availability info, create event management solutions, and define dynamic pricing policies and priorities (i.e. charge less for parking on lower demand days/seasons and more during peak days/seasons).**

e **Drive greater utilization and direct traffic away from full/congested parking lots with real-time parking availability information signs/online/data application.**

f **Identify funding strategies to enable the construction of the Zoo expansion parking lot and parking garage. This project will have numerous benefits. Expediting the timeframe is a priority.**

g **Mitigate commuter congestion and parking demand through a bus/transit pass program for park and park institution employees. Consider a funding strategy to enable a "Commute Club" with free bus or Metro passes for Park and Institutional employees.**

h **Coordinate with the City on establishing the operational requirements / parameters as bike share comes on line in and around the Park.**

i **Test the use of parking permits for Lagoon Drive, adjacent to the golf course, using the already established administrative method at Forest Park Forever.**

LONG-TERM ACTION ITEMS

j **Consider an event-based strategy which includes an external park-and-ride. Pair a future park-and-ride location with the Park circulator and shared parking agreements with partners.**

k **Explore cooperative use of parking garages near Forest Park for potential capacity for Park users. Inventory and analysis should include an understanding of weekend use and occrance of off-peak time periods that correlate with peak parking times at the Park. Inventory should include existing and future planned garages at adjacent institutions such as Washington University.**

SIGNAGE

PARKING SIGNAGE

Signage that specifically relates to communication of parking opportunities to patrons is the immediate priority that will result in improved traffic demand management at Park entries.

Once visitors are inside the Park, strategically placed signage can help them find parking more efficiently. Using "dynamic" signage indicating real-time parking availability will reduce the number of visitors driving around the Park to find a parking spot. In addition, some signs can be full LED and be used as variable message boards for events, emergencies or high-volume days.

Forest Park's vast user programming can often cause surges of vehicular congestion throughout a given day. Congestion exists at certain key locations, in part, because visitors do not currently have efficient information about parking availability and alternative routes to destinations in the Park. With changes to Forest Park's communication methods, visitors can reach their travel destinations more efficiently. Using real-time information about parking from space occupancy sensors, data can be relayed to variable message signs on highways, Park streets or integrated with navigation apps.

Visitors nearing parking lots that are full or approaching capacity can be directed with travel times to different parking lots via uncongested alternate routes. The real-time parking signage near the Zoo will ensure the Zoo lots remain full while providing efficient overflow parking. Other parking facilities might include options for other modes of secondary travel like the current Park Trolley or the future Park circulator. At peak times and during full parking occupancy, visitors could also be directed to off-site park-and- ride locations with shuttles.

This improved coordination between mapping applications, real-time data and alternative routing can greatly reduce Forest Park's peak time congestion. Signage implementation should be implemented in partnership with Park institutions and align with the Park's current graphic standards for signage.

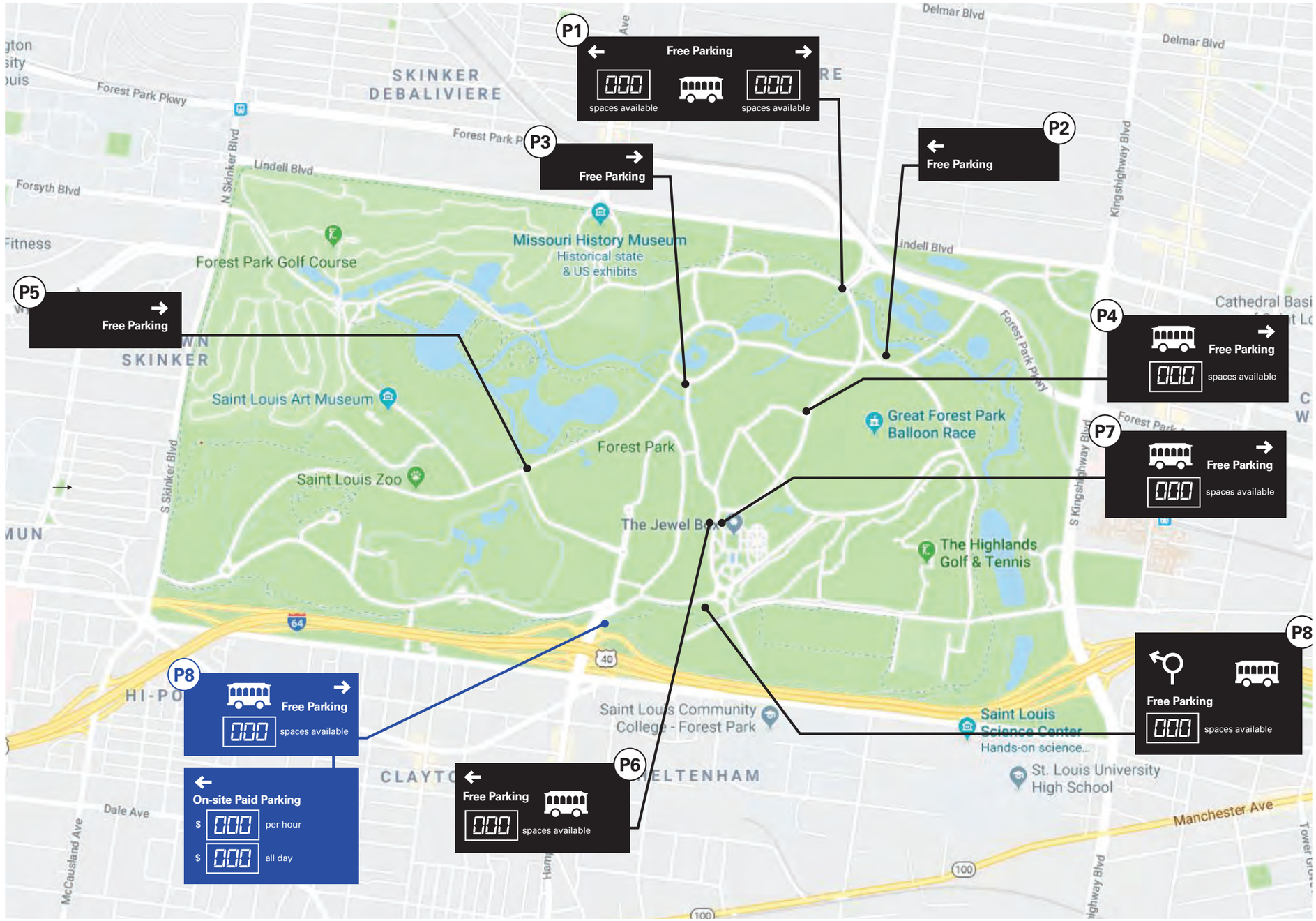


Figure 7: Proposed parking signage locations within the Park

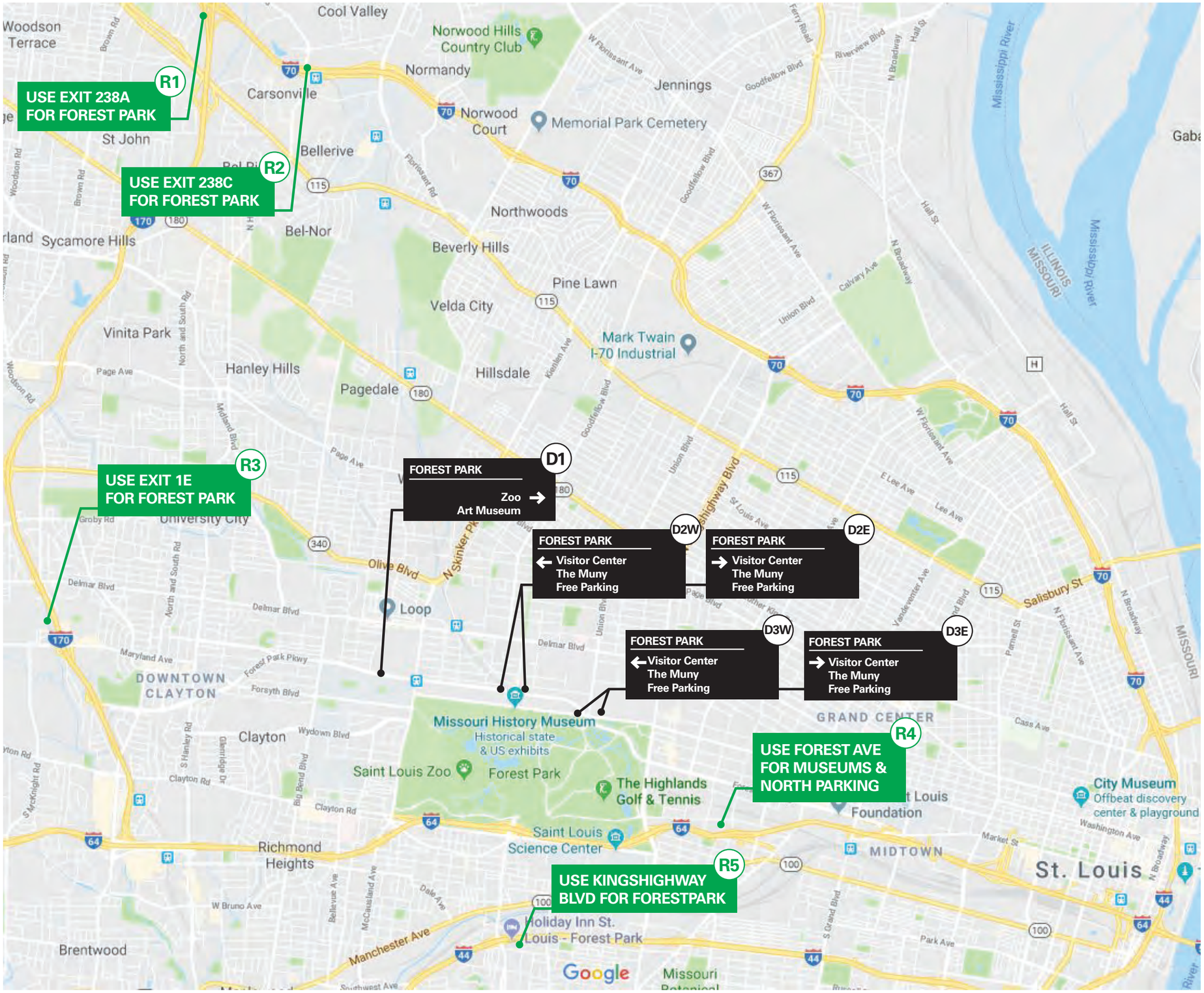


Figure 8: Proposed regional wayfinding signage locations

As discussed in the traffic access management section of this study, a significant portion of vehicular entries to the Park occur at one entry point, Hampton Avenue, causing congestion. Implementing signage at the regional (interstate) and local scale can encourage and guide drivers to use other Park entry points. As an example, there are currently no regional wayfinding signs directing drivers to Forest Park via the Forest Park Parkway even when the road name itself suggests a clear route to Forest Park. With clear signage encouraging the use of Forest Park Avenue and Forest Park Parkway (FPP), drivers will have the choice of many Park entries like:

- Lagoon via Skinker via east or westbound FPP
- North DeBaliviere via Lindell Boulevard via Skinker via east or westbound FPP
- North DeBaliviere via east or westbound FPP
- Cricket via Lindell via eastbound FPP
- Union via Lindell via eastbound FPP
- Union via westbound FPP
- West Pine via Kingshighway via east or westbound FPP
- Hospital Drive via Kingshighway via east or west bound FPP

Strategically placing regional wayfinding signage on I-64, I-170, and Forest Park Parkway would assist with directing drivers towards alternative Park entries at decision-points and exit ramps much further away from the Park.

3.5 DATA MANAGEMENT AND TECHNOLOGY

DATA MANAGEMENT AND TECHNOLOGY

There is significant potential for Forest Park users' experience to be improved through technology. The following are general recommendations for technologies that may be implemented in the near- and mid-term. Emphasis has been on the creation of user-based systems for wayfinding, and display of real time information about choices available in the Park. It is important to exploit all opportunities for data systems to serve multiple purposes. The same systems informing park users of mobility choices can also provide Park managers with real time information, analytics and tools to assist in both daily and longer-term decision making in the Park.

It is important to consider that a even simple display on a hand-held device or smart sign providing real-time information requires investment in hardware and software systems that supports the collection, transmission, storage, management, processing, analysis and formatting of data and of resulting outputs. Because technology is frequently updated, we have exercised caution in recommending specific technologies at this time. Closer to the time of implementation it will be necessary to carry out a detailed feasibility study by a software developer to verify specific technology types, evaluate options and develop a detailed budget.

Forest Park Forever has established a regularly-updated informational mapping website. Potential information technology solutions described in this section may integrate with this site, but additional or alternative solutions may need to be explored. It is vital that if multiple approaches are taken they all incorporate the same information without the need for parallel management. The following are resources we have used to help in creation of these recommendations:

- Software and data infrastructure: Eric Dynowski, Turing Group. This company has experience developing software and hardware solutions for groups such as RTA and Metra in Chicago.
- Park-related data technologies and applications: Bobbi Nance, Recreation Results.

Figure 9: Rendering of Dynamic Transit Signage Concept. Such solutions have the potential to be user-interactive and provide the ability to make parking or transit purchases.

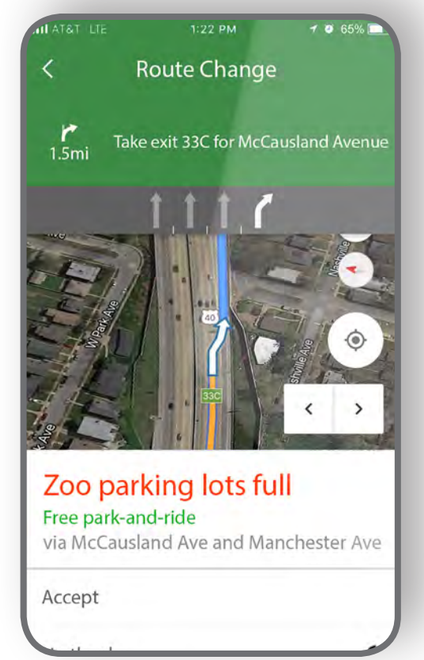
DESIRED OUTCOMES

The following are the key recommended outcomes for the system. If not implemented at one time, physical and data infrastructure should be developed to support their phased addition..

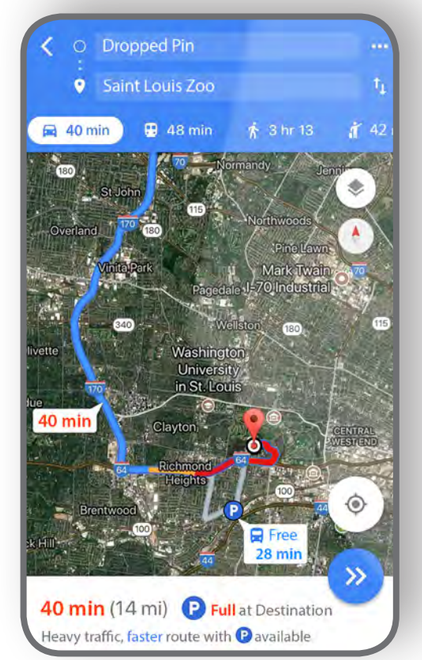
- Provide user navigation and wayfinding that varies by specific park destination and origin. This may require an implementation of a third-party proprietary mapping system, with localized overlays.
- Provide prescribed preferred-route feedback to third party mapping applications for specific destinations.
- Support the ability of users to plan multi-modal trips. (e.g. direction to park and ride, total time of trip, arrival and travel time of next circulator to ultimate destination).
- Provide real time parking information with traffic management connected to signage, wayfinding and mapping apps.
- Provide the ability to automatically direct users to alternate parking when destination is approaching capacity, or for a manager to provide overrides. Alternative route coverage would include a combination of in-Park routes, local roads or on interstates as regulations permit.
- Within the Park provide the ability for managers/agencies to add events to third party map navigation that can implement planned traffic management plans or alert of specific local closures. Such events would be able to be changed real-time to allow park managers or Police to actively manage parking or routing.
- Provide real-time transit information, either city-wide (metro), local (Loop Trolley) and park-only (circulator). Output location and arrival times to mapping app, transit tracker and variable message signage. Ability to track and adjust circulator ridership and make service changes.
- Ability to add circulator stops or make route changes during events and have these reflected in mapping/signage. This ability would extend to on-demand transit that can deviate from a predetermined route.
- Integration with data made available by one or more local area or City-wide bike share providers to provide information on location bike hubs and individual bikes in or adjacent to the park. This would not replace the bike sharing app but make park users aware of choices without switching apps. A link to the bike sharing service app. would be provided for renting etc.
- The ability to establish and provide information on no-parking zones for bike share with integration with bike share vendors.
- Ability for user to pay for parking, transit or other park services where applicable using single or multiple vendors.
- Integration with institutions in the Park (notably St. Louis Zoo) which may have their own data or desired outcomes.
- Ability to synthesize and share data with parallel government systems.
- The same data outputs replicated in app, website, social media, institution websites, etc. to avoid double entries, or duplicated management.
- Observe open data standards.

CHALLENGES:

1. Limited technological ability, human and financial resources currently exist to allow institutional user/agency users to provide real-time updates to Google/Waze etc.
2. Limited ability to provide institution specific signage on Interstates and some City Streets due to advertising regulations, and standing agreements.
3. Consideration of the impact of Forest-Park only improvements on the wider City infrastructure.



Navigation App Concept Visualization: Parking Notification with Alternative Route



Navigation App Concept Visualization

4. The need to provide equal or alternative ADA access and accommodate individuals without technology access.
5. The need to observe FOIA, privacy requirements.
6. Costs and legal limitations associated with the licensing and usage of private/ proprietary vendor data.
7. The pace of change for technological systems.

POTENTIAL ADDITIONAL OUTCOMES

The following additional outcomes items may not be essential for near-term operation but should be considered if cost effective or expedient. The primary data infrastructure should be designed and constructed to allow flexible addition of such capabilities.

- Provide user or manager with options for congestion management (or autonomous rerouting) based on certain parameters (e.g. not every route is an acceptable alternative). This requires coordination with STL Streets and/or MODOT as a whole. Output can be connected to dynamic signage and third-party navigation.
- Ability for managers/agencies to implement traffic parking/management schemes for major events with connectivity to mapping, Google Maps etc. (e.g. Chicago Marathon road closures).
- Ability for Park managers to track visitor statistics by use of real-time individualized but anonymous data. Currently, visitor numbers are only estimated in total. There is no way within these numbers to differentiate between, for example, 365 single visits by 365 individuals and a single individual visiting 365 times.
- Ability to cross reference user data with other indices. e.g. weather, energy/water use, congestion etc.
- Delivery of specific services based on user density e.g. the ability to alert Park maintenance staff when certain normal usage thresholds are exceeded. This would give managers the ability to provide additional garbage pickup, bathroom servicing etc. on peak days.
- Ability to track under-utilized services based on user patterns/purchases. This would allow for short term incentives like special programming or coupons to be applied, or for Park planners to make long-term decisions about new facilities. For example, zoo patrons within a geofence might get an alert that encourages them to patronize a nearby vendor that isn't getting much attention.
- Provide manager in the field easy access to GIS mapping of maintenance issues or events like accidents, crime etc. via a tablet.
- Ability to manage user feedback/reports of safety/maintenance issues.
- Ability to prepay for parking or obtain special permits or pavilion rentals.
- Update attraction hours in real-time in response to severe weather or other unexpected events (e.g. Users waiting 30-45 minutes for an attraction to re-open after a thunderstorm can be informed why the attraction is closed and when it will reopen).
- Ability to provide users with specific location-based alerts about a major emergency such as a tornado. Based on geofence locations, specific directions could be conveyed to users in a particular area.

Other ideas that could encourage use by visitors or augment the experience:

- Curated content integrated with PR programs and social media. (e.g. popular photo spots).
- Search menu that includes basic filters (age, cost, etc.) to help users find activities suited to their interests or needs.

Parking Availability App Concept building on the existing Forestparkmap.org

Real-Time Transportation Updates building on the existing Forestparkmap.org

Wayfinding kiosks provide access to interactive wayfinding for people without access to personal technology. Kiosks could also provide the ability to pay for services, purchase tickets etc.

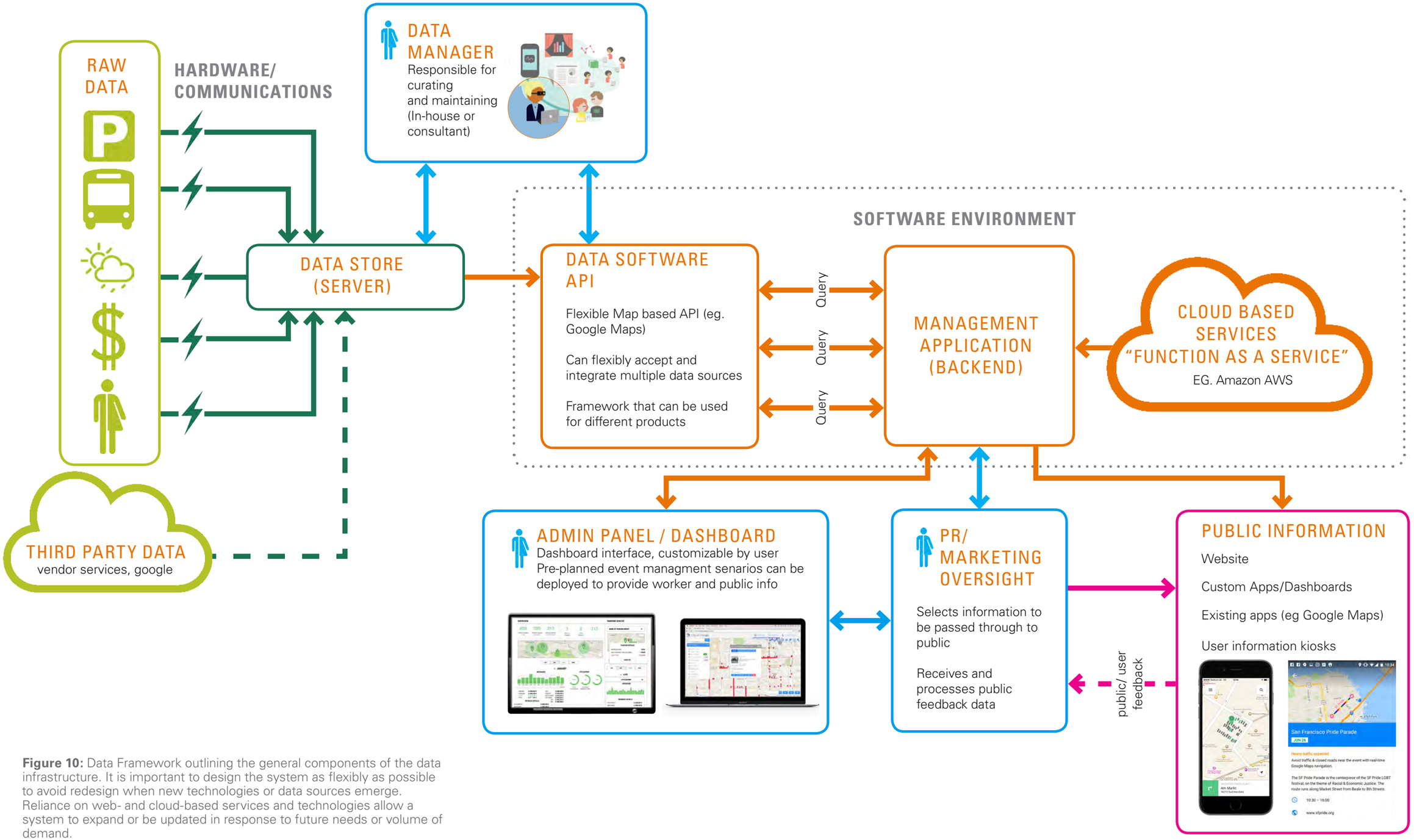


Figure 10: Data Framework outlining the general components of the data infrastructure. It is important to design the system as flexibly as possible to avoid redesign when new technologies or data sources emerge. Reliance on web- and cloud-based services and technologies allow a system to expand or be updated in response to future needs or volume of demand.

DATA MANAGEMENT AND TECHNOLOGY

SOFTWARE REQUIREMENTS

USER INTERFACE

The system will be most flexible if both public and management interfaces are web-based. This ensures that applications work on multiple platforms and key information is easily maintainable by day-to day staff without specialist support. Websites designed for mobile devices can provide a similar user experience to an "app", without the expense of designing, programming and maintaining a custom application. Forest Park Forever current maintains an interactive map Forestparkmap.org. This could include the overlay of unique real-time Forest Park data, such as current parking availability, together with public third-party data, such as live Metro routes and arrival times over a mapping product, provided either by Google or another provider, displayed within the website. This ensures that Forest Park Forever and the City of St. Louis Department of Parks, Recreation & Forestry is not responsible for creating of maintaining a unique mapping application.

Reliance on web interfaces does limit technologies to those that can be used, however. Technologies that could be precluded include Virtual Reality (VR) and augmented reality (AR) that provide more immersive user experiences, such as 3D virtual tours or annotation of landmarks over a live camera image. These require access to more extensive hardware-based processing capabilities that are available only through a device-specific applications. This would limit access to those with specific devices or platforms and required creation of custom software and content. This would add cost and impose more significant ongoing obligation or content creation, software maintenance and support.

SOFTWARE ENVIRONMENT AND FLEXIBILITY

The data software infrastructure should consist of:

1. A robust and flexible software "back-end" server that maintains the data whether stored locally or in the cloud, or both. A widely available platform for this is Amazon Web Services (AWS).
2. User interfaces ("front-end").
3. An Application Program Interface (API) developed to handle data requests from the front-end, and to or from external data sources; and format them such that they can be used by the various functions of the data system.
4. A series of third party applications could be integrated via the API to provide specialized services such as custom mapping overlays or specific types of data analytics (e.g. traffic or parking management). These services could be cloud-hosted "Platform as a Service" (PaaS) or Function as a Service (FaaS) applications. Both PaaS and FaaS remove the need for in-house maintenance and allow for scalability of demand, bandwidth, storage space, or data needs increase.

Some potential functions (e.g. Traffic management coordination with wayfinding apps and services such as Google or Waze) require capabilities that the relevant agencies do not yet have. Such capabilities may be either planned or not yet considered or may require financial and human resources not currently budgeted.

Similarly, tracking of certain desirable data may not currently be supported by available technologies, or such data may be subject to negotiation with private commercial organizations. An example of this may be locating available bikeshare bikes on the site. The availability of these data to City or FPF would be dependent upon the contract negotiated with the specific vendor.

Regardless of the current availability of such capabilities, we strongly recommend that the back-end and API be developed with as much flexibly as possible to allow for future integration of data in various forms and the ability to "plug in" additional functions. As technology evolves quickly it is not advisable to define the types of input that may be required in the future.

Additional opportunities for data and data analytics exist beyond the immediate scope of Wayfinding and parking management technologies. This is an evolving field but one that is worth planning for at this stage. Using an array of live data would provide Forest Park Forever and the City of St. Louis Department of Parks, Recreation & Forestry valuable insights into Park use patterns. This should also be considered as part of the data and would allow planning procedures to evolve from a periodic to a continuous activity.

PHYSICAL DATA INFRASTRUCTURE

The development of recommendations for physical data infrastructure is beyond the scope of this study except where noted in relation to specific technologies for parking occupancy and signage in foregoing sections. It is frequently a challenge to collect data or plan for distribution technology when technologies may have evolved by the time projects are implemented.

Considerations for physical infrastructure may include:

- The need for mounting sensors in ground or on poles.
- The use of hard-wired, or wireless interfaces to transmit data, use of existing infrastructure, and the need for placement of new overhead or below-grade wiring.
- The need for specific types of storage technology inclusive of interfaces, panels or enclosures that need to be placed either in the Park or within structures; and physical space requirements for these.
- The provision of power to a distributed network of sensors, placement of wires, electric panels, solar panels etc.

More immersive technologies like Augmented Reality AR (pictured) or Virutal Reality, require hardware capabilities that do not lend themselves to web-based technologies.

The placement and impact of physical data infrastructure components required to support technologies such as parking occupancy sensors need to be considered. These include equipment such as wifi antennae, interface boxes and cabling.

DATA MANAGEMENT AND TECHNOLOGY

EXISTING TECHNOLOGIES

Several technologies or classes of application exist that could create the basis of some components of the system, these include

1. EAM/CMMS Computerized Maintenance Management Solutions
2. PMMS-Parking Moniroting and Management Solutions
3. Google maps data layer
4. Google Directions API
5. Amazon AWS cloud computing platform.

DATA MANAGEMENT AND STAFFING

Management of physical infrastructure, flow, storage of data, management and upkeep of in-house software, management of relationships with outside vendors and the control of public information should be done by a member of staff. Depending upon volume this could potentially require more at least a full-time position, and require support from other staff for particular work (such as IT support). This function could be fully or partially outsourced to a contractor, however we recommend that, for flexibility and alignment with the mission of Forest Park Forever, the management consultant be independent of providers.

We recommended that wherever possible data used or generated by Forest Park embrace Open Data protocols and be made available to other agencies/groups. Management of what data should be collected and shared with the public in observance of data regulations (FOIA and data protection privacy regulations) would need to be a responsibility of the data manager in collaboration with the public relations team.

SHORT-TERM ACTION ITEMS

b **Create flexible data infrastructure to collect, store, analyze and present real-time information to public and Park managers.**

c **Create public online/data application and data kiosks that focus on live data specific to Forest Park.**

d **Appoint Park data manager.**

e **Coordinate data with external agencies, City vendors etc.**

LONG-TERM ACTION ITEMS

f **Utilize real-time data as a Park planning and decision-making tool.**

IMMEDIATE ACTION ITEMS

a **The next step of development of user experience technologies should be a detailed feasibility study that will define the exact physical and software requirements. A recommended RFP scope is included in the appendix. The key components are:**

GOALS AND DESIRED OUTCOMES

- Management Goals
- Short term
- Long Term
- Additional Opportunities

USER INTERFACES-VARIOUS PLATFORMS

- Determination of need for web or application based approach
- Manager side
- Public Agency
- Public side
- Permissions structure

DATA:

- Existing public data sources
- New FP Generated data (Short/Medium/Long term)
- Regulatory framework
- Third party data (licensed)
- Shared Data
- Private open source data: usage limits

DATA MANAGEMENT SOFTWARE

- Data Server Back End
- API(s)
- External Applications

PHYSICAL INFRASTRUCTURE:

- Data collection: Specific hardware to data source
- Data Transmission
- Power requirements
- Storage hardware
- Physical space requirements

MANAGEMENT:

- In-house staffing
- Contracted staff/service
- Coordination with other management functions

IMPLEMENTATION:

- Final recommendations for initial extent of physical system and software environment
- Phased recommendations
- Change Management

3.6 BICYCLE SYSTEM

BIKE SHARE

As of January 2018, the City is working to advance the St. Louis regional bike share program by working with regional partners. Forest Park can serve as an incubator for these changes, while also leveraging the bike share program to achieve many of the goals of the Great Streets Study. As St Louis moves toward a city-wide dockless bike share system, Forest Park Forever should position the Park as a client and participate in developing general principles and regulatory framework for dockless bike share within the Park. The following should be established with the vendor:

1. Data Gathering Agreement: The data gathering system adopted in the Park would require open data which the Park can utilize for future planning.
2. Established Parking Locations: Even with a dockless system, there needs to be designated bicycle parking zones within all City parks to encourage good behavior. The bike share locations can serve as "home base" for bicycles. As the framework is established with the vendor/operator, there need to be procedures in place for periodic collection and redistribution of the bicycles to "home base." This will ensure that the bike share program is viewed as a reliable transportation option. Park Partners should be actively engaged in the process of communicating bike use etiquette, including communicating to users that all bikes should be parked in racks when stopped within Forest Park. To support this regulation, the operator should establish safeguards and spot-checks to discourage unfavorable behavior. One option could flash a message *"Bicycles must be parked in racks while in Forest Park"* to Park bike share users as they execute the rental or return of their bicycle. Any signage related to the operation or etiquette of bike share should be aligned with the Park's signage and wayfinding aesthetic. Bike share signage should be integrated with the Park circulator and parking signage to clearly communicate the range of transportation options available.
3. Geo-fencing: At this early stage of bike share, it is recommended that the Park be "geo-fenced" to ensure that the data collected and communicated is used as a method to get around the Park. Within the enforcement process, clear penalties should be established and communicated. As the bikeshare system expands city-wide, further precaution should be built into the system to discourage patrons of adjacent institutions from using the bike share as free parking in the Park. For example, the dockless system could be geofenced around Faulkner and Lagoon and if bikes are left in those areas for a period of time, the user could incur a penalty charge thereby discouraging parking in these areas by users of adjacent institutions.

GREENWAY CONNECTOR STREETS

The 2016 Mobility Study recommended creation of commuter routes through the Park that connect the Great Rivers Greenways as the point of entrance into the Park – framing Forest Park as the "hub" for three existing greenway connections. These connections should be made clearer through roadway pavement "sharrow" markings and wayfinding signage designating these as "Greenway Connector Streets" (see Figure 11). Markings should follow MUTCD guidelines. The intent of improving these greenway connections aims at branding these streets to demarcate their value and clarify greenway points of connection.

The existing bicycle paths through Forest Park allow residents to travel safely to or through the Park to their destinations. However, there are gaps in the overall system that result in longer, indirect routes for those commuting or traveling at higher rates of speed. This makes the commuter riders more inclined to take the leisure or pedestrian paths increasing the risk of collisions. Creating established on-street commuter routes through the Park will provide faster and safer routes for these riders. The existing right-of-way available within Park roads does not allow for a separated bicycle lane, however a sharrow marking that specifically identifies these streets as "Greenway Connections" will communicate a shared arrangement to bike riders and drivers alike.

The fourth Greenway connection is currently under consideration for the aligment of the Chouteau Greenway. The quality of the Greenway user experience would be greatly improved if the Chouteau Greenway entered the Park at a "front door" location as an opportunity to bring visibility and awareness to the Greenway system and celebrate the connection from Forest Park to the Arch grounds. Figure 9 illustrates four potential locations for the Chouteau Greenway to enter Forest Park. The form and treatment would vary at all possible locations. Implementation could take the form of a surface path, a pedestrian/cycling bridge or an underpass. More specifically, the possibility of crossing over I-64 would require a significant bridge or structural "lid," while the possibility of crossing over Kingshighway Boulevard would require 256' or more of ramping to achieve clearance over vehicular travel lanes and the need to overcome visual and physical access challenges. The map also illustrates an underpass location at Clayton which would require realignment of the existing underpass, while a new underpass at West Pine or Forest Park Parkway would require at least 155' of ramping and a tunnel width of at least 16' with good lighting and clear visual approaches. If the Greenway were to enter the Park across Kingshighway above Steinbery Ice Rink, it would require the addition of an elevated path to provide accessible entry and navigate significant grade change. As the design competition for the Chouteau Greenway concludes, the access point and method should engage the Park within the goals of this study.

CLARIFY THE CENTRAL SHARED PATH

The multi-use path located in the central area of the Park is currently causing confusion with Park visitors. The current treatment of asphalt with a white center stripe and white bicycle symbol painted on the surface communicates to users that this path is intended either for cyclists or "wheels," though it is intended for all users as it connects sidewalks to the various destinations and institutions within the Park. Asphalt markings should clarify the multi-use nature of this central path. A new extension of the central path should connect the twin lots at the Visitor Center to Grand Drive.

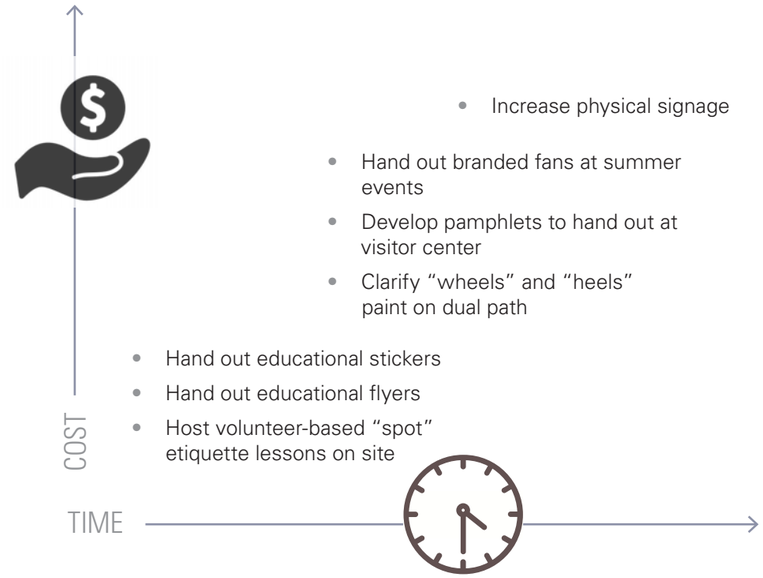
NEW ON-STREET BICYCLE LANES

Refer to the "projects" section of this Study: Lindell Boulevard and Clayton Underpass for recommendations related to on-street bicycle connections.

ETIQUETTE CAMPAIGN

While signs along the dual path indicate "wheels to the right, heels to the left", these are often not heeded. Focus group respondents suggested that there is a general sense among users that the other group should behave with greater courtesy and there is a general sense of confusion as to the intended predominant user.

Establishing a strong etiquette campaign with a clear branding and an educational component will further encourage correct usage of the dual path. Such a campaign should include a range of approaches ranging from short-term and inexpensive strategies to longer-term strategies.



The etiquette campaign should communicate a clear set of user guidelines such as:

- Share the Trail & Keep Right: Please help us make the trail a friendly environment for all trail users by not blocking the path. Walk and bike on the right side of the trail to facilitate two-way traffic. Use caution when passing other trail users. All trail users should respect other users on the facility regardless of their mode, speed or level of skill. Parents, please keep children from wandering into oncoming trail lanes to avoid accidents.
- Pedestrians Have the Right of Way: Faster moving trail users, such as bicyclists, rollerbladers, and skate boarders should yield to walkers and joggers. When the trail is busy, ride single file.
- Communicate When Passing: Give a clear warning signal before passing. Signal may be produced by voice, bell, or horn. A bicyclist should politely yell, "On your left" before passing to alert those in front of them. Be aware that other people may want to pass you.
- Maintain a Safe Speed: Slow down when rounding curves, passing other trail users, traveling downhill, where the trail narrows, approaching intersections or when conditions dictate. If your speed endangers other trail users, check for alternative routes or consider riding on the road.
- Use Caution at Intersections: Slow and stop at all street crossings and use caution when proceeding into the intersection, even when using a marked crosswalk.
- Keep Pets on Short Leashes & Remove Pet Waste: Dogs are welcome on the trail, but please keep them on a short leash to keep the trail safe for all users.
- Obey traffic laws: Be aware that when riding on the road you are subject to all duties applicable to the driver of a vehicle – the same rules apply to you as a cyclist.

IMMEDIATE ACTION ITEMS

a **Increase the legibility and visibility of all crosswalk markings from Park-adjacent neighborhoods into Forest Park. Ensure all crosswalks have high-visibility markings and permanently mounted crosswalk safety signs.**

b **Pilot test road diet and protected bike lane as one potential alternative on Lindell Boulevard.**

c **Position the Park as a client of the Citywide bike share program by establishing the general principles and regulations for dockless bike share with the vendor/operator. Facilitate an agreement with the bike share operator for an agreed upon regulation, communication method and enforcement method for ensuring bicycles are parked in racks while in City parks.**

SHORT-TERM ACTION ITEMS

d **Implement bike share within the Park concurrently with the implementation of the Transit Hub at the Parking and Festival Plaza at the Upper MUNY. This will allow Park visitors to park once and utilize bicycles to visit multiple destinations within the Park.**

e **Improve access to Greenways and improve function of Forest Park as a Greenway connector. Explore wayfinding and branding that defines specific internal Forest Park streets that serve as "Greenway Connections." Ensure speeds are marked and enforced at 20 mph to reduce the use of these streets as "cut-through" routes.**

f **Clarify asphalt markings that indicate the dual-use intent for the central shared path system.**

g **Create a new dual-use connection that connects the twin lots at the Visitor Center to Grand Drive.**

h **Implement dual-path etiquette program to include PR campaign, signage, training program.**

LONG-TERM ACTION ITEMS

i **Track and monitor path usage with real-time data.**

BICYCLE SYSTEM

LEGEND

- Greenway Connector Streets
- Off-Street Bike Route (Existing)
- Off-Street Bike Route (Proposed)
- On-Street Bike Route (Existing)
- On-Street Bike Route (Proposed)
- Multi-Use Path (Existing)
- Multi-Use Path (Proposed)
- Greenway Entry
- Potential Future Greenway Entry
- Reconfigured Bicycle Access Ramps
- Proposed Bike Share Parking

Figure 11: Bicycle recommendations

PEDESTRIAN SYSTEM

WALKING CONNECTIONS

COMPLETING THE NETWORK

Forest Park has an expansive network of trails connecting its numerous amenities that are spread over a broad area. However, opportunities exist to create more direct routes to these major attractions by completing the missing network connections.

The concept for completing this network of paths is proposed in three levels of priority. It should be noted that none of these new connections should remove any existing trees. Priority 1 implements the most crucial missing connections throughout the Park. Priority 2 aims at creating additional pedestrian connections as well as introducing better access to vehicular parking. Priority 3 improves pedestrian connections in the Park and provides additional access options. These paths are not necessary designed to navigate the Park in its entirety, but provide a more practical route for visitors. Additional crossings are recommended along the perimeter of the Park in Chapter 4 Site-Specific Projects.

LEGEND

- New Crosswalk and Bumpouts
- New Crosswalk - no Bumpouts
- Priority 1 Pedestrian Connection
- Priority 2 Pedestrian Connection
- Priority 3 Pedestrian Connection
- A Recommended in 2016 Mobility Study
- Existing Sidewalk
- Existing Path

Note that two of the proposed crosswalks are located on roads without parking and therefore cannot benefit from the addition of bump-outs. These locations are on Washington Drive and Concourse Drive, both bordering the Zoo.

Figure 12: Pedestrian connections

PRIORITY LIGHTING PATHS

Focus groups have indicated that there is a need to access the Park during evening events as well as evening hours in the fall and winter. If pedestrian routes had improved lighting, especially leading to adjacent neighborhoods, local residents are more likely to bike or walk to the Park for these events.

The figure to the right highlights priority areas for lighting paths and roadways in the Park to improve security and basic human safety, however the type and level of lighting will differ by location and context. The future lighting plan for the Park should relate lighting to the evening functions of a particular space and the necessary connections to various modes of transport. Lighting should be utilized in terms of how the type, placement, and illuminance affect how a space is perceived and used.

Every situation has a different set of variables, and the light levels must be considered for each specific location. In addition to dealing with the characteristics described above, lighting levels and an overall lighting plan must be derived from a number of existing conditions including existing light levels, fixtures and availability of electricity. The process and considerations for determining the type of level of lighting should include the review of best practices and regulatory standards related to security, environmental context and electrical standards. The design process should establish a series of use patterns of areas and identify priority areas for lighting and areas for low level lighting and non-illumination.

Recommendations should identify power and control systems (photocell vs. motion-sensing vs. timers vs. dimming) and where appropriate, timing and the addition of surveillance cameras. Recommendations should also consider the impact of installation including the supply of electricity to remote or under-serviced areas. Consideration should be given to alternative power supply where appropriate, including solar.

This study should include the consideration of the Park's natural resource components, as lighting in certain open space environments within the Park. All future lighting within the Park should meet the specifications of the International Dark-Sky Association. Improper outdoor lighting can impede the view and visitor enjoyment of a natural dark night sky. Full-cutoff luminaries should be specified to direct nearly all their light downward, thus reducing light pollution.

IMMEDIATE ACTION ITEMS

a **Engage a design team to establish a lighting inventory of current conditions (light levels, fixtures and electrical distribution) to inform future lighting recommendations. This study should establish lighting guidelines that align with the character of Forest Park including the type and level of lighting for each condition.**

SHORT-TERM ACTION ITEMS

b **Phased implementation of the above to align with other Park improvements.**

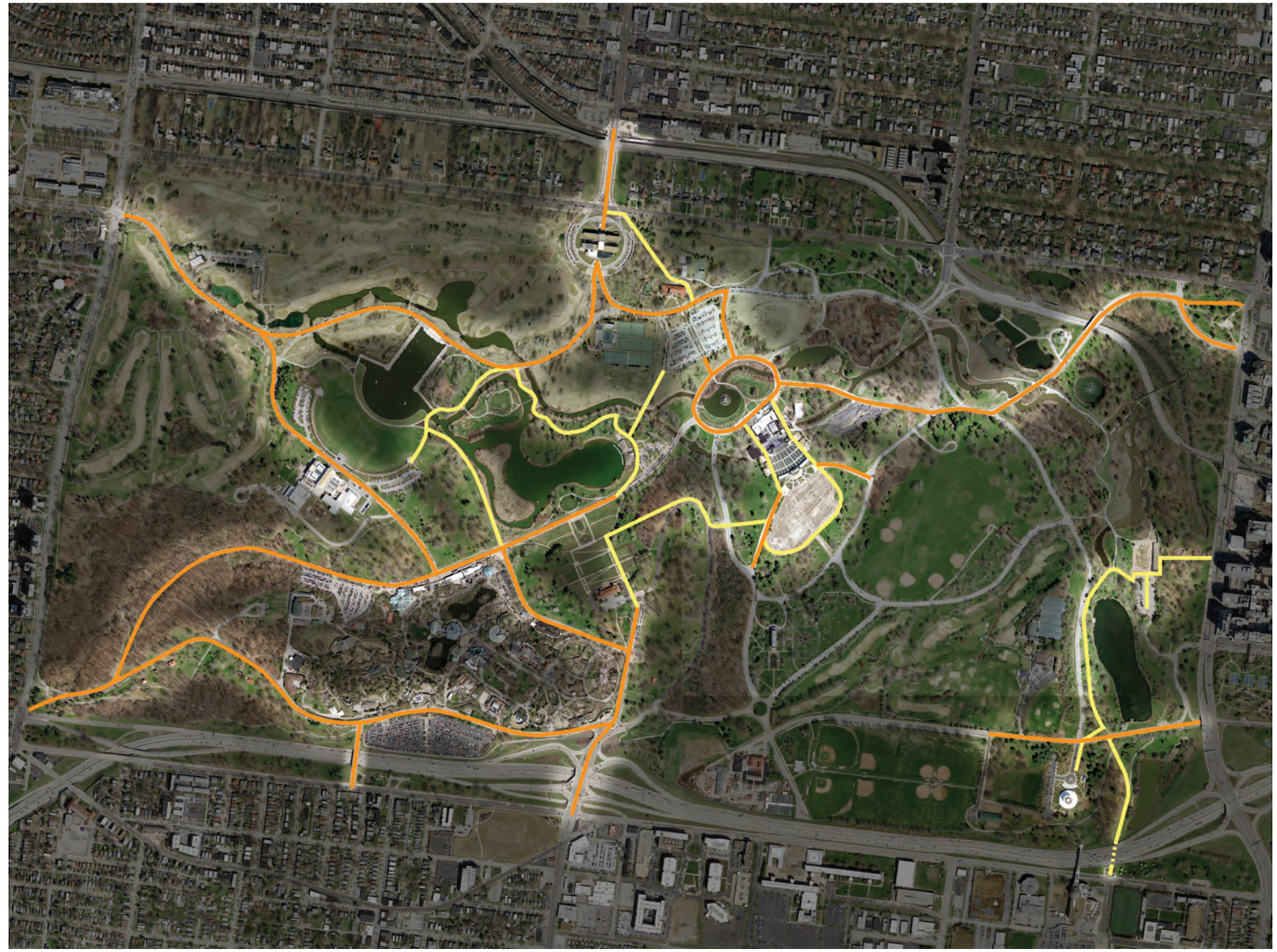


Figure 13: Recommended lighted paths

LEGEND

Prioritized Area for Path Lighting

Prioritized Area for Street Lighting

3:

IN-PARK STREETS

IN-PARK STREETS

STREET AND CROSSING DESIGN

Sample vehicular speeds taken within the Park indicate dangerous speeds, particularly during rush hour, and along roads used as "cut-throughs" for commuters. This is in part due to the broad width of many Park roadways when parking is unoccupied. The excessive speeding endgendered by the design speed creates a hazard for visitors walking and biking within the Park.

Recommendations for internal Park streets include:

- Reduced traffic speed for all Park roadways to 20 miles per hour
- Visually narrow driving lanes with the addition of stripe defined parking lanes and center-line
- Phase in bump-outs at all existing and recommended crosswalk locations to aid in influencing the driver's perception of speed
- Visually reinforce the presence of bikes by placement of sharrows
- Construct bump-outs combined with speed tables at crosswalks

Reducing the posted traffic speed for all Park roadways to 20 miles per hour will improve conditions for on-street bike traffic and crosswalk safety. Visually narrowing driving lanes with the addition of stripes defining parking lanes and bump-outs will reduce travel speeds within the Park. Striping of these streets is focused only on areas where congestion is a common issue (See 3.3 Parking) to minimize the visual impact and reduce maintenance. Maintenance of striping should be carried out along with current striping and maintenance scheduled by the City. Bump-outs can be combined with speed tables to reduce traffic speeds and improve visibility at crosswalks as well as with natural stormwater infiltration methods such as rain gardens. The comprehensive goals of this recommendation are to ensure all crossings, sidewalks and access points are universally accessible and safe, and to improve the atmosphere and enjoyability of the Park.

Figure 14: Typical treatment at crosswalks within the Park. Markings should include sharrows when on greenway connector streets.

3.9

GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE

Any future implementation project within Forest Park should include an understanding of baseline metrics and a means of measuring these improvements. Stormwater management strategies within the Park should include the following methods for reducing stormwater runoff:

- permeable paving in lieu of traditional impermeable paving methods;
- increasing soil volumes and soil porosity around trees;
- increasing the number of trees overall, which helps to intercent stormwater and improve air quality while reducing heat island effect;
- use of native landscaping to increase wildlife habitat and increased stormwater detention.

Stormwater management in Forest Park is governed by the Metropolitan St. Louis Sewer District (MSD). Any future projects must meet their requirements to comply with their Clean Water Act Phase II Stormwater Permit and obtain their approval. MSD requires stormwater Best Management Practices (BMPs) to reduce runoff volumes and improve water quality when new projects are designed and built.

The 2013 Forest Park Stormwater Master Plan outlines conditions specific to Forest Park, agreed upon by the City of St. Louis Board of Public Service (BPS), Forest Park Forever (FPF) and the Metropolitan St. Louis Sewer District (MSD). In 2018, the parties agreed that the conditions are still valid. The most relevant conditions are summarized below. Please refer to the source document for all conditions to be considered.

- Projects that directly drain to the River Des Peres combined sewer need no BMPs, but may need flood protection/detention. This runoff does not fall under MSD's Phase II requirements.
- The linear connected waterway system (LCWS) is categorized as a protected waterway of the State, so projects that drain to the LCWS need volume reduction BMPs to treat runoff and need to meet MSD's Phase II requirements.
- Projects are treated as standalone needing their own BMPs. Swapping BMP mitigation benefits between projects is allowed only in project locations where BMPs are proven not feasible.
- Any disturbances (i.e. widen and overlay, increase in impervious, converting open drainage to closed drainage) require BMPs for mitigation. Typical BMPs creating runoff reduction include: rain gardens/bioretention; permeable pavement; rain water harvesting/store and reuse such as green roofs, rain barrels, cisterns. Credits could exist such as sheet flow runoff through undisturbed buffer or runoff through dry swales. Surface methods to treat runoff reduction should be attempted first, if possible.

APPROACH

Forest Park already utilizes the Linear Connected Waterway System as a global strategy for stormwater management. All efforts should be made to preserve that environmental resource. Forest Park currently manages stormwater runoff in a localized fashion, with BMPs designed and applied to each individual project undertaken. Continuing to use this localized approach will reduce overall stormwater runoff and peak flows to both the LCWS and to the River Des Peres combined sewer tunnel.

EXISTING BMPS

Forest Park is already utilizing several types of BMPs, including on-street bioretention basins, site specific bioretention, parking lot median bioretention, permeable pavement in parking lot medians & parking pads, amended soils, and open channel bioswales. The on-street bioretention on Government and Wells Drives features reused granite City curbs as decorative baffles that tie to the local history with recycled discarded infrastructure elements. The basins will be planted with Missouri native plants & trees to reduce the maintenance effort.

RECHARGE LCWS WITH STORMWATER.

While a large area of the Park drains to the LCWS, and the recirculation system was reconstructed to reduce the large amount of city tap water used to maintain the ponds, the LCWS is still dependent on city tap water inputs. There is simply not enough runoff generated from surrounding areas to keep the lake levels up. To reduce this dependence on city water, the 2013 Forest Park Stormwater Master Plan included a suggestion to evaluate increasing the tributary area to the waterway and lake network where possible. This would be accomplished by reconfiguring storm sewer systems that drain to the River Des Peres combined sewer tunnel instead to drain to the LCWS. These areas would need to meet MSD Phase II requirements not required to drain to the combined sewer. Project should continue to be evaluated for feasibility to accomplish this on a case by case basis.

EDUCATIONAL OPPORTUNITIES

Adding interpretive signage to new or existing BMPs could increase public awareness about BMPs and how they operate to effectively store & treat stormwater runoff. There are several examples of signage in the region:

Existing interpretive signage in Forest Park

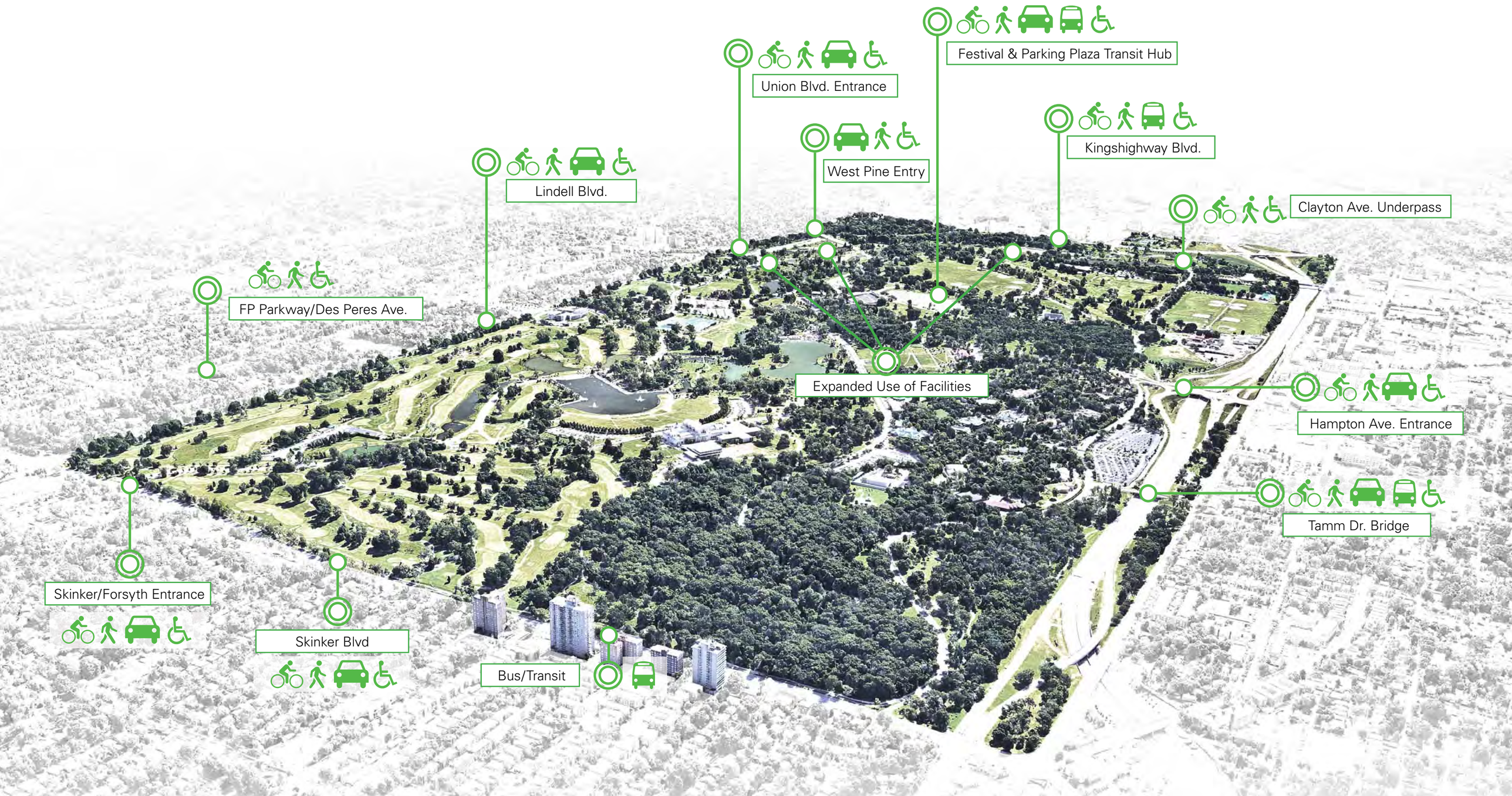
Existing rain garden installation in Forest Park

SITE-SPECIFIC PROJECTS

This section of the Study outlines recommendations for Great Streets Projects within and adjacent to the Park. Immediate, short and long-term "action items" were established through focus group input and work sessions with Park Partners and adjacent institutions.

SITE-SPECIFIC PROJECTS

BELOW, LOCATIONS FOR SITE-SPECIFIC IMPROVEMENTS RECOMMENDED IN THIS LONG-TERM PLANNING STUDY



4

KINGSHIGHWAY BOULEVARD

KINGSHIGHWAY BOULEVARD

CONNECTING TO THE CENTRAL WEST END

While Kingshighway is a pedestrian barrier and carri it safety concerns, the road is also a sign of commerce and a successful commercial district. Residents of the Central West End have expressed the need to drive to the Park simply to avoid the danger of crossing Kingshighway. Traffic speeds, volume, wide right-of-way, short crosswalk timing, and traffic movements contribute to a dangerous condition for pedestrians and cyclists.

The original design intent as documented in the Report of the Kingshighway Commission in March 1903 was for Kingshighway Boulevard to serve as a grand boulevard to link the major parks in St. Louis. Traffic volumes and frequency of emergency vehicles accessing the medical district on Kingshighway Boulevard require six vehicular lanes and therefore no significant lane reductions are recommended at this time. Other modifications are recommended to help reduce traffic speeds and improve safety. Opportunities exist to improve sight-line visibility and shorten crossing distances through curb extensions or other geometric changes. Parallel parking on the west side of Kingshighway can be removed in areas where appropriate while retaining high-demand spaces. This trade-off for a safer environment for pedestrians outweighs the small loss of parking along the street. In addition to improving walking safety and visually narrowing the corridor to reduce speeding, curb extensions with rain gardens will add green space to Kingshighway.

Specific interventions along Kingshighway Boulevard include:

1. Remove sections of parking lanes on the west side of Kingshighway to create bumpouts and shorter crosswalks. Improve markings and visibility of crosswalks to delineate bike and pedestrian crossing.
2. Extend median end caps to create protected refuges for pedestrians and cyclists.
3. Supplement existing bumpouts and parking where possible on the east side of Kingshighway. Rain gardens should be considered within bumpouts where topography favors their function. Opportunities exist north and south of West Pine and North of Hospital drive, which are the low points along Kingshighway.

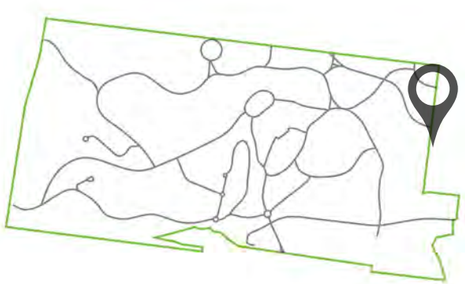


Figure 1: Kingshighway Commission Report illustrating the relationship of Kingshighway to main arteries of travel and St. Louis parks

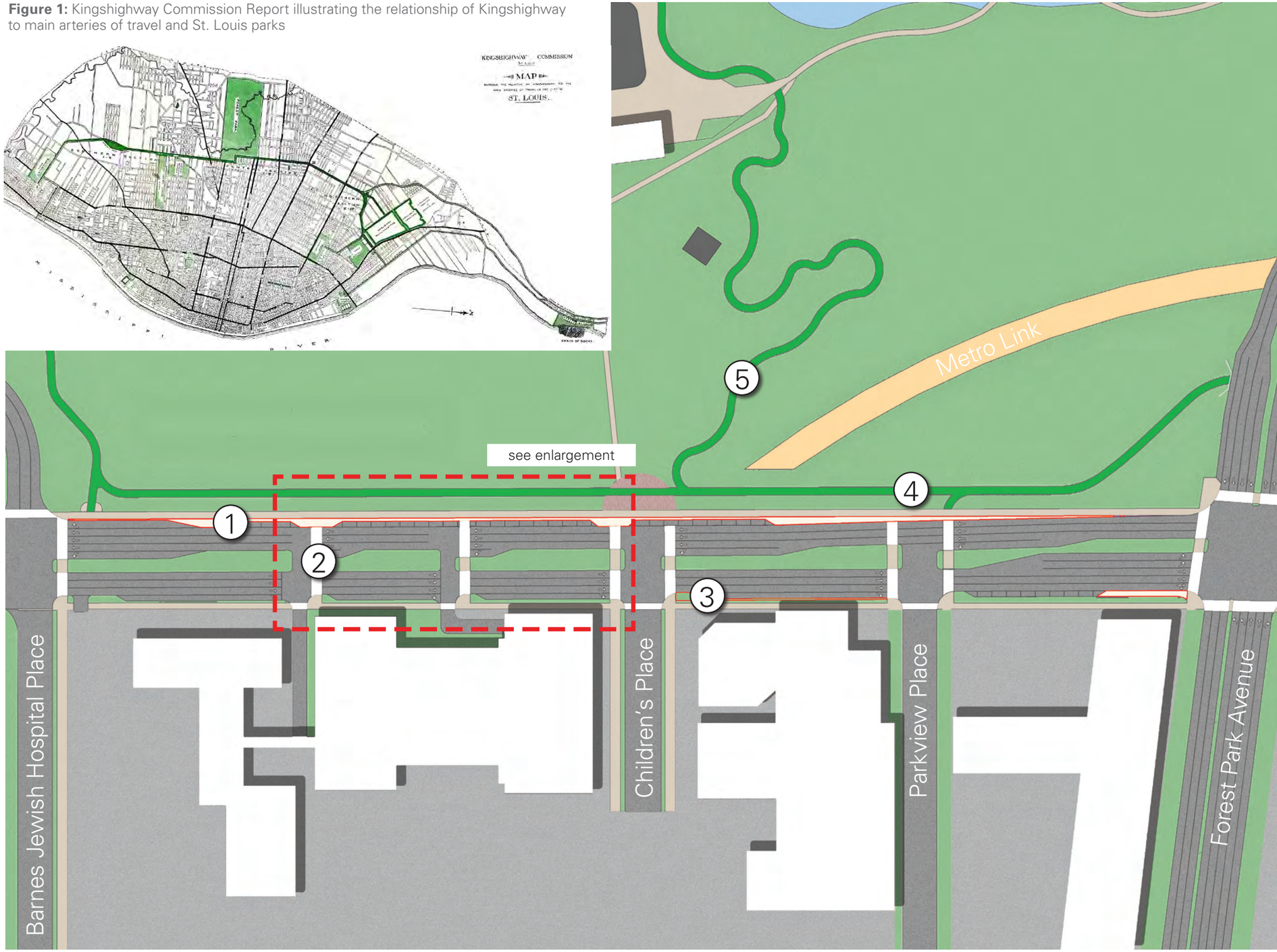
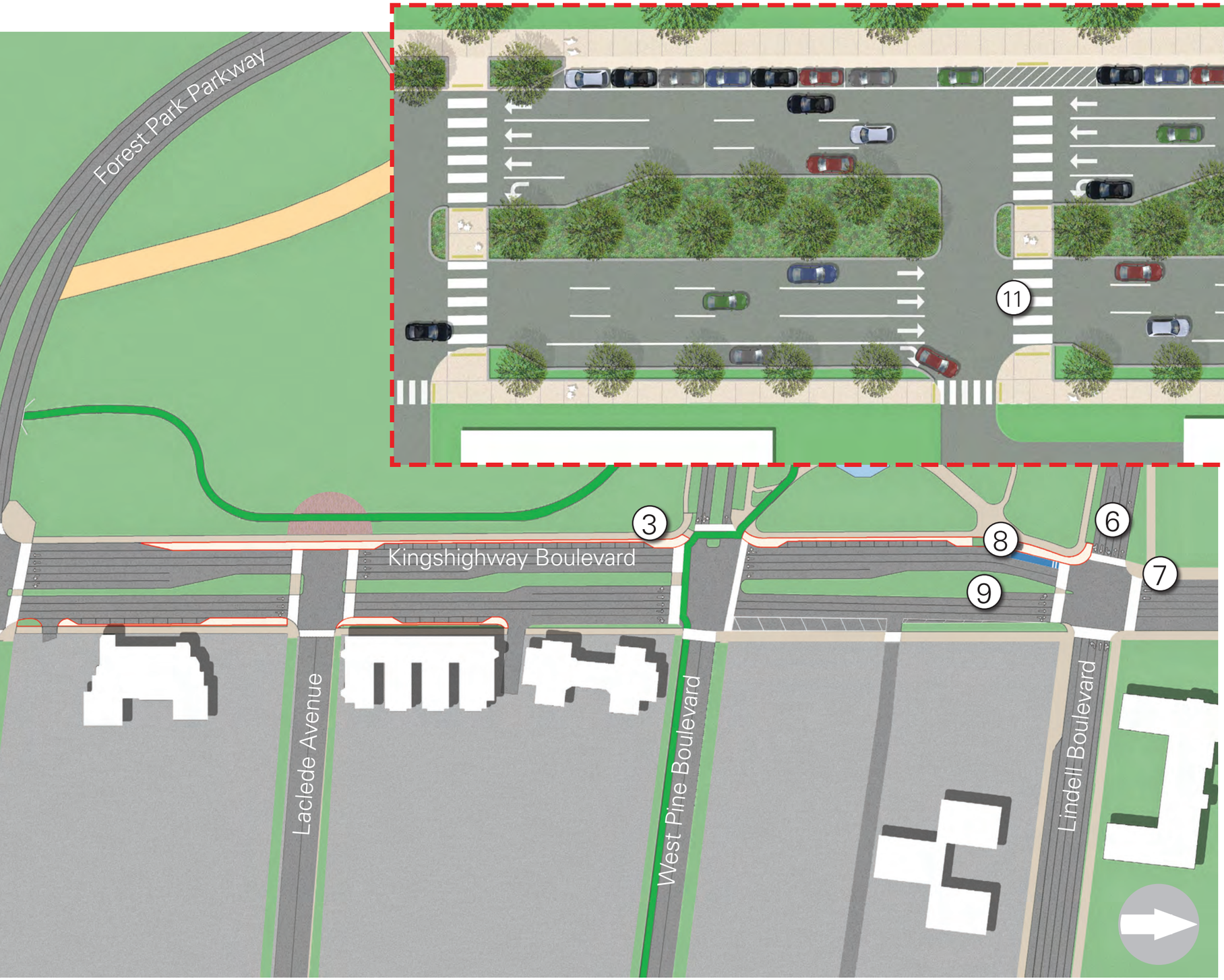


Figure 2: Kingshighway Boulevard proposed improvements

Figure 3: Enlargement of Kingshighway Boulevard at Children's Place



4. Extend dual path system along west side of Kingshighway within Forest Park to increase Park user visibility.
5. New path connection to Steinberg Ice Rink and dual path system.
6. Improve alignment and geometry of Kingshighway/Lindell intersection southbound approach to improve signal visibility and reduce red light violations. Replace signals with higher visibility dual head signal arms. Review placement of vegetation, signage and bus stops that impede visibility.
7. Remove "Pork Chop" that provides southbound free-flowing right turn from Kingshighway onto Lindell. Reduce lanes on Lindell from 6 to 4 to reduce crossing distance.
8. Relocate Bus #95 southbound Bus Stop at Lindell to the far side of intersection. Visibility of signage is obscured by vegetation and alignment. A transit stop at the entry of Forest Park improves user access.
9. Provide a left turn lane onto Lindell Boulevard. See West Pine Entry in section 4.6 of this study for further discussion.
10. Signalization improvements – study adding LPI (leading pedestrian interval) to all intersections with Kingshighway Boulevard. An LPI is a best practice at all high-volume pedestrian crosswalks to provide a lead for pedestrians/bikes to cross, before allowing vehicles to do so.
11. Add new pedestrian crosswalk at existing traffic signal at Children's Place to better connect the hospital visitors and employees to the sidewalk along Forest Park.
12. Reduce posted Speed limit from 35 to 30 miles per hour.

4.2

SKINKER BOULEVARD

SKINKER-BOULEVARD IMPROVEMENTS

STRONGER CONNECTIONS TO THE WEST

Skinker Boulevard is characterized by high traffic speeds and volumes. The absence of safe pedestrian facilities for crossing this traffic is a barrier and safety hazard to the significant volumes of people walking and biking to the Park along Wydown Boulevard, the Centennial Greenway, Washington University and the neighborhoods to the west of the Park. In addition, the absence of crosswalks between Wydown and Rosebury further contributes to this physical barrier to walking access. Both bicycle and pedestrian traffic should feel comfortable crossing over to the Park-side of Skinker Boulevard which is a safer north-south route with fewer driveways and separated bicycle and pedestrian traffic.

Because Skinker Boulevard carries almost 30,000 cars a day, the corridor is not suitable for a reduction in the number of driving lanes. However, there is ample opportunity to shorten crosswalk distances and introduce curb extensions to improve sight lines and safety for pedestrians. Introducing rain gardens within the curb extensions will add sustainable stormwater treatment and green space to the roadway.

The distances between crossing opportunities can be shortened by introducing a new crosswalk at Fauquier Drive with a pedestrian-activated HAWK (high intensity activated crosswalk beacon) signal and bulb-outs. Bus stops at Arundel, Northwood and Southwood can be consolidated into one at Rosebury Avenue (both northbound and southbound) to improve connectivity to the Park. An improved high visibility crosswalk with wide, separated bicycle/pedestrian markings can also be added at this location.

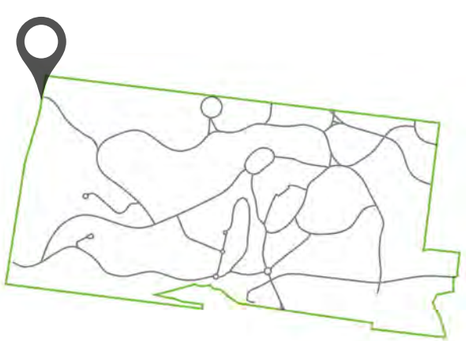
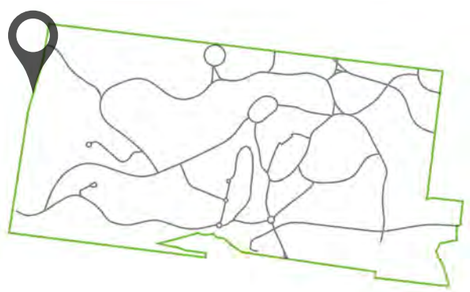


Figure 1: Proposed Improvements at Skinker and Lagoon



1. High visibility crosswalk with improved crosswalk timing and separated bicycle/ped markings
2. Bump-out with rain garden for increased visibility from the driver's field of vision
3. Striped Parallel Parking
4. Reconfigured access ramps for smooth entry to the Park for pedestrians and cyclists and to meet ADA
5. Reconfigured Lagoon intersection
6. Entry plazas to welcome arrivals into Forest Park and provide an opportunity for wayfinding

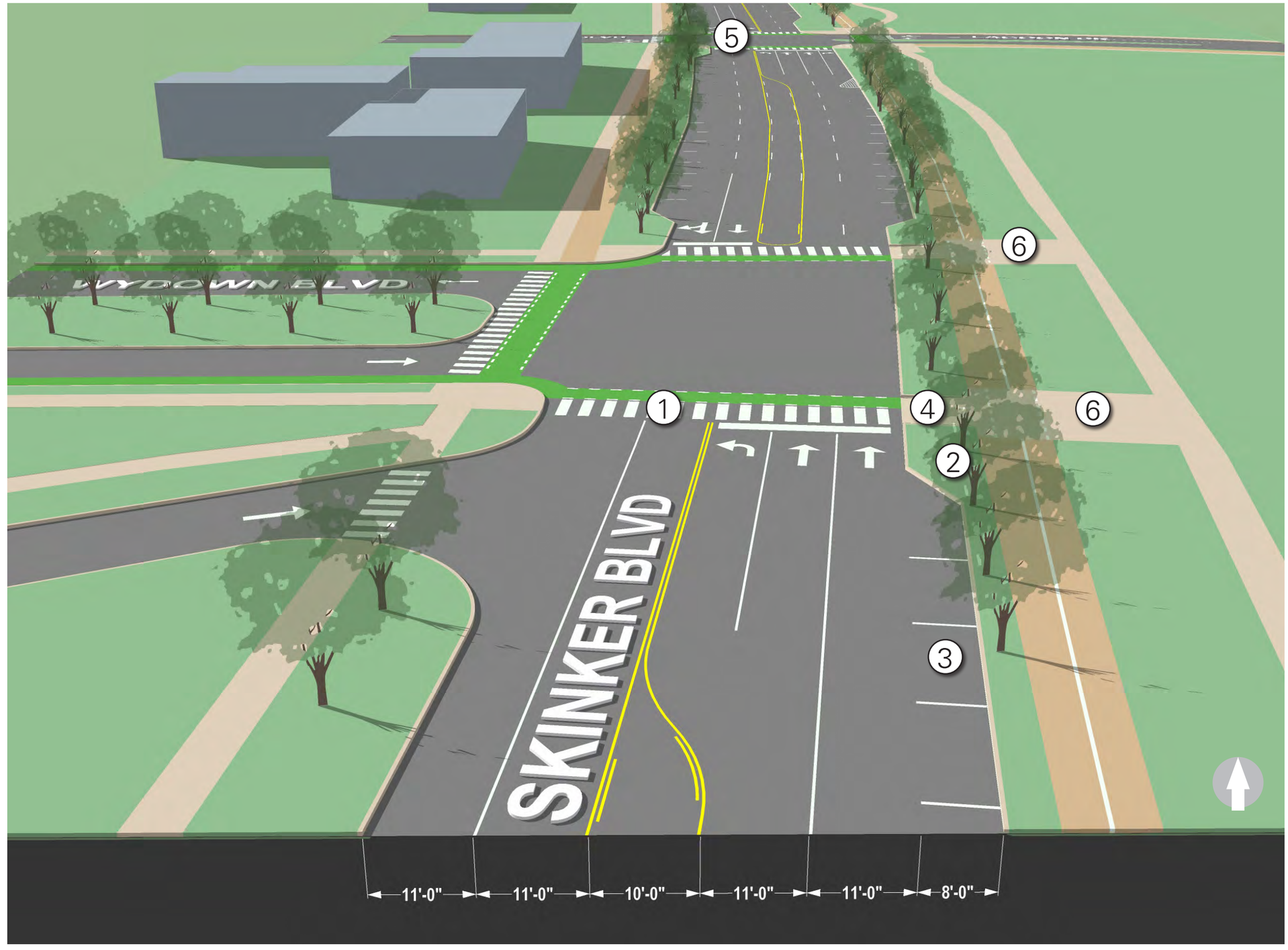


Figure 2: Proposed Improvements along Skinker Boulevard at Wydown Boulevard

SKINKER BOULEVARD AT FORSYTH/LAGOON IMPROVEMENTS

Improvements to the west side of the Skinker Boulevard and Forsyth Boulevard intersection will be completed in the summer of 2018 and therefore not part of this project scope. These improvements generally include:

- Separated bike and walking crosswalk striping across Forsyth Boulevard and across Skinker Boulevard on the south side.
- A right turn lane on Forsyth to southbound Skinker, including a bump-out and rain gardens.
- The regulation of no right turns on red throughout the entire Forsyth/Skinker/ Lagoon intersection.

Within the scope of the Great Streets Study, the proposed design for the east side of Skinker Boulevard and Forsyth Boulevard intersection will tie seemlessly to the improvements by others described above and create a stronger pedestrian and bicycle connection to the heavily-used north side of the Park. Entry plazas at the southeast and northeast corners of the intersection allow a wide space for pedestrians and cyclists to mingle and rest before crossing the roadway safely.

High-visibility markings separate bicycle and pedestrian traffic, with clear written and graphic signage denoting path of travel for each user type and limiting the potential for conflict areas. Markings, using thermoplastic material, can be custom-designed and should be implemented at the time when new paving is installed to ensure longevity.

Signalization improvements will ensure that crosswalk timing is sufficient for all users at 3.5 feet per second. Bike-only signalization and LPI (leading pedestrian interval) of five seconds is recommended for the Lagoon/Skinker intersection. LPI is a best practice at high volume pedestrian crosswalks to provide a lead for pedestrians to cross, before allowing vehicles to do so. In addition, this intersection should provide "bike only" signalization to minimize conflict.

1. Clear pavement markings and delineation for merging modes of transport
2. High visibility crosswalks - separating bicycle and walking traffic
3. Entry plazas to welcome arrivals into Forest Park and provide an opportunity for wayfinding
4. Existing right turn lane
5. New sidewalk extension into the Park
6. Rain garden

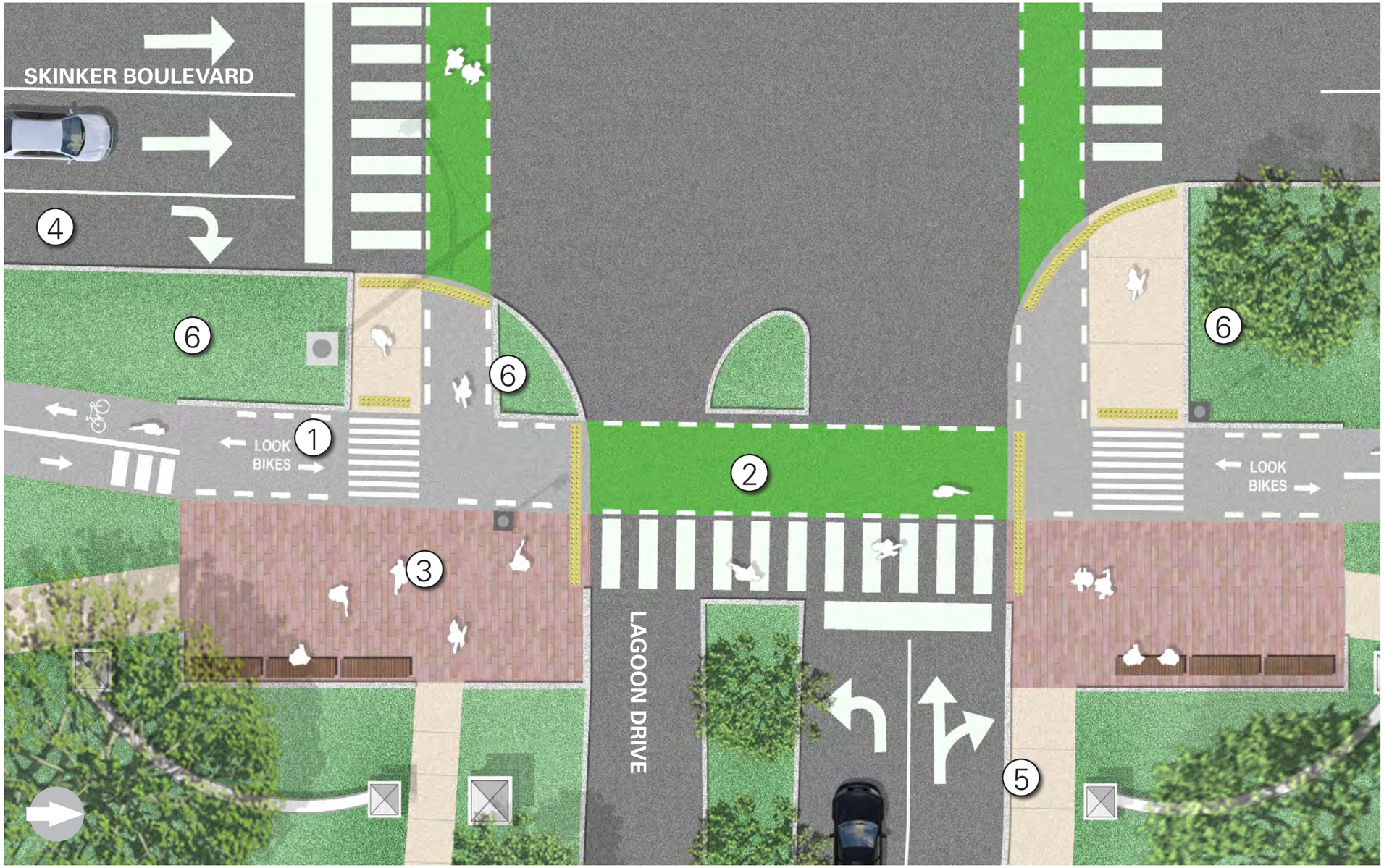


Figure 3: Enlargement: Proposed Improvements at Skinker and Lagoon

SKINKER BOULEVARD ADDITIONAL CONSIDERATIONS

FUTURE CONSIDERATIONS

1. **Bike path from Lindell Boulevard to Delmar along Skinker.** Due to the high number of cyclists already using this route, there have been past studies which recommend that the City consider creating a formal bicycle facility in this section of Skinker Boulevard. This process would also need to engage property owners, business owners and residents along this segment, and design considerations will need to address safety, visibility and trade-offs due to displaced parking that may be required.

IMMEDIATE ACTION ITEMS

a **Traffic counts for all turning movements at every intersection along Skinker.**

b **Feasibility study for HAWK signal design at Fauquier.**

c **Retrofit existing painted crosswalks to be high visibility crosswalks using a durable material like thermoplastic inlay.**

SHORT-TERM ACTION ITEMS

d **Implement LPI (Leading Pedestrian Interval) at all signalized intersections (3 second lead). Implement 5 second lead at Lagoon/Skinker intersection.**

e **Schematic Design Development of Skinker Boulevard improvements as illustrated in this section.**

LONG-TERM ACTION ITEMS

g **Complete construction of bump-outs.**

h **Coordinate execution of bump-outs with bikeway on west edge along Washington University campus.**

Figure 4: Proposed Improvements for Skinker Boulevard / Rosebury Drive

SKINKER AT ROSEBURY CROSSING

The proposed improvements at the intersection of Skinker and Rosebury show the opportunity for increased safety, access, and convenience along Skinker Boulevard without reducing the number of travel lanes. A bump-out on the Park side of the intersection shortens the crossing distances while allowing a more gradual entry into the Park for bicyclists and pedestrians. A rain garden within the bump-out adds enhanced green space to the Skinker corridor while providing environmentally-friendly filtration for stormwater runoff.

4.3

LINDELL BOULEVARD

LINDELL BOULEVARD

Lindell Boulevard creates a barrier to accessing Forest Park due to traffic speeds in excess of current posted limits and a lack of safety at crosswalks. The street was designed to feel like a neighborhood street within Forest Park; however, vehicles travel at speeds above 35 miles per hour (RITIS 2016) which results in a much great risk of fatality in an accident. (National Association of City Transportation Officials notes the following study: "Relationship Between Speed and Risk of Fatal Injury," Department for Transport, London.)

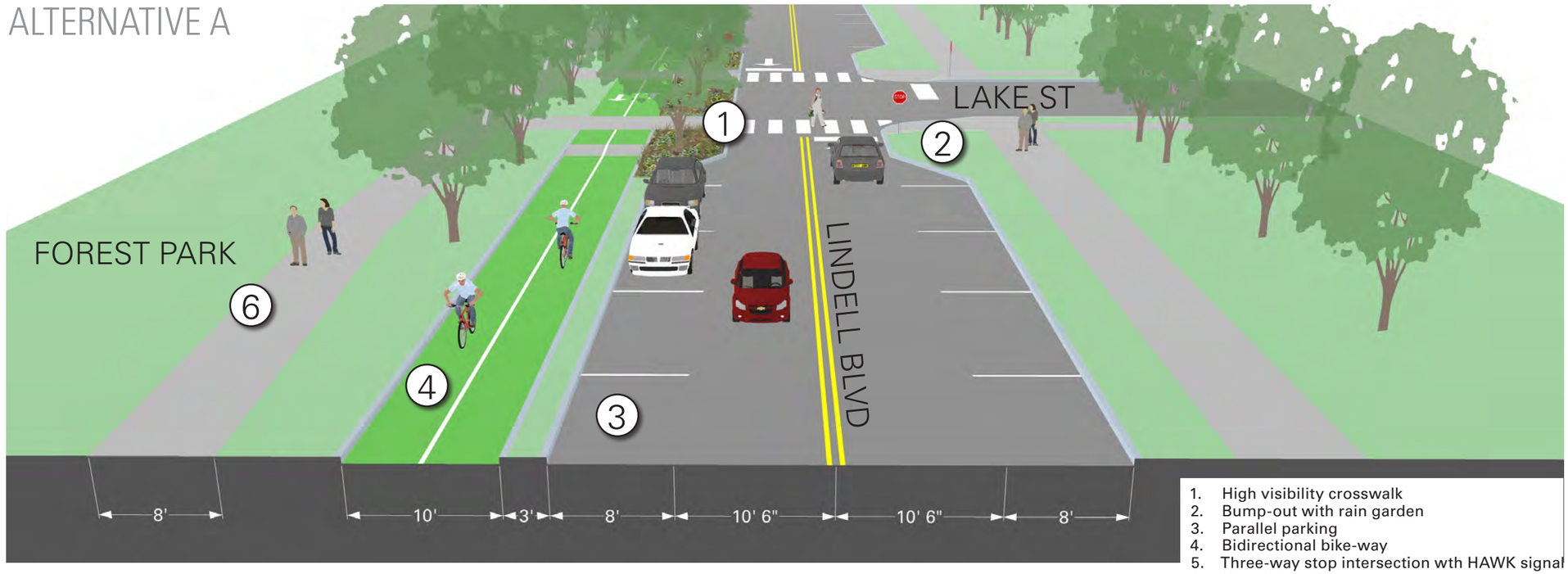
In addition, the existing cross section has more travel lanes than it needs to carry average daily traffic volumes currently (See appendix for Existing Conditions). However, following the construction of the Forest Park Parkway intersection at Kingshighway Boulevard, traffic volumes will need to be reassesed to confirm a lane reduction is warranted as drivers readjust their routes.

The park-like atmosphere of Lindell Boulevard can be improved through reducing travel lanes, calming vehicular traffic and shortening crosswalks through bulb-outs and planted rain gardens. The addition of a commuter-friendly two-way bikeway on one side of the street is an option that would facilitate a nearly uninterrupted east-west connection for serious cyclists, allowing recreational cyclists and casual users to enjoy the pathways within the Park without fear of conflicts. Bulb-outs and rain gardens would not only add green space to the Park, but would provide significantly shorter crosswalks, lowering the risk exposure for accidents with vehicles. A three-way stop at Lindell Boulevard and Lake Avenue should be considered to provide safe pedestrian crossings while facilitating vehicular turns to and from the adjacent residential area. This intersection would benefit from either a 3-way stop with a pedestrian-activated signal or, if the vehicle counts are more than 100 vehicles per hour (vph), a traffic signal should be studied. In addition, a new sidewalk extension is proposed for the south side of Lindell Boulevard to better connect pedestrians and cyclists into the Park and into the Bike St. Louis system at West Pine Boulevard.

Two alternative road configurations are proposed:

ALTERNATIVE A

Create a 10' bidirectional bike-way on the side of Lindell Boulevard through a road diet, reducing the roadway to one lane each way with parallel parking on both sides. This solution will calm traffic speeds, provide safer pedestrian access to the Park, and allow a safe east-west route for commuter cyclists.



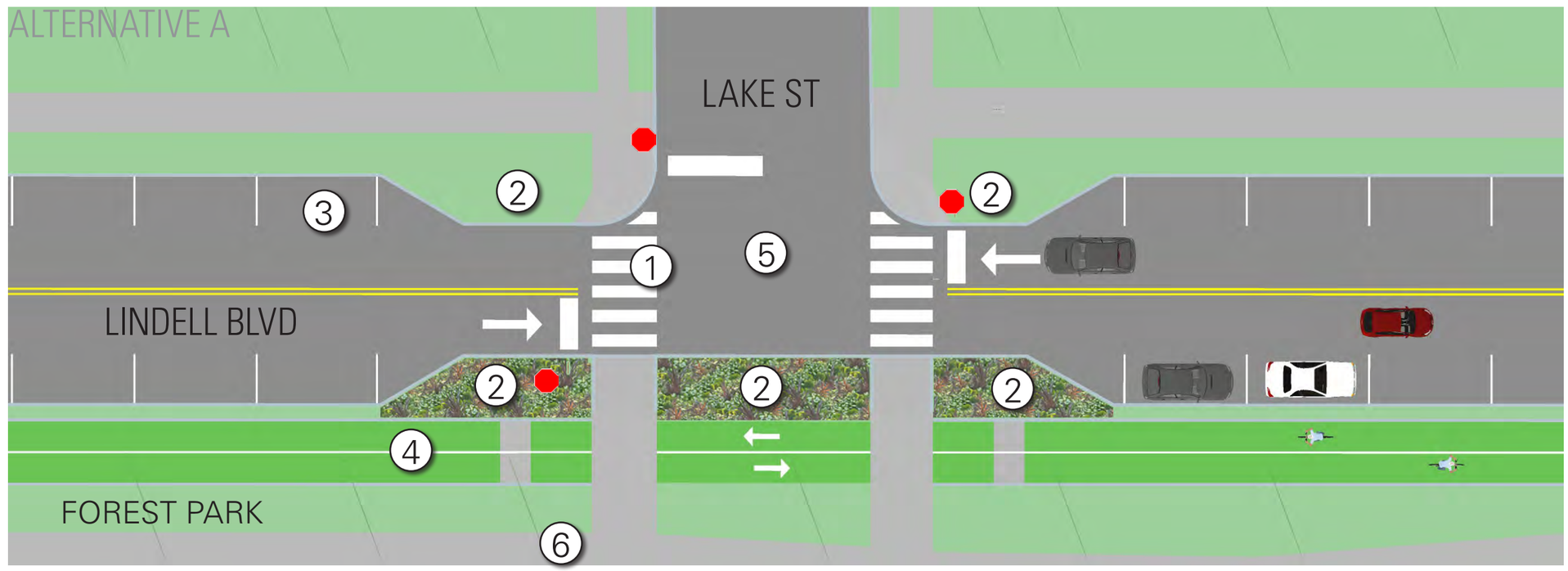


Figure 1: Alternative A for Lindell Boulevard: Example above is the intersection of Lake Street and Lindell Boulevard

LINDELL BOULEVARD

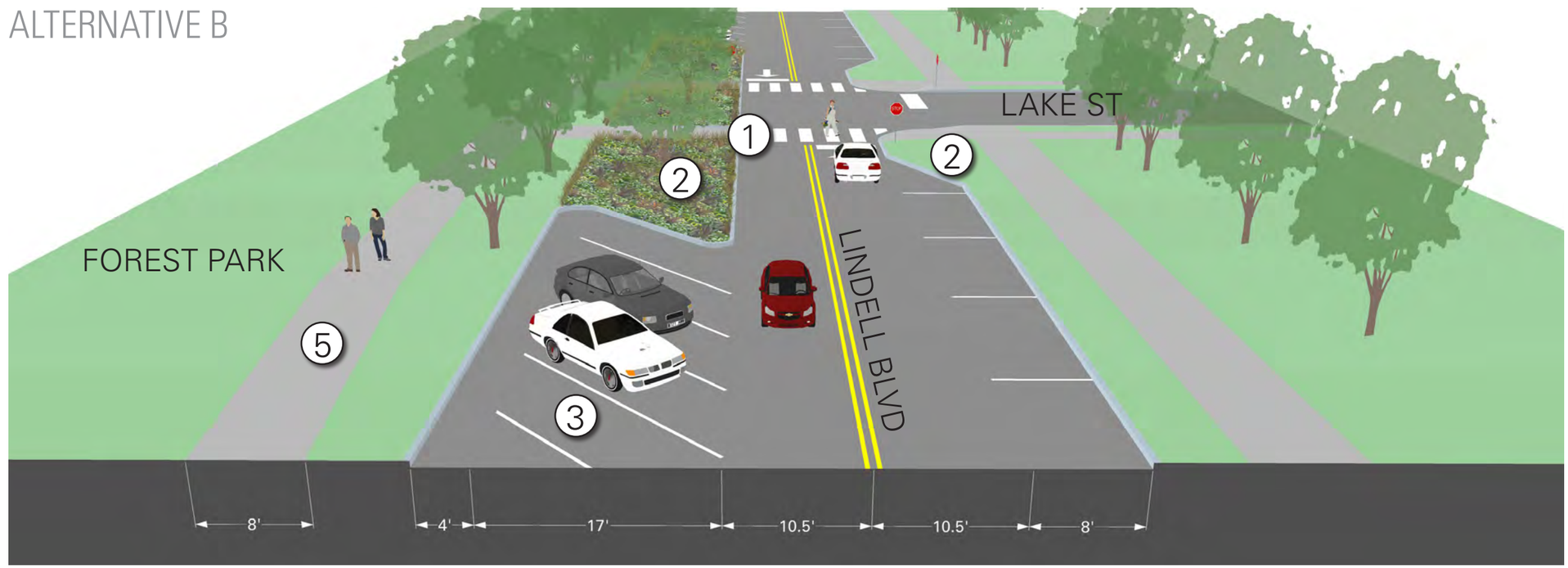
ALTERNATIVE B

Alternative B accomplishes the same goals as Alternative A in terms of connecting pedestrians and cyclists into the Park at thi spoint. A three-way stop at Lindell Boulevard and Lake Avenue should be considered to provide safe pedestrian crossings while facilitating vehicular turns to and from the adjacent residential area. This intersection would benefit from either a 3-way stop with a HAWK signal or, if the vehicle counts are more than 100 vehicles per hour (vph), a traffic signal should be studied. In addition, a new dual path extension is proposed for the south side of Lindell Boulevard to better connect pedestrians and cyclists into the Park and into the Bike St. Louis system at West Pine Boulevard.

As an alternative to an on-street bikeway, more efficient parking could be provided through back-in angled parking spaces on the south side. No on-street bike facilities are included in this alternative.

Providing back-in angled parking spaces allows for an increase in parking supply and helps calm traffic speeds along the street. It also increases the safety and visibility of entering and exiting a parking space. This solution should also consider either a 3-way stop with a pedestrian-activated signal at Lindell Boulevard and Lake Avenue or, if the vehicle counts are more than 100 vehicles per hour, a potential traffic signal should be studied.

1. High visibility crosswalk
2. Bump-out with rain garden
3. Back-in angled parking
4. Three-way stop intersection wth HAWK signal
5. New sidewalk



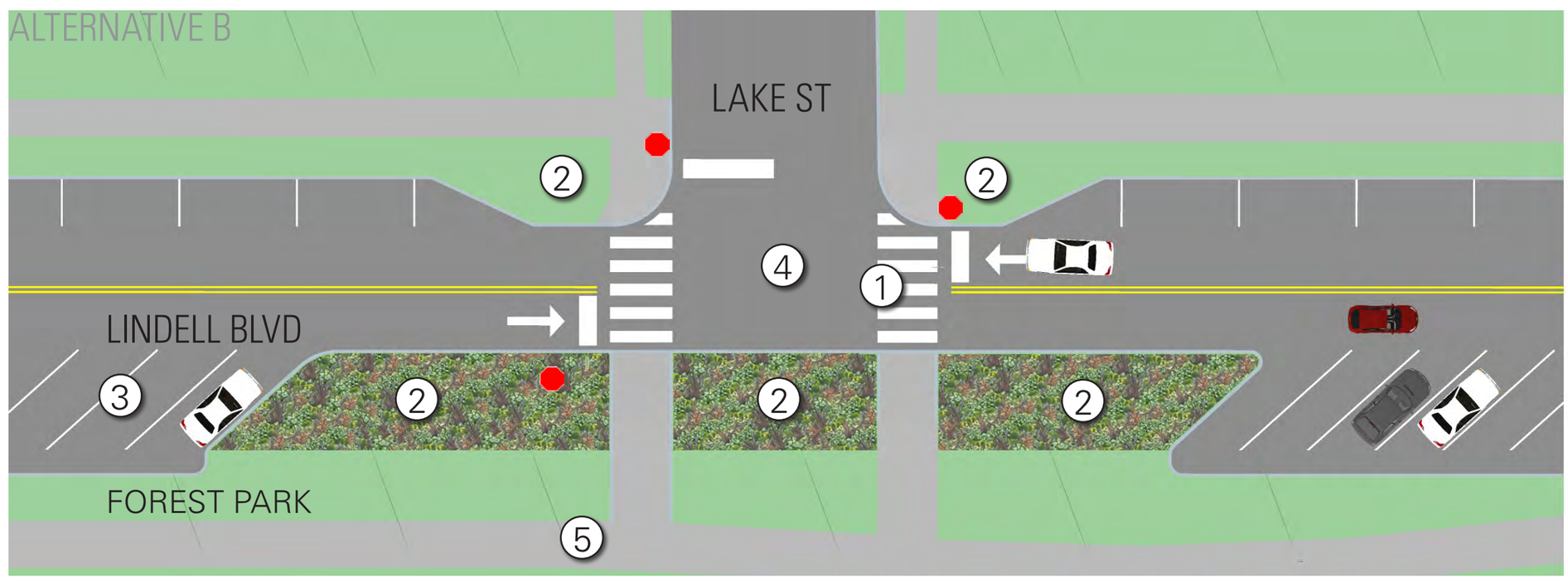


Figure 2: Alternative B for Lindell Boulevard: Example above is the intersection of Lake Street and Lindell Boulevard

LINDELL BOULEVARD

IMMEDIATE ACTION ITEMS

a **Gather necessary data** to further inform the recommended road section for Lindell Boulevard including confirmation of vehicular counts after new Forest Park Parkway construction, existing level of bike commuter counts, and vehicular count data at the Lake and Lindell intersection during peak hours. Have a consultant perform a computer traffic simulation to test the realignment. Coordinate data collection needs and pilot test preparations with the proposed West Pine realignment and new westbound left turn off Kingshighway as well as the proposed Union Boulevard realignment.

SHORT-TERM ACTION ITEMS

b Following a successful computer simulation, **execute a pilot test** which re-stripes the roadway and mocks up the alternative proposed redesigns, allowing it to function with the recommendation prior to advanced design and construction. It may be beneficial to pilot test both alternatives for the road diet. The pilot test should be executed as a partnership between City Streets, BPS and Forest Park Forever and should include public engagement in the form of a hot line at a minimum. The pilot test on Lindell Boulevard should be in place for 6 months in order to give residents and visitors an opportunity to adjust to the changes.

LONG-TERM ACTION ITEMS

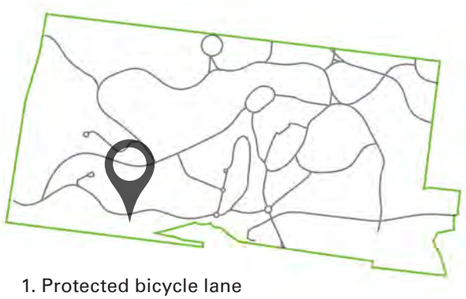
c **Design and Construct** the successful road section alternative according to results of the pilot test.

4.4 TAMM DRIVE BRIDGE

RECONFIGURING TAMM DRIVE BRIDGE

Residents from neighborhoods south of Forest Park have limited options for entry, particularly when arriving by foot or bicycle. Recent improvements along Oakland Avenue greatly increased safety and connectivity to Forest Park from adjacent neighborhoods through new sidewalks, crosswalks and dedicated bike lanes. Despite the recent critical improvements along a one-mile stretch of Oakland Avenue, safety remains a concern at the Tamm Drive and Oakland Avenue intersection, given the multiple movements that need to occur to exit and enter the Park. This access point is also critical to the functionality of the Forest Park circulator, which will connect multiple parking locations to the Zoo entries.

The new configuration for the Tamm Drive Bridge will provide one wide sidewalk on the east side of the bridge with northbound and southbound bike lanes, as well as a new underpass for bicycle traffic on the dual path system within the Park and a new walking connection to the bridge from Turtle Park. The location of the underpass should be determined through an analysis of existing grade and avoid the bridge structural supports. A three-way stop at Tamm Drive and Oakland Avenue would better facilitate the flow of southbound exit traffic, particularly for those making left turns going east. According to a 2008 study, only 4% of the entries and exits to the Park used the Tamm Drive Bridge with an Average Daily Traffic count of approximately 5,000 vehicles. This recommendation will accommodate a substantial increase in traffic from that baseline.



1. Protected bicycle lane
2. Bus-only center lane (blue paint for illustrative purposes only)
3. Bus-only queue jump
4. High-visibility crosswalk bike + ped
5. New dual path underpass
6. Sidewalk

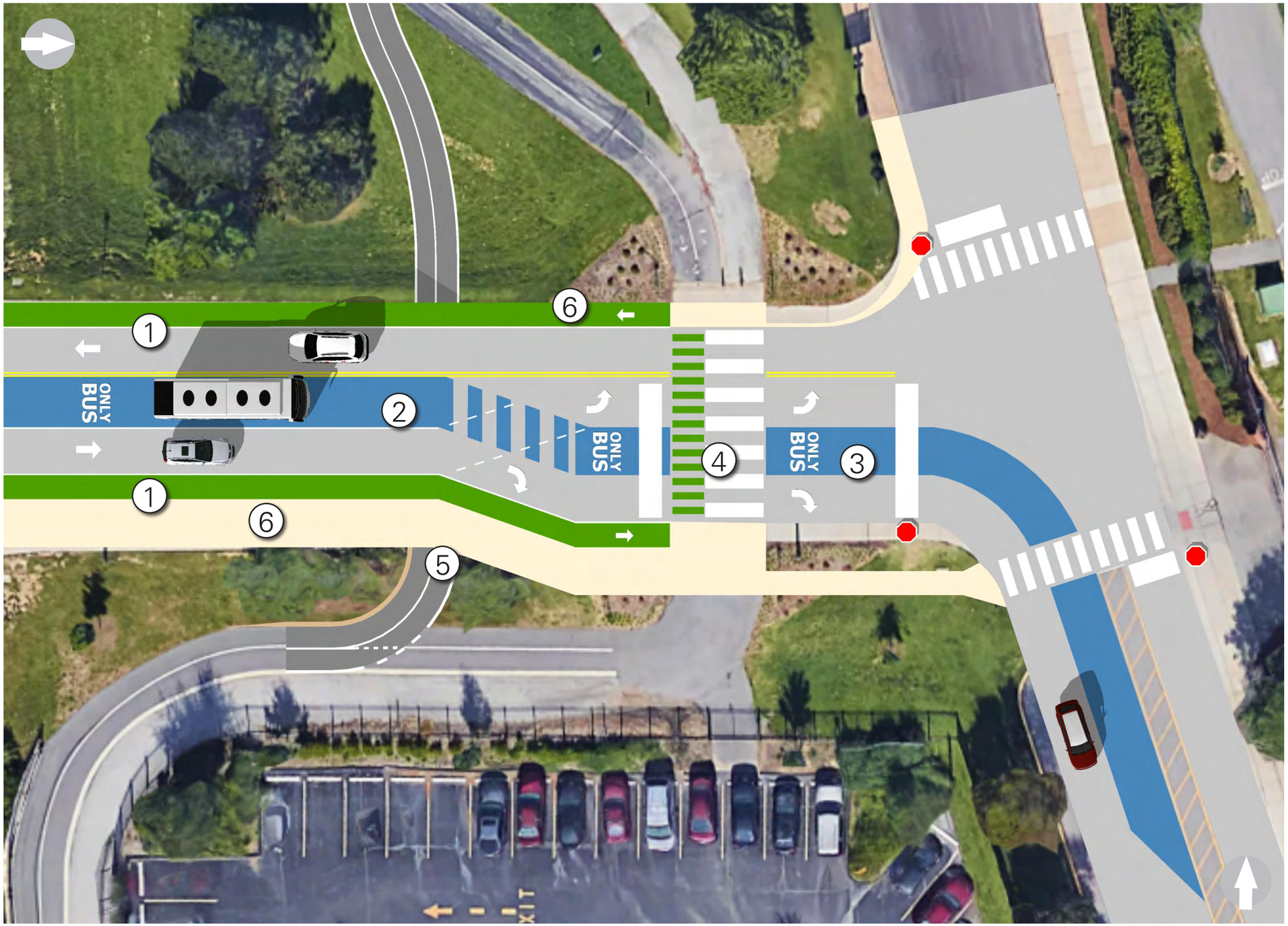


Figure 1: Proposed improvements at Tamm Drive / Wells Drive intersection

RECONFIGURING TAMM DRIVE BRIDGE

Phasing is critical to the success of this concept. This improvement is recommended to occur after the new Zoo parking development is completed at Oakland and Hampton. The new design would be an improvement for both pedestrian and cyclist access, as well as provide a clear bus-only lane and queue jump for the Circulator, creating further incentive to use alternative methods of access to the Zoo. Congestion points in the Park were identified through the outreach process and key stakeholder input. An overall traffic study is needed to determine in more detail the congestion points within the Park which will allow the location of congestion avoidance measures, such as bus-only lanes, to be confirmed (See 3.1 Access Demand Management.)

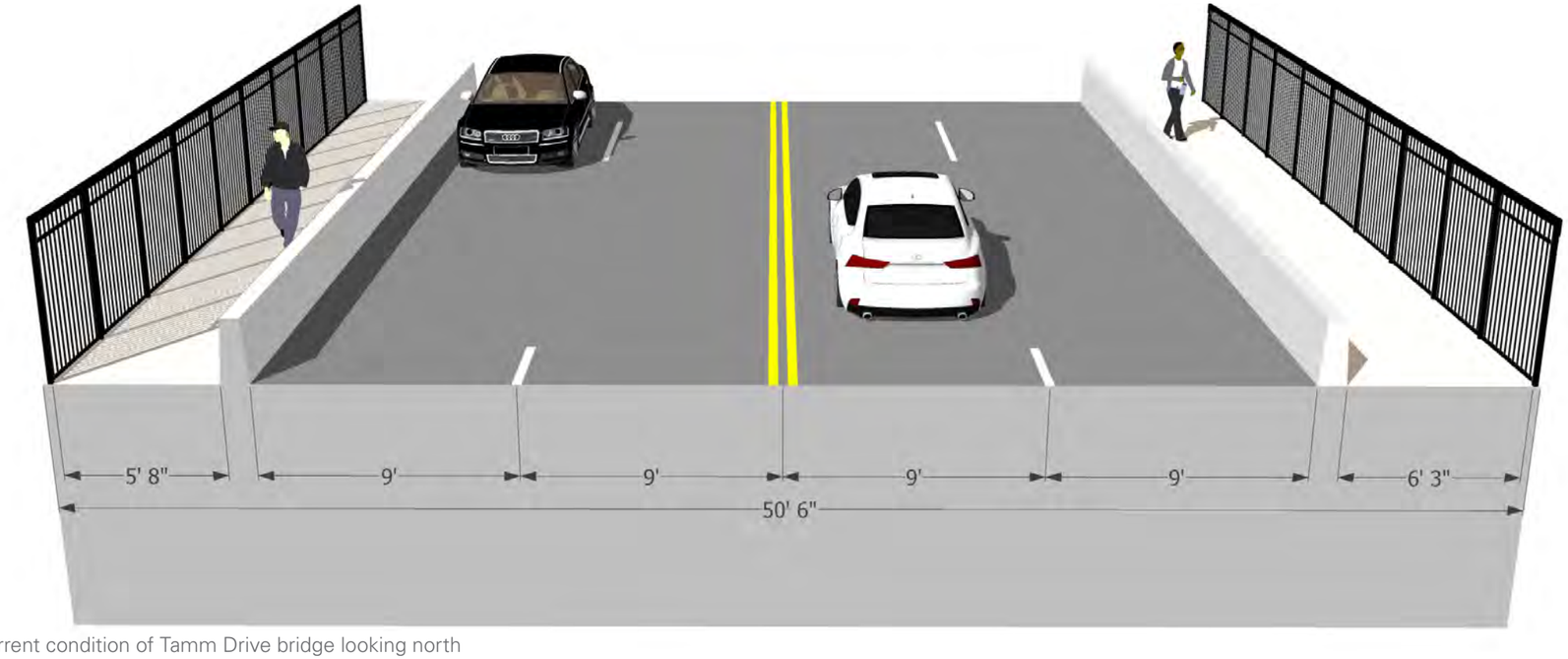


Figure 2: Current condition of Tamm Drive bridge looking north

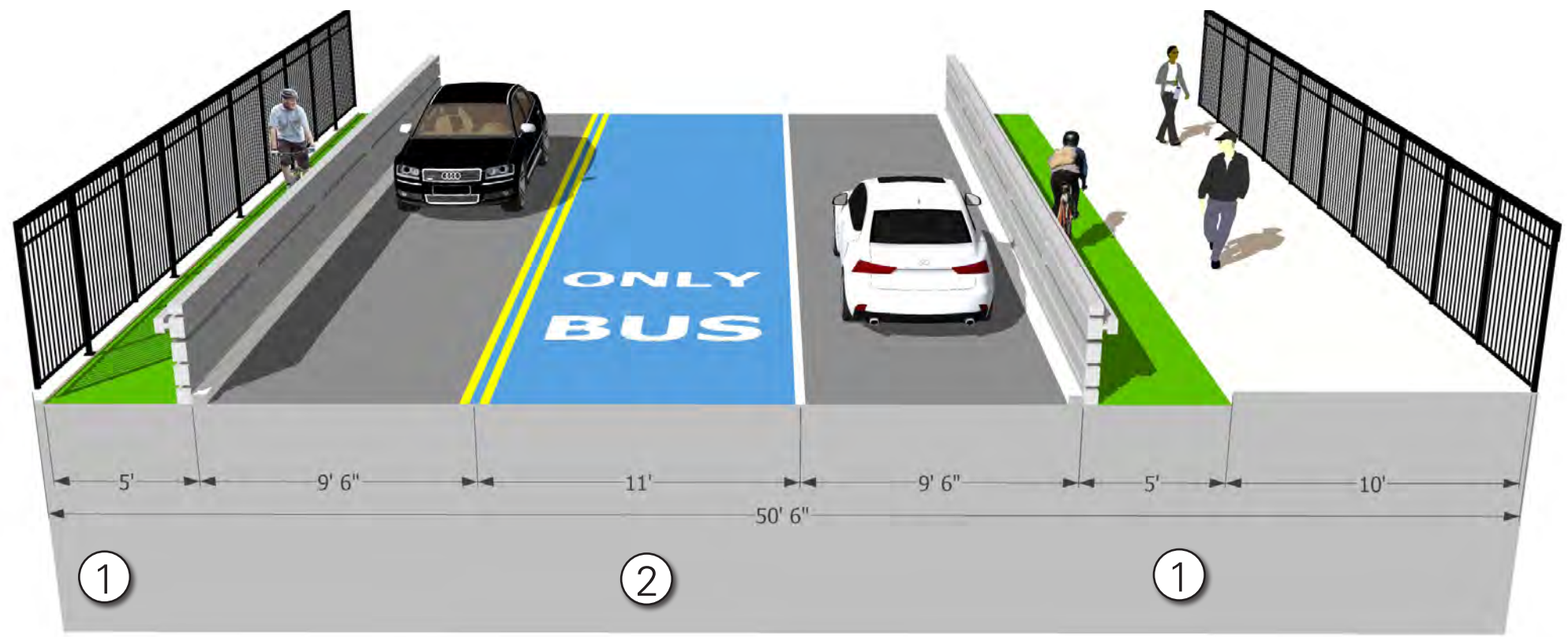


Figure 3: Proposed long-term improvements to Tamm Drive bridge looking north

RECONFIGURING TAMM DRIVE BRIDGE

Figure 4: Proposed long-term improvements to Tamm Drive bridge

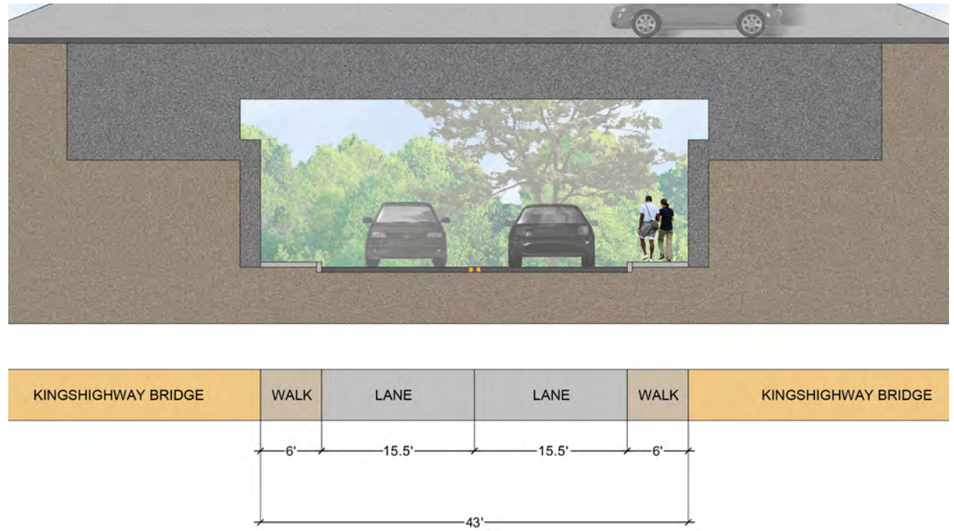
CLAYTON AVENUE UNDERPASS

CLAYTON UNDERPASS

EXISTING CONDITION

The current configuration of Clayton Avenue consists of two vehicular lanes, approximately 15 feet wide each with accompanying sidewalks on either side. The existing lane width is excessive for the current traffic volumes along Clayton Avenue, which presents an opportunity to repurpose parts of the right-of-way. The sidewalks currently connect to the existing dual path system in Forest Park where pedestrian and bicycle traffic merge. On-street parking is allowed along on the south side of Clayton Avenue, west of the underpass.

Our recommendation for the Clayton Avenue underpass under Kingshighway Boulevard is to further study three potential solutions, one of which is a short-term plan to better connect to the Central West End and neighborhoods to the south/southeast of the Park as well as connect to the existing bike bridge over I-64 from Clayton Avenue.

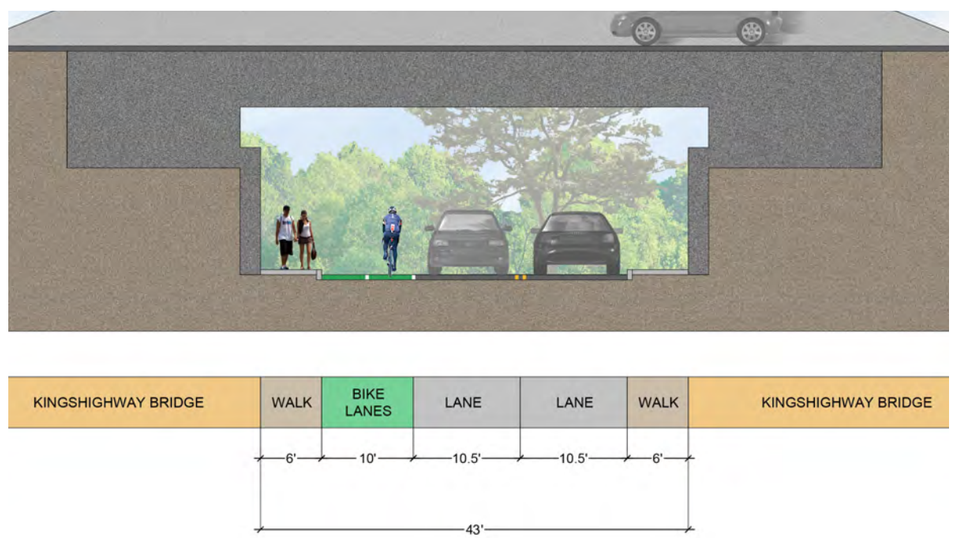


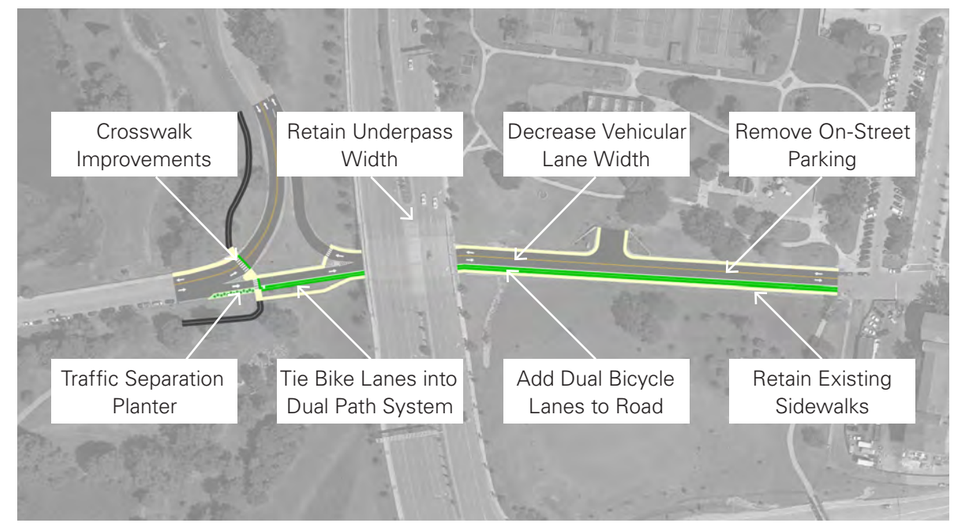
Existing

Figure 1: Existing conditions at the Clayton Avenue underpass looking west

OPTION 1 - SHORT TERM PLAN

The least costly option would be to reduce the existing lane widths from 15 feet, to 10.5 feet. This would free up 10 feet of the right-of-way that may then be repurposed for on-street bicycle lanes into the Park; safely connecting cyclists from the Central West End to the dual path system in Forest Park. Crosswalk improvements as well as introducing a traffic separation planter can also create a safer environment for both cyclists and pedestrians.





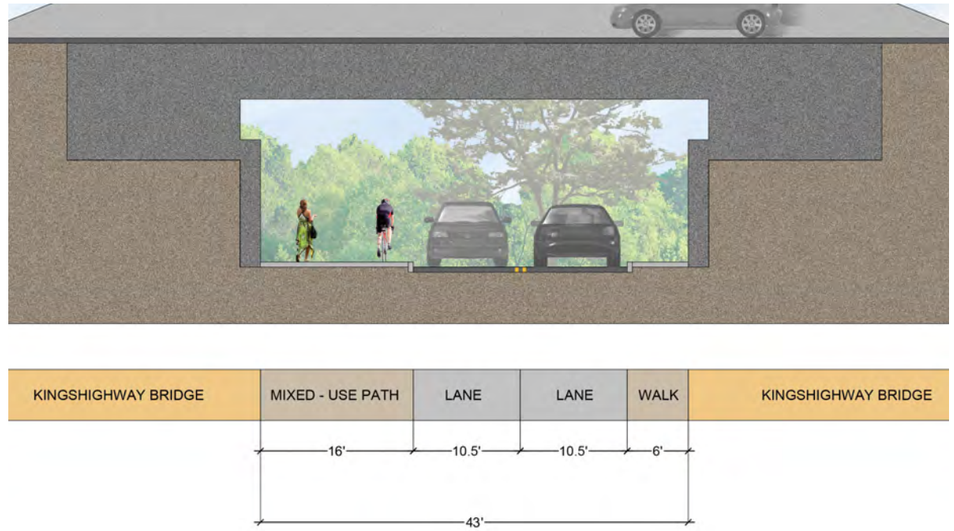
Proposed

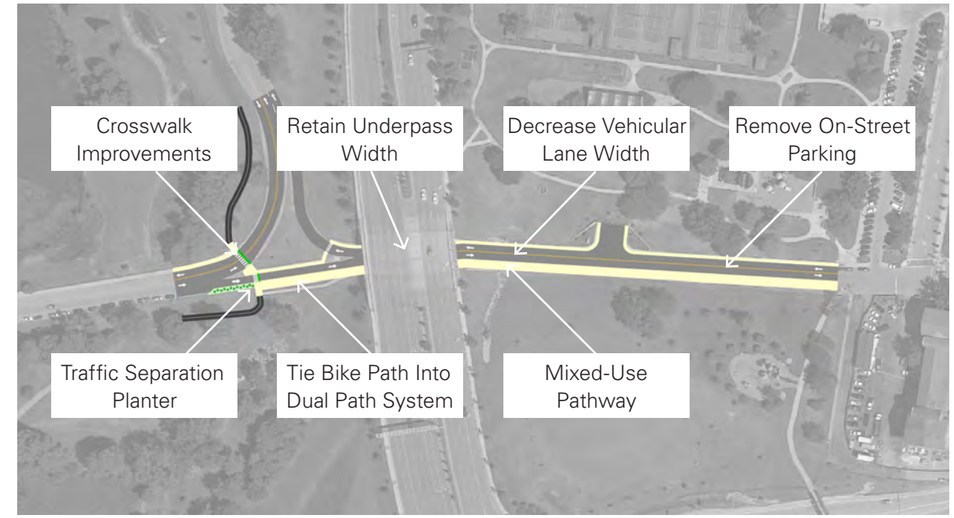
Figure 2: Short-term improvements to the Clayton Avenue underpass looking west

CLAYTON UNDERPASS

OPTION 2 - LONG TERM PLAN

Like the short-term plan, this option also proposes reduction in lane widths to provide more space for pedestrians and cyclists. However, this option recommends widening of the existing sidewalk from 6 feet to 16 feet which can be used by both cyclists and pedestrians. This creates a safer environment while retaining the existing width of the underpass.



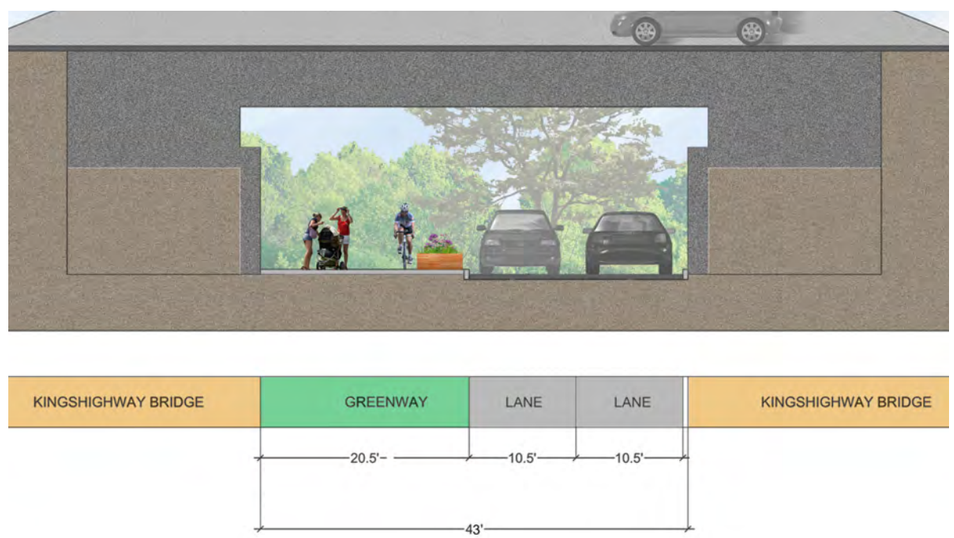


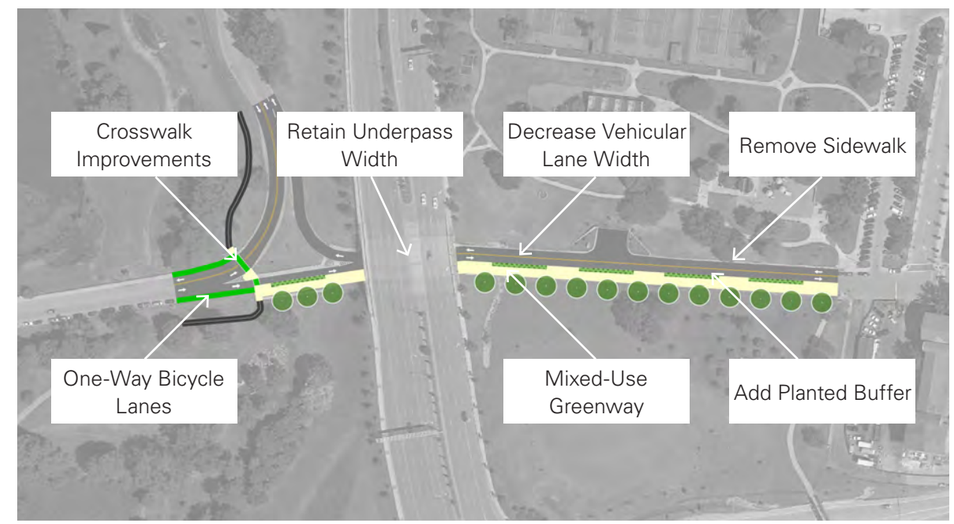
Proposed

Figure 3: Long-term improvements to the Clayton Avenue underpass looking west

OPTION 3 - GREENWAY

The option 3 takes the long-term plan one step further by removing the sidewalk on the north side of Clayton, allowing the pedestrian and bikeway to expand into a greenway - a linear pathway that provides not only access for cyclists and pedestrians, but also green space, shade from added trees, and additional buffers from vehicular traffic. This represents one option for connecting the Chouteau Greenway to Forest Park. (See Figure 9 in Section 3.6. for all options.) The underpass would benefit from an artistic lighting installation, fruther enforcing this entry as a welcome gateway from adjacent neighborhoods.





Proposed

Figure 4: Greenway scenario within the Clayton Avenue underpass looking west

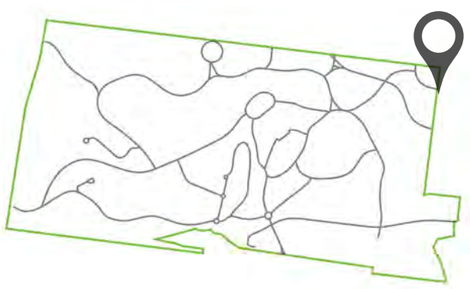
4.6

WEST PINE ENTRY

WEST PINE ENTRY

The West Pine Park entry/Lindell Boulevard has become an alternative route to Forest Park Parkway resulting in increased traffic volumes and speeds along Lindell Boulevard and disconnecting the northeast corner from the rest of the Park. At the same time, there is decreased pedestrian safety and accessibility to the Park from adjacent neighborhoods across Kingshighway Boulevard and crossing West Pine.

Implementing the recommendation from the 1995 Forest Park Master Plan to remove the West Pine road section between Grand Drive and Lindell Boulevard will re-establish the route as a historic Park entry connecting to Grand Drive. This recommended approach fulfills the goals of the Master Plan while allowing integration of improved bike and pedestrian facilities. Removing this section of roadway will also open-up pedestrian access to the Murphy Lake area of the Park north of Grand Drive. Left-turning traffic to West Pine might be reduced significantly with the closing of the portion from Grand Drive to Lindell Blvd.



1. Removal of West Pine Boulevard connection to Lindell Boulevard
2. Reconfigured Park entry marker
3. Enhanced crossings
4. Programmed activities
5. Sidewalk addition
6. Left turn lane addition to Northbound Intersection at Kingshighway and Lindell
6. Add left turn lane to Northbound Intersection at Kingshighway and Lindell to offset Grand Drive closure.

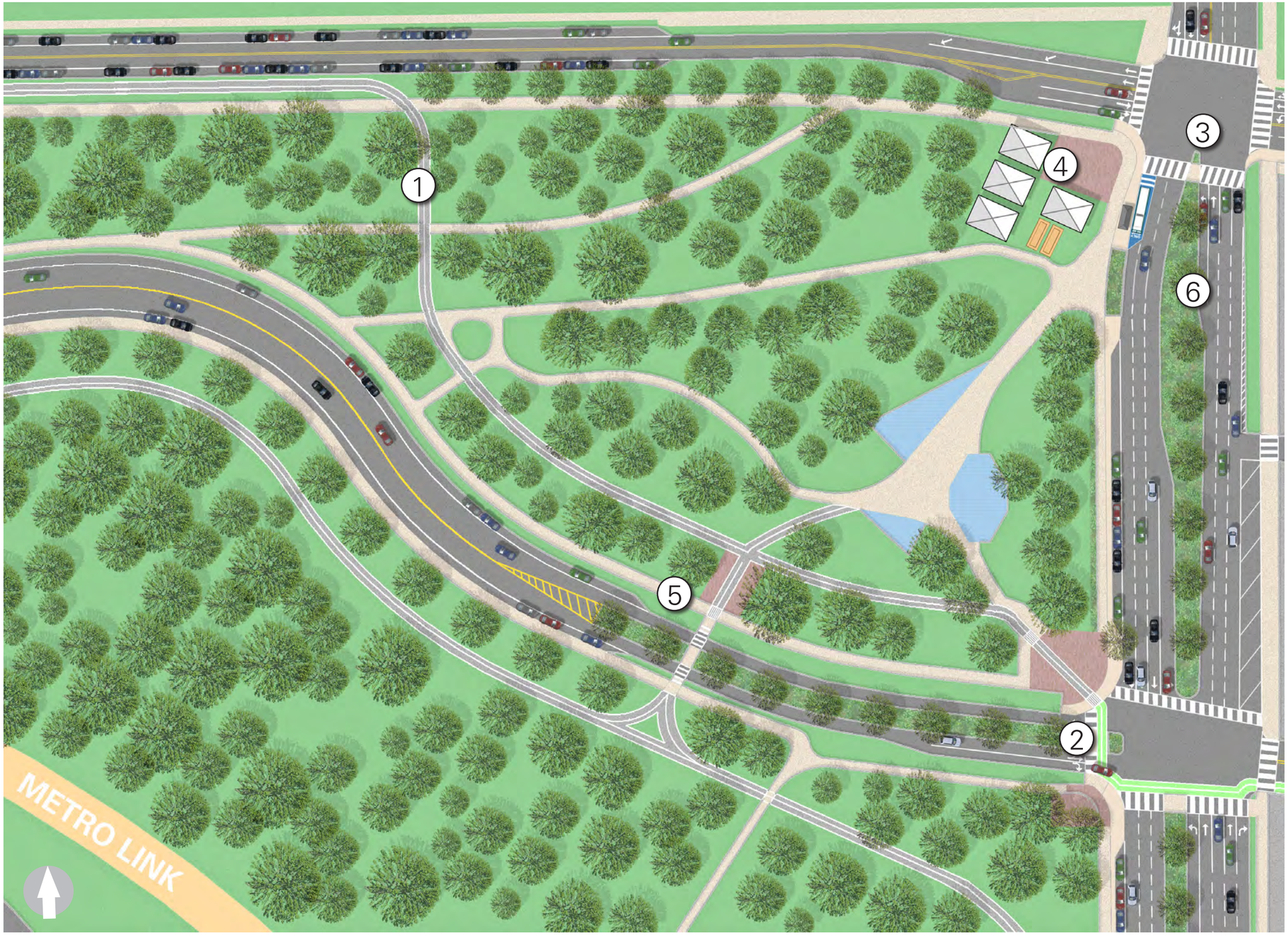


Figure 1: Proposed improvements and realignment of West Pine as it enters Forest Park

WEST PINE ENTRY

In order to maintain access to Lindell Boulevard, the left NB lane on Kingshighway could be converted into a left-turn lane, maintaining the center lane for through traffic, and the right lane for through and right-turn traffic (right turn movements are less than 10% of total NB movements). This solution would remove one lane and therefore reduce the crossing distance across Kingshighway. This recommendation should be confirmed with updated traffic data and should be tested along with the pilot test of the Lindell Boulevard reconfiguration. Some left-turn movements however, may continue onto Forest Park Parkway with the new intersection at Kingshighway Boulevard.

The sense of arrival to this Park entrance can be reinforced by the addition of a boulevard and entry marker. According to traffic movement counts, there is no need for two travel lanes per direction on West Pine Drive west of Kingshighway. The recommended entry configuration reduces the intersection to one lane in either direction with a right turn lane going south on Kingshighway Boulevard to accommodate the high number of turning movements that occur in this location.

The 2013 traffic counts indicate that 64% of the eastbound traffic at this intersection turning right on Kingshighway Boulevard originates from Lindell Boulevard (eastbound traffic turning right on West Pine). With the closure of West Pine from Lindell to Grand, traffic volumes on West Pine will decrease, but right turns will still be higher than through traffic to West Pine east of Kingshighway. To keep traffic moving, the recommended configuration maintains a right turn lane with a 100-150' stacking length. The increased boulevard median, reduced traffic speeds and addition of enhanced crossings at West Pine will improve pedestrian and cyclist safety. Crosswalks traversing Kingshighway Boulevard and Lindell Boulevard can also be improved by making them wider – to accommodate the higher number of pedestrians and cyclists crossing from the Central West End. Locating temporary programmed activities just inside the Park entry will ultimately make the northeast corner of the Park a more attractive entry point from the adjacent neighborhoods.

IMMEDIATE ACTION ITEMS

a **The City should perform a traffic study** showing updated data at least 6 months after the opening of Forest Park Parkway at Kingshighway. Data collection and evaluation should be coordinated with the recommendations for realignment of Lindell Boulevard, Union Boulevard entry and the westbound left turn off Kingshighway Boulevard.

b Seek small-scale **pop-up events** to reactivate the northeast corner of the Park.

c **Improve signal timing** safety using LPI (Leading Pedestrian Inverval).

SHORT-TERM ACTION ITEMS

d **Pilot test** the removal of West Pine between Grand Drive and Lindell Blvd using temporary materials such as raised planters and re-striping. The pilot should include the provision of a left-turn lane off Kingshighway onto Lindell Boulevard.

e **Enhance crosswalk visibility** at Lindell and West Pine crossing Kingshighway.

LONG-TERM ACTION ITEMS

f If the pilot test is successful, perform the design and construction needed to **close West Pine** between Grand Drive and Lindell Boulevard.

g **Add planted median, crosswalk, and pedestrian refuge** to West Pine to allow further accessibility, safety, and convenience for connecting into the Park.

4

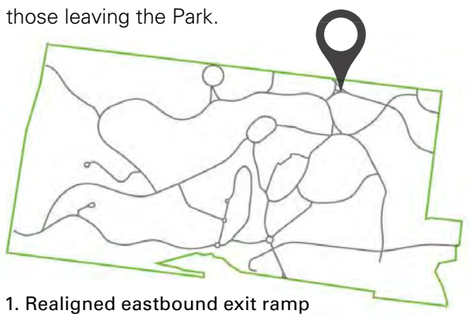
UNION BOULEVARD ENTRY

UNION BOULEVARD ENTRY

The recommendation to reduce congestion at other Park entries and the imminent need for reconstruction of the existing bridge structure over Forest Park Parkway and Metrolink at Union creates an opportunity for Union Boulevard, at the Union/Lindell intersection, to become a more significant access point. Reimagining the Union/Lindell intersection can transform this entryway into a new multimodal entrance for all types of Park visitors.

With the construction of Forest Park Parkway complete, the opportunity is ripe to reinvent this Park gateway. The Union Boulevard entry into Forest Park currently supports 4% of total vehicular entries. The desire to reduce congestion at other Park entries creates the opportunity for Union Boulevard to become a more significant access point. According to the City of St. Louis, the bridges over Forest Park Parkway and Metrolink lines are nearing the end of their life and in need of replacement. This provides an opening to reconfigure the current vehicular, pedestrian and bicycle access into the Park at this location.

The proposed solution includes an elliptical roundabout to allow consolidation of all approaches and elimination of signals. Because all vehicles approach the roundabout at the same speed, this will result in improvements to safety. Realigning the eastbound exit ramp from Forest Park Parkway will remove the current stop sign intersection at Lindell and improve traffic flows. A new westbound on-ramp to Forest Park Parkway will provide a more convenient exit route for those leaving the Park.



1. Realigned eastbound exit ramp
2. New westbound on-ramp
3. Improved pedestrian crossings
4. Integrated bike lane
5. New pedestrian + bicycle Park entry
6. Vacated Catlin Tract property
7. Convert street to smaller driveway access
8. Maintain parking lot access
9. Entry marker opportunity
10. Cabanne House
11. Underpass entry

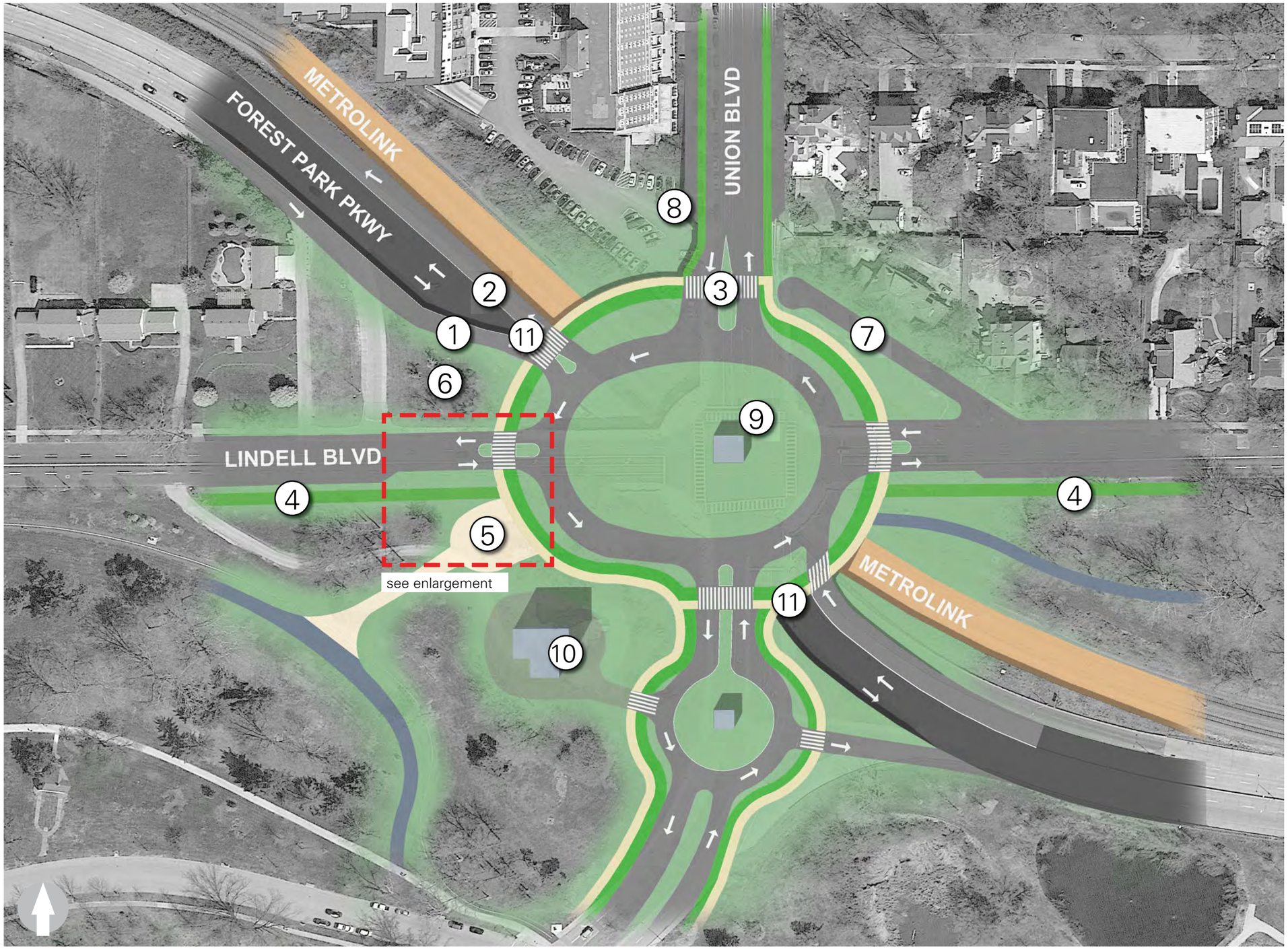


Figure 1: Proposed new entry at Union Boulevard and Lindell Boulevard

UNION BOULEVARD ENTRY

Larger sidewalks will accommodate safe pedestrian and cyclist crossings, bicycle lanes and improved crossing facilities. An integrated protected bicycle lane can act as an extension of the existing dual path system in the Park connecting the Murphy Lake area to the on-street bicycle lanes along Union Boulevard.

The central space within the roundabout allows for the creation of a grand entry to the Park with gateway features acting as a wayfinding tool for visitors navigating the Forest Park area. The proposed configuration also cretes the opportunity for new entry plazas and improved access and visibility into the Park.

The implementation of this project should be coordinated and evaluated with the proposed West Pine realignment and new westbound left turn off Kingshighway as well as the realignment of Lindell Boulevard.

Specific interventions include:

- Creation of an elliptical roundabout will allow consolidation of all approaches and elimination of signals. Because all vehicles approach the roundabout at the same speed, this will result in improvements to safety.
- The existing Parkway eastbound off ramp intersection/stop sign at Lindell will be eliminated and incorporated into roundabout.
- The addition of a westbound access ramp to FP Parkway will allow traffic exiting the Park to access Forest Park Parkway going west, alleviating traffic on neighborhood streets.
- Changing the Cabanne House vehicular entry from Lindell to Union allows additional Park space to be reclaimed and the creation of a visible entry point off of the roundabout and direct access to the dual path system.
- Bicycle and pedestrian traffic will be directed around the perimeter of the roundabout, connecting with existing facilities on Union and proposed facilities on Lindell.

1. Off-street bicycle paths
2. Improved bicycle lanes and sidewalks
3. Enhanced crosswalks
4. Planted lane separation medians
5. New entry plaza
6. Planting

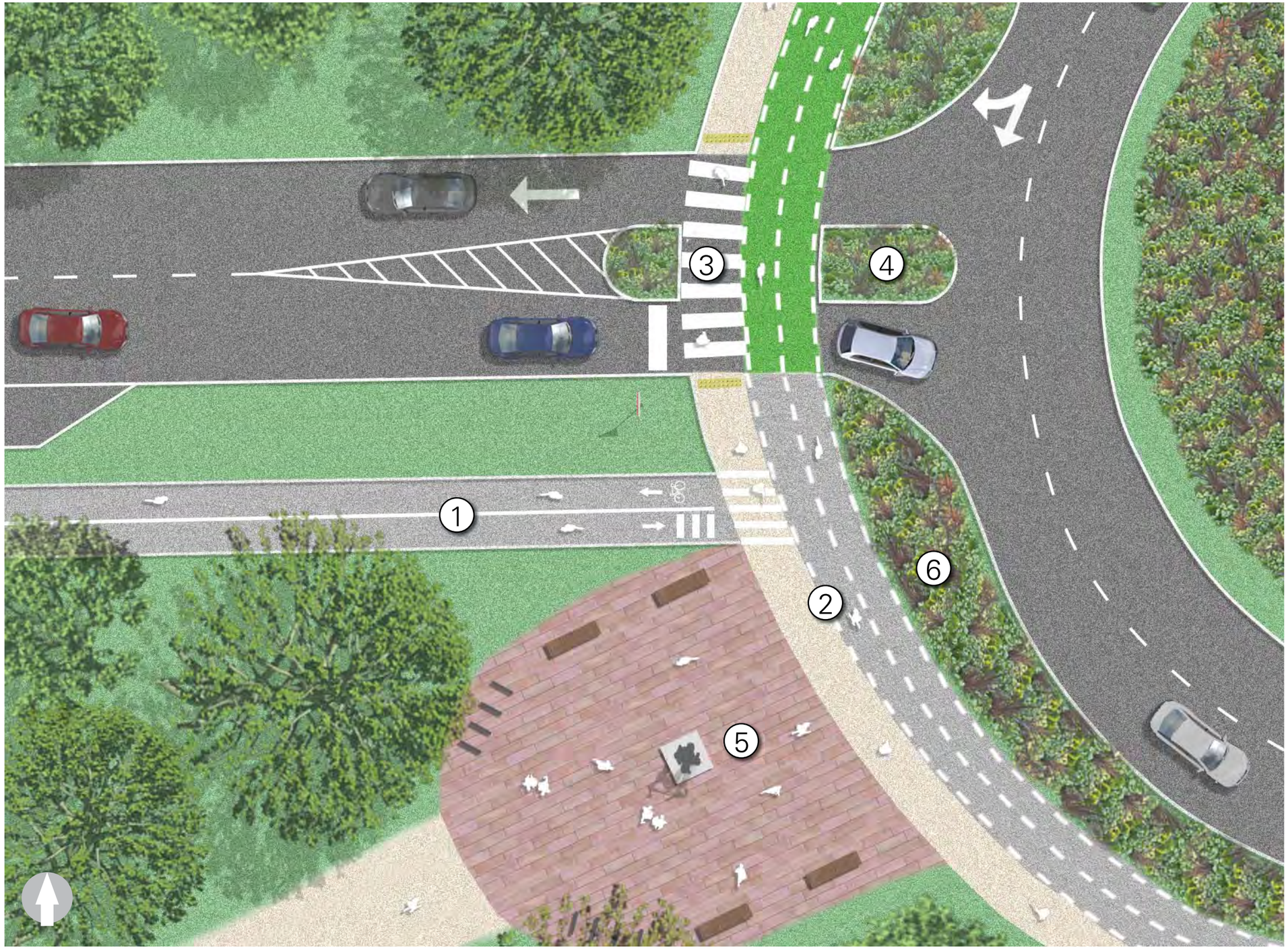


Figure 2: Detail view of proposed pedestrian and cyclists' new entry at Union Boulevard

FOREST PARK PARKWAY / DES PERES

FOREST PARK PARKWAY / DES PERES INTERSECTION

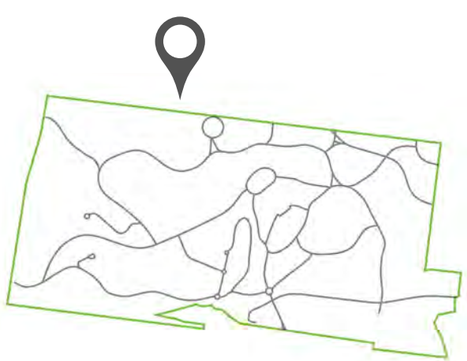
Residents north of the Park attempting to cross Forest Park Parkway face access challenges due to high traffic speeds, lack of sidewalks and unsafe crossings.

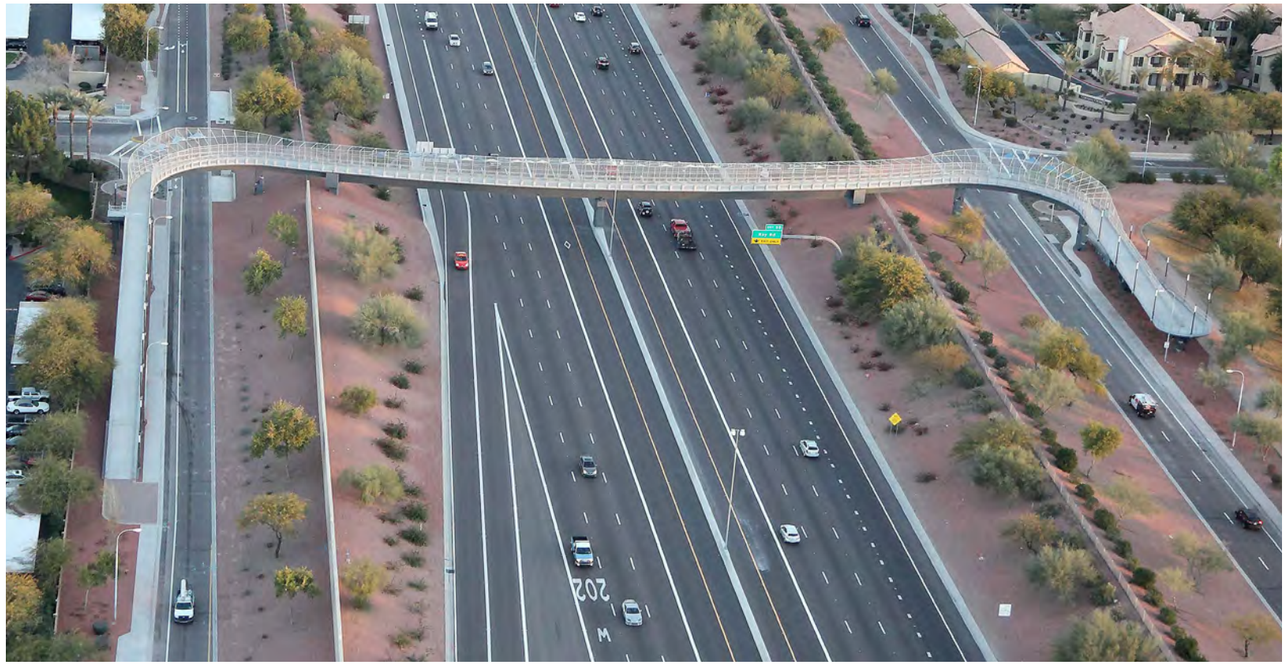
In the immediate term, the existing bridge crossing should remain after making significant improvements to visibility and safety. This can be achieved by introducing new pavement markings, a new pedestrian refuge and other improvements as described in figure 2.

In the longer term, two alternatives are recommended for better connecting Forest Park to the adjacent neighborhoods to the north:

1. A pedestrian overpass extension to the existing Metrolink overpass. Adding an extension to the existing ramp on the south side would increase the total bridge and ramp length to 600 ft. In addition, achieving 14.5' vehicle clearance under the overpass and providing ADA access will require an additional 230ft ramp to extend west along the north side of Forest Park Parkway. After reviewing multiple precedents of pedestrian bridges, a design in Chandler, Arizona was determined to accomplish similar goals.
2. A combination of pedestrian and bike elevators combined with an overpass. This alternative will provide a more direct route but at a significantly higher cost. Research indicates that enclosed spaces in elevators can become a crime hotspot and provide the perpetrator the opportunity to control the situation. If this alternative is chosen, Crime Prevention through Environmental Design (CPTED) principles should be applied to mitigate possible safety issues. A glazed elevator and open bridge structure with good lighting and clear approaches are recommended.

In either alternative described above, in order for the existing crosswalk to function, we recommend planning for an alternative route for times when ramps or elevators are inaccessible.





Precedent pedestrian bridge located in Chandler, Arizona

18th Street Pedestrian Overpass, Brooklyn, Portland

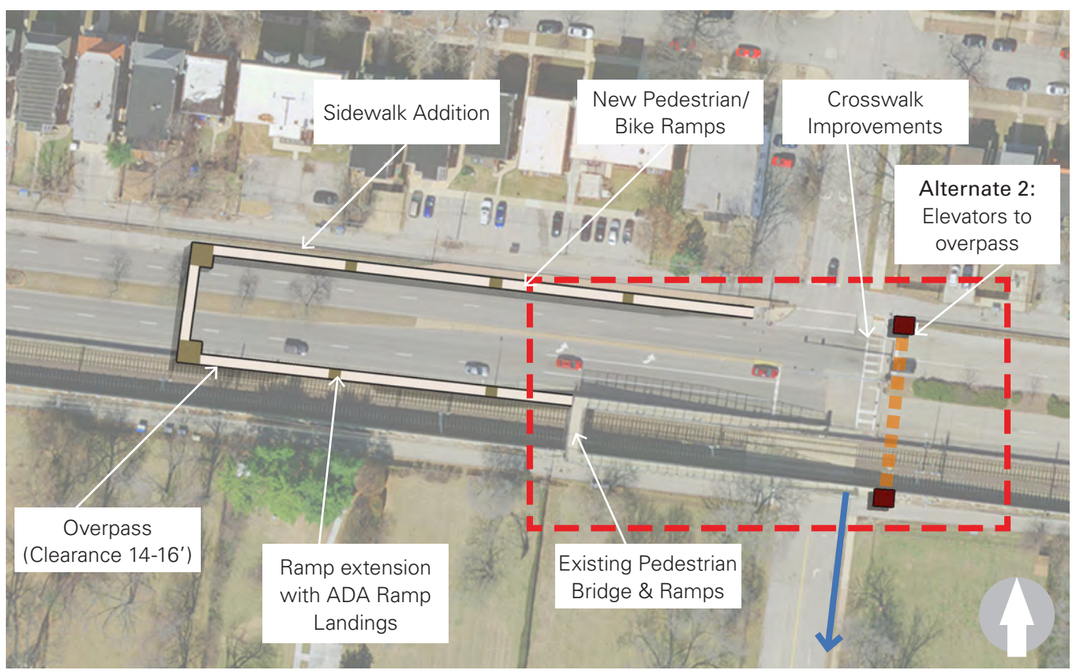


Figure 1: Alternate approaches to improving pedestrian and bike access across Forest Park Parkway at Des Peres: Ramped access or elevators to overpass.

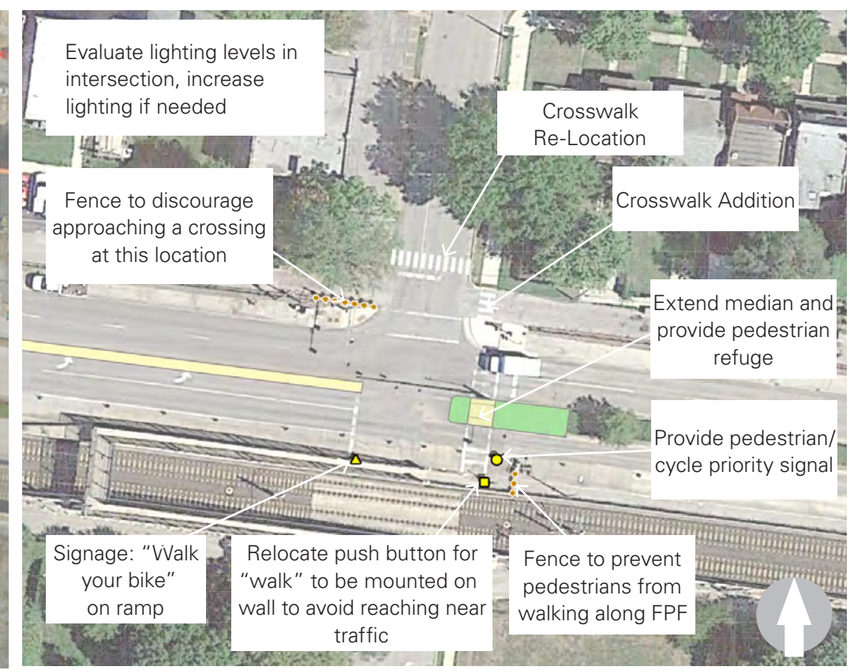


Figure 2: Immediate-term safety improvements to crosswalk

4c

TRANSIT HUB

CREATING A TRANSIT HUB

The Festival and Parking Plaza, also known as the Upper Muny Parking Lot, has a capacity of approximately 750 vehicles, but is underutilized during the day when other parking lots around the Park are congested and full as well as in the evening during the Muny and events, in addition to being generally underutilized during the Park's off season.

As recommended in the Park Systems section of this study, creating a central transit hub in the Park will encourage a more sustained and consistent use of this lot during the current low peak hours. Visitors parking in the Festival and Parking Plaza will have multiple options to connect to Park institutions and destinations including the Park circulator, bike share and new walking path connections (see 3.7 Pedestrian System). These opportunities for shifting travel modes should be communicated through the proposed data management framework allowing visitors to understand parking opportunities before they leave for the Park and/or as they arrive to the Park (see 3.4 Signage and 3.5 Data Management). This facility will also provide access to food vending, pop-up vendors, and improved restrooms, making it a reliable and comfortable place for visitors to land when they come to the Park.

1. Circulator route
2. Two-way bus loading zone
3. Pop-up vendor and food truck area
4. Bike share station
5. New restrooms
6. New path connection
7. New directional signage

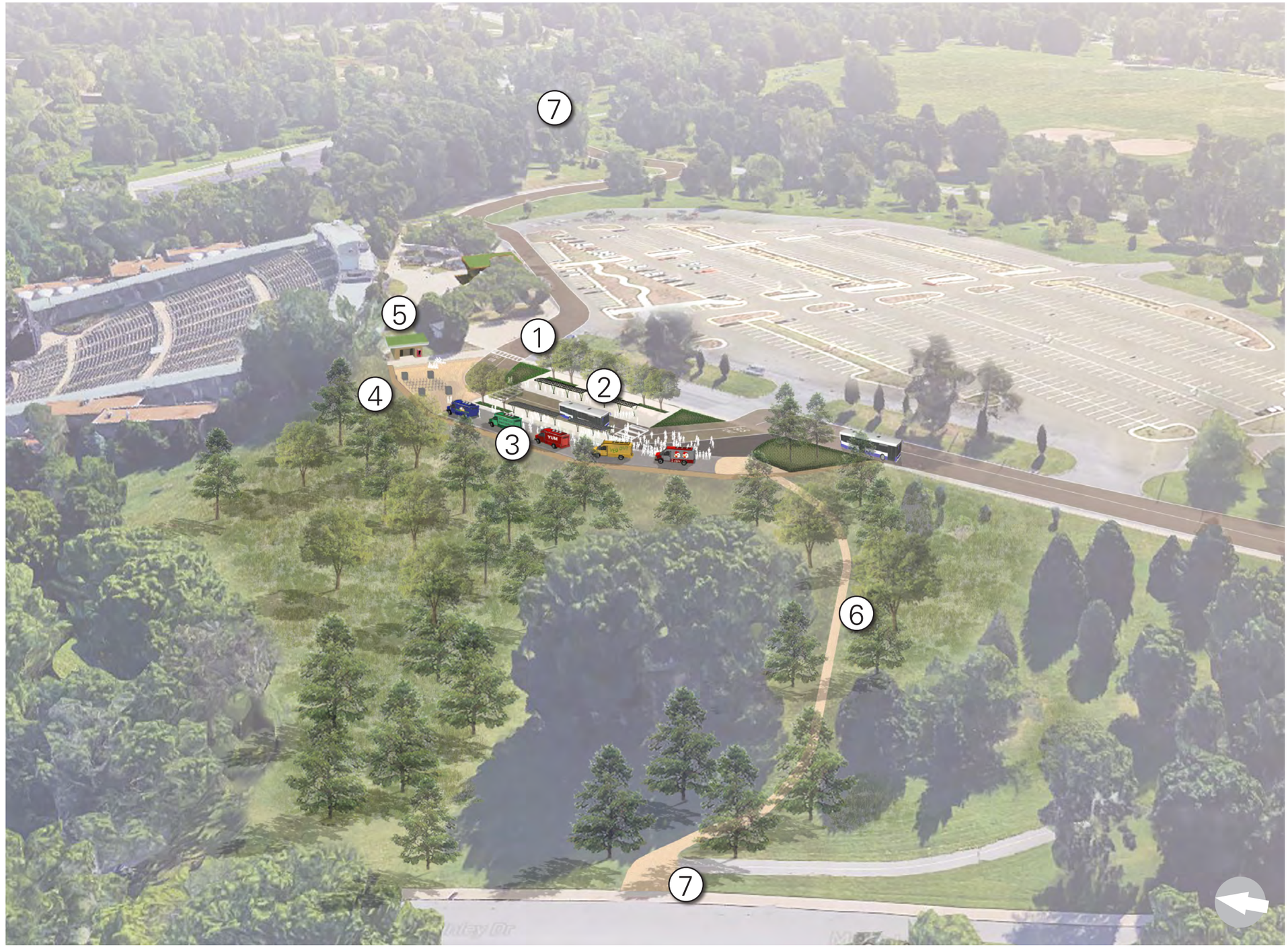


Figure 1: Artists impression of proposed improvements at the Festival and Parking Plaza

UNDERUTILIZED STRUCTURES

UNDERUTILIZED STRUCTURES

Given limitations on new development in the Park as specified in the 1995 Forest Park Master Plan, there may be opportunities to leverage existing structures in the Park that are seasonal or underutilized for potential expansion of concessions, retail amenities or programming. These structures include: (1) the Steinberg Skating Rink, which draws 60,000 to 70,000 visitors from November through February, but normally remains dormant for spring, summer and early fall, however this summer shuffleboard will be available at Steinberg. (2) The Forest Park Fish Hatchery building, which is used occasionally for educational programming and as a construction project management office; and (3) the Cabanne House, which is currently used as a rental event space; and the comfort station near Grand Drive that is currently vacant.

MARKET ANALYSIS AND STRATEGY - KEY TAKEAWAYS

1. Forest Park is critical to the economic future of the region.
2. There is an opportunity to celebrate pluralism, reflect our culture, and increase the user experience opportunities.
3. Food and dining experiences can be used to highlight local entrepreneurs, regional heritage, culture and identity.
4. Leverage local talent and organizations to promote more music, art, culture, and education in the Park.
5. Interventions can include temporary/pop-up experiences and activating underutilized or seasonal structures.
6. Analysis indicates market capacity for additional development that complements nearby commercial and dining. Underserved demand can be met by adding "net more" commercial dining development in the area without negatively impacting current dining operations.

STEINBURG ICE RINK

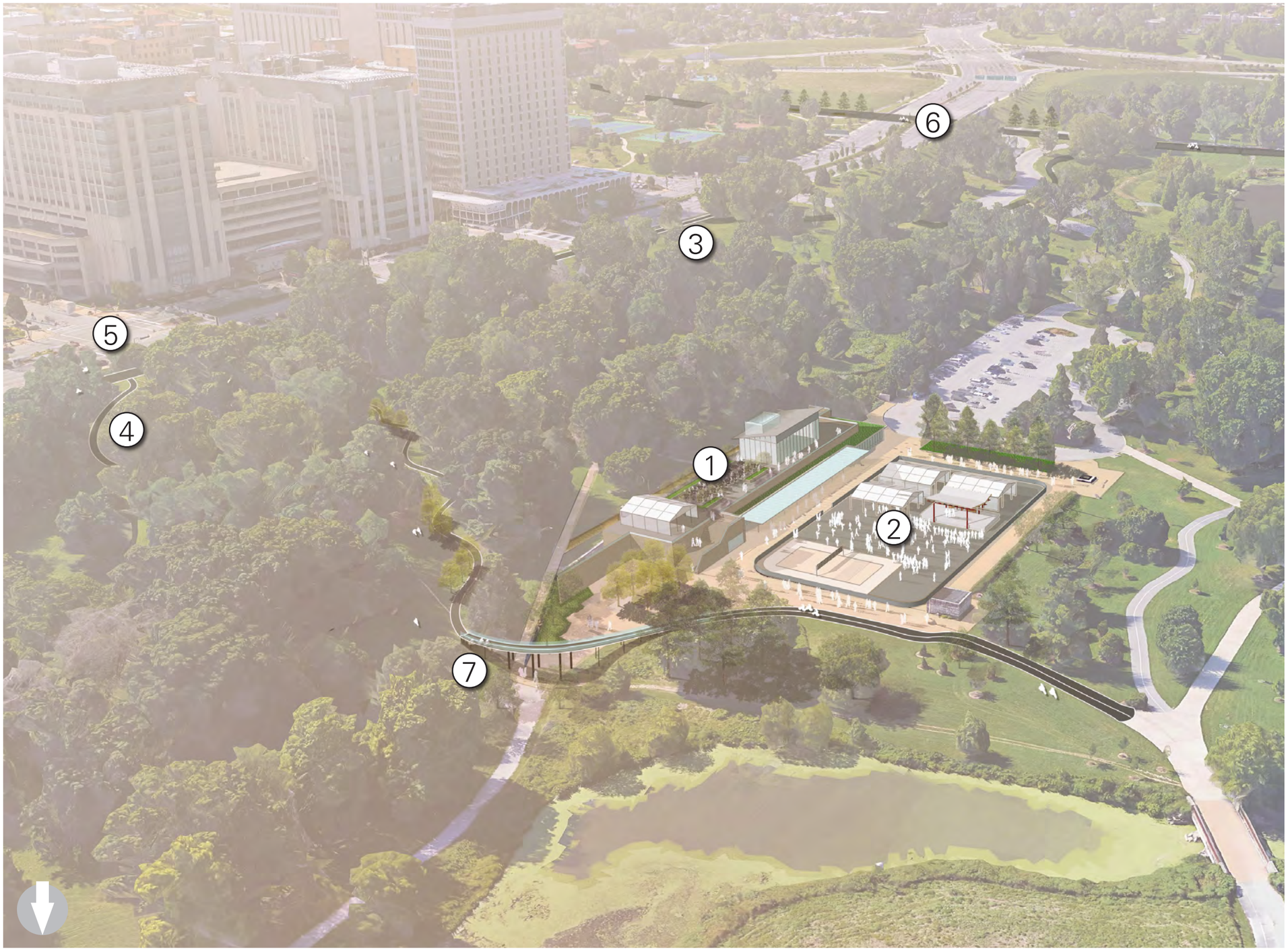
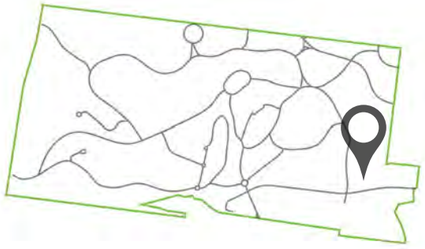


Figure 1: Artist's rendering of the proposed improvements to and near Steinberg Ice Rink

STEINBERG ICE RINK

The future of Steinberg Ice Rink envisions a rooftop restaurant on top of the existing structure. While ensuring the preservation of the beauty and tranquility of this part of the Park, the concept is intended to help more visitors enjoy this area through a new access path and bridge from Kingshighway Boulevard, improved lighting and safety, opportunities for food service and events as well as improved seasonal programming during the non-skating season. The concept improves neighborhood connections to the Central West End Neighborhood while engaging and extending the dual path system along Kingshighway Boulevard.

Implementation of this concept must account for building upgrades while respecting the character of this iconic, 60-year old attraction. In addition, the new path connection from Kingshighway Boulevard has a significant grade change. The existing "desire" paths down the hill exceed 5% slope, making them unsuitable for biking or wheelchair access. Extending the walk into a flyover can provide an ADA accessible path, a unique experience as visitors walk through the dense tree canopy, as well as an opportunity to create an architectural statement in this location.



1. Restaurant & Event Space
2. Spring/Summer/Fall Programming
3. Extended Dual Path System
(Separate from this study and scheduled for construction Summer/Fall 2018)
4. Enhanced Connection to Central West End
5. High Visibility Crosswalk
6. Clayton dual path to east
7. New path connection and iconic bridge

STEINBERG ICE RINK

Expanding the use of the Steinberg Skating Rink presents a market-based opportunity to capture consumer demand for food, beverages, and other concessions. Given the size and configuration of the space and access to parking, providing more programming and activities outside of "ice skating season" could establish a new activity hub and destination in the Park. The market-based opportunity for this site is supported by its prime location less than a half mile from one of the region's primary employment hubs (BJC HealthCare), within walking distance to the one of the region's most active housing markets in the Central West End, and possibly near the entry for the future Chouteau Greenway (Great Rivers Greenway). The Steinberg parking lot also provides a "gateway" to Forest Park for many joggers, cyclists, and other users in the spring and summer months creating added visibility and marketability for the site. In addition to enhancing the dining experience in Forest Park, this site could also offer expanded recreational activities such as court sports, roller skating or splash pad for the spring/summer season, additional special event or performance space, and as well as a location for a bicycle hub that could include repair shop, pop-up retail, and secured bicycle parking.

Potential Uses

- Restaurant/beer garden/event space
- Summer/Spring sports outdoor recreation center
- Bicycle hub (repair, shop, gear/retail, secured bicycle parking)
- Outdoor theatre or concert space
- Fishing pole rental and instruction

Funding and Costs

As a market-driven use, operations and maintenance costs could be supported by leasing agreements, fees, and taxes. Operational costs for recreational uses or a bicycle hub could be covered by a third party non-profit or organization or the future bike share operator. Initial capital costs for renovation/rehabilitation would likely require a public-private partnership or capital campaign.

Implementation

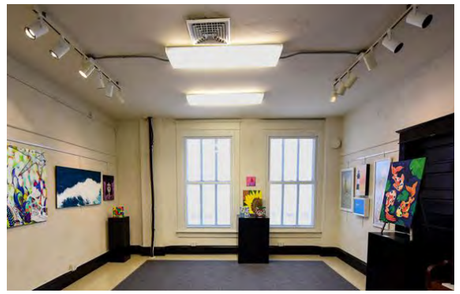
- Develop RFP (development criteria).
- Align signage, wayfinding, and connectivity to and from other Forest Park main destinations including The Muny, St. Louis Science Center, and St. Louis Zoo.
- Align signage, wayfinding, and connectivity to and from adjacent areas outside of Forest Park, especially BJC HealthCare, Central West End and CORTEX.
- Develop food and beverage "pop-up program" to increase marketability and visibility of space/site.
- Explore partnerships with hospitality businesses, breweries, and other potential vendors/operators.
- Explore leasing structure to allow for multiple annual operators (leases by season) and/or special events and performances.
- Determine useful life of existing ice rink (refrigerants).
- Explore partnerships with GRG, Trailnet, and other regional bicycle advocacy groups to analyze feasibility of the development of a bicycle hub facility.

CABANNE HOUSE

The Cabanne House is currently used as a rental space for weddings and special events. Given its location with vehicular access from Lindell Boulevard, limited parking availability, and relative proximity to the Boat House and Visitor's Center, the space is less conducive to a permanent location for food, beverage, or concessions. Though the space could provide a unique experience as a café or coffee shop, there likely is not enough vehicular or pedestrian traffic to maintain the desired flow of customers. However, the programming of the building could be expanded to include a more diverse range of "destination" special events, including pop-up restaurants, art exhibitions, performances, and other activities. These types of uses could help develop and formalize St. Louis identity and culture in Forest Park as well as enhance the dining experience.

Potential Uses

Special event space with expanded programming to include art events, pop-up restaurants and performances



Funding and Costs

The facility was last renovated in 2006, so future renovations and operational costs would have to be determined by a physical property assessment/inspection. Given the limited market support for a permanent year-round use with a standard leasing structure, future operations and maintenance should be supported by user fees/agreements. A third-party, non-profit organization/conservancy should be considered for maintaining a more active programming schedule and fundraising for capital improvements.

Implementation

- Conduct physical assessment/inspection of property to determine current and future renovation and maintenance costs.
- Develop operational structure in which user fees directly support operations and maintenance of facility.
- Explore formation of a third-party programming organization, concessionaire or conservancy for Cabanne House or multi-year concessionaire contracts.
- Explore partnerships with regional arts organizations and institutions for use of space, including but not limited to: Regional Arts Commission (RAC), St. Louis Art Museum, Center for Creative Arts (COCA), Contemporary Art Museum (CAM), Craft Alliance Center of Art + Design, and Art St. Louis.
- Conduct outreach with local pop-up restaurants and hospitality community by contacting key representatives with Riverfront Times, Feast, and St. Louis magazines and local chefs and restaurateurs.

FISH HATCHERY

The Fish Hatchery Building has been used intermittently as a Park Ranger station, an education center and a construction management office for projects in the Park. The programming of the building could be expanded to include a more diverse range of "destination" special events, including pop-up or limited-duration restaurants or concessions, art exhibitions, performances, and other activities. The market potential for full time dining may be challenging given the site's distance from other activity centers in the Park, and limited on-site parking (although there is usually ample on-street parking on Grand Drive)." Additionally and given the more bucolic environs in this portion of the Park makes the Fish Hatchery suitable as an education or community center. The surrounding grounds could be used as an "ecological classroom" for both youth education and workforce development related to horticulture, arboriculture, urban farming, and environmental science. Other uses could include a community center with meeting space or shared non-profit office space.

Potential Uses

- Ecology-based education center
- Community center
- Shared Non-Profit Office Space
- Special events

Funding and Costs

Given the limited market-based uses of the site, the creation of a more formalized education or community center would be resource-based, requiring fundraising for capital improvements and public subsidy, philanthropic funding, and/or user fees for operations and programming. In the near-term, partnering with existing youth education and/or community programs and organizations could minimize operational costs.

Implementation

- Conduct physical assessment/inspection of property to determine current and future renovation and maintenance costs.
- Explore partnerships and/or shared use agreements with local youth education and workforce development agencies and organizations, including, but not limited to: City of St. Louis YouthBuild, Urban League, Gateway Greening, and St. Louis ArtsWorks.
- Explore partnerships and/or shared use agreements with local schools and institutions, including, but not limited to, St. Louis Public Schools, St. Louis Community College, Washington University, St. Louis University, and University of Missouri-St. Louis.

PARK MAINTENANCE BUILDING

The Parks Maintenance Building and envrions is the home to most of the City of St. Louis Department of Parks, Recreation and Forestry's maintenance supplies and equipment as well as office space. This location also houses the Department's equipment, materials storage and supplies. The historic structure presents a market-based opportunity for food, beverage, and other concessions given its location within relative proximity of the Park's primary activity centers, visibility from Interstate 64, and accessibility from the Hampton Street entrance. Given the size, configuration, and curb appeal of the structure, a food hall and/or marketplace could be a potential future use, although a feasibility and market analysis would be needed to proceed. Feasibility should address the posibility for select Department services to remain, while a new use occupy the historic structures as the "front door." Other uses could include office or classroom space in coordination with St. Louis Community College-Forest Park. The City of St. Louis would also have to determine an alternate location of its park operations as would Forest Park Forever have to find other facilities for its Land Management operations.

Potential Uses

- Food hall
- Public market
- Office/classroom space

Funding and Costs

As a potentially market-driven use, a large portion of the capital costs for the adaptive reuse could come from the private sector, although public subsidy would likely be needed to bridge the "feasibility gap." The project could potentially leverage Historic Tax Credits as well as other public funds from local and regional economic development and tourism organizations to partially finance the renovation. Given the current development of the City Foundry STL Public Market, less than two miles east, a market study is needed to evaluate the market feasibility for an additional food hall/public market concept. Using the site for classrooms or institutional space would likely require a capital campaign (Historic Tax Credits are typically only awarded for income generating uses) with operational costs and use fees from the institutions themselves.

Implementation and Key Criteria

- Conduct highest and best use/market analysis for the adaptive reuse as a food hall or market place.
- Conduct needs assessment and costs analysis of City of St. Louis Department of Parks, Recreation and Forestry operations and Forest Park Forever Land Management.
- Explore eligibility of Historic Tax Credits and other public subsidies to partially finance capital costs for renovation/rehabilitation.
- Explore partnerships and/or shared use agreements with local institutions, including, but not limited to, St. Louis Community College, Washington University, St. Louis University, and University of Missouri-St. Louis.

Allowing flexibility for a wider range of vending options could provide a short-term, low-cost solution to expanding the food and beverage experience in the Park. Since these interventions can have little to no capital costs, are less dependent on physical structures, and can be seasonal in nature, the implementation should focus on policies, procedures, and partnerships. By allowing more "pop-up" opportunities for food, beverage, and other concessions there are opportunities to capture market demand, but also pilot certain types of offerings and allow for community-based programs. By formalizing policies and procedures as they relate to food and beverage, there are also opportunities to better promote healthy eating, lifestyles, and outcomes through a healthy vending policy such as in cities like Chicago and Minneapolis. Finally, there is a need to allow for greater flexibility for non-conventional or innovative food vending such as rickshaw picnic basket cart or on-demand delivery service.

Grand Drive Comfort Station

The Comfort Station off of Grand Drive between Union and Cricket drives offers an opportunity for expanding the vending and concessions opportunities in the Park given its prime location and visibility for motorists and users of the trail system. This structure could host a number of concessions-oriented uses such as vending machines, small café, coffee shop, or pop-up shop for seasonal and/or artisanal food, arts, and crafts. Though there would be limited space for seating inside, the area just south of the building could include a patio with outdoor seating during the spring and summer season.

Potential Interventions

- Healthy vending machines
- Picnic baskets
- Expanded concessions offerings
- Temporary stands
- Use of Grand Drive Comfort Station

Funding and Costs

Most of these interventions have little to no costs beyond the operator/vendor itself. The use of Grand Drive Comfort Station as concessions stands or to house vending machines would have minimal costs, although some renovation/reconfiguration would be required. Vending machine operators typically cover equipment costs, although much of this is determined through the business/lease agreements. Permitting fees for temporary or seasonal vendors, such as food carts or stands, could cover additional costs incurred by Forest Park, including insurance, additional trash pick-up, and other regulatory costs related to temporary structures or vendors.

Implementation and Key Criteria

- Conduct physical assessment/inspection of comfort stations to determine renovation costs for using as concessions/vending locations.
- Conduct space assessment and feasibility analysis for Grand Drive Comfort Station.
- Formalize policies and procedures related to vending in Forest Park, including huckster and peddlers policies, temporary stands and structures, and permitting processes.
- Explore the development of healthy vending policy for Forest Park and potentially City wide.
- Explore collaborations with local food purveyors/producers as current and future concessions locations.
- Develop policies and opportunities for non-conventional and innovative food delivery, like rickshaws, food carts, or on-demand service.

4.1

100-YEAR VISION

100-YEAR VISION

THINKING FORWARD

Why is it useful to have a 100-year vision? A typical park master plan looks 10 to 20 years in the future, with all conclusions based on the best available information. Envisioning the future of Forest Park in 100 years forces us to think about possibilities that are not necessarily feasible in the present, but focused on an aspirational future - one that is not constrained by current technologies, regulations or social behaviors.

Interstate 64 adjacent to Forest Park has been rebuilt multiple times since it was originally constructed. Will it be rebuilt three more times in the next 100 years, and if so, how different will it be in that distant future? Considering the opportunities addressed in this study, what conditions could change over time to improve safety, convenience and accessibility to the Park?

By 2118, Interstate 64, or the area that is currently the Interstate, should serve as an extension of the Park - a way to relink the Park to the neighborhoods to the south. This could be accomplished by burying the highway segment adjacent to the Park below grade or by creating a deck or "lid" over the interstate. If a multi-lane highway is not needed in this location due to social or technological advancements, the highway can simply be filled in with green space – a highway becomes a park. This would allow the neighborhoods to connect directly to the Park and encourage the economic revitalization of Dogtown and areas adjacent to the Park which once had Park frontage. The Forest Park Southeast/Grove neighborhoods could then benefit from an extended Park footprint as the Park reaches out like green fingers in the those neighborhoods. Likewise on the north side, Forest Park Parkway could be buried or covered to create a seamless connection with the neighborhoods to the north. The proposed Chouteau Greenway connection into Forest Park could occur over I-64 or over Kingshighway to ensure improved greenway access east to dowtown and the Arch grounds.

Similarly, Kingshighway Boulevard could be restored to its original design intent to link the major parks of St. Louis - perhaps serve as a linear Park itself. As the Central West End continues to densify over time, boundaries between this vibrant district and the Park should be blurred. More than ever, when in the Central West End you should feel as if you are already in the Park. As Kingshighway links the major parks of St. Louis, the Great Rivers Greenways will continue to stitch neighborhoods together and to the Park with increasing safety and ease.

The historical ecology of the Park's natural areas could be restored - serving the region by cleaning the water and providing even more urban wildlife habitat through reforestation of those parts of the Park that were affected during the World's Fair.

Figure 1: Artist's impression of Forest Park in 2118

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IMPLEMENTATION

The following tables provide a probable opinion of cost for the capital projects identified in this study. Due to the physical and operational breadth of the recommendations, the stakeholder responsibility is identified.

Note that implementation of roadway configuration changes or signalization improvements by City Streets would follow the typical process through the Board of Public Service. Federally funded projects will requre local investment.

PROBABLE OPINION OF COST

PROJECT	TIMELINE	SUB-PROJECT	CAPITAL COST	STAKEHOLDER RESPONSIBILITY	ASSUMPTIONS	NOTES
SITE-SPECIFIC PROJECTS						
Forest Park Parkway/Des Peres Intersection and Crossing	Short-term	Existing intersection improvements	$138,864	FPF, City Streets, City Traffic	Project Cost	Concrete Curb ramps, Curb, 4" W Paint, 24" W Paint, ADA Domes, Ped Signal
	Long-term	Elevator + pedestrian overpass	$2,304,133	FPF, City Streets, City Traffic	Project Cost	Elevator, 8' Ped Bridge, Fence barrier, handrails, ADA landings, grading, drainage, bike path
West Pine/Grand Drive Realignment and Entry		Coordination with other site-specific projects: Union Entry, Lindell Boulevard Realignment, West Pine Entry/ new left turn off Kingshighway Boulevard should be evaluated and executed in coordination.	$2,822,552	FPF, City Streets, City Traffic	Project Cost	Pavement & SW removal, Medians, Bike path, travel lane, curb, 24" W Paint, landscaping, ADA Domes, BMPs
Transit Hub at the Festival & Parking Plaza at the Upper Muny			$3,036,180	FPF, Metro	Project Cost	Rock base, Asphalt, sidewalk, curb, earth fill, retaining wall & Fence, pavilions, bike share station, restrooms.
Union Roundabout and Entry		Coordination with other site-specific projects: Union Entry, Lindell Boulevard Realignment, West Pine Entry/ new left turn off Kingshighway Boulevard should be evaluated and executed in coordination.	$14,141,620	FPF, City Streets, City Traffic	Project Cost	Removals: (SW, C&G, Pavement, Signals), Agg Base, Concrete Pavement, Guardrail, Median, SW, Bridge Wall, Lighting, Seeding
Ped-Bike Bridge - KHWY to Steinberg			$1,764,800	FPF, City	Project Cost	Multiuse path, bridge & pavement, ADA Landings, earthwork, drainage
Clayton Underpass	Short-term	Realignment for dedicated bike lanes	$113,946	FPF, City Streets, City Traffic, BJC	Project Cost	Curb, BMP, Paint: (24" White , 4" White, 10' Green, 4" Yellow), SW removal, mixed use path, MSE Wall
	Long-term	New underpass alignment	$4,936,307	FPF, City Streets, City Traffic, BJC	Project Cost	Curb, Pavement Paint, Bridge Replacement, Greenway, Planters & trees, Earthwork.
New Pedestrian Connections			$636,365	FPF	Project Cost	Walking & bike paths, Curb R&R, Pavement Paint, grading, drainage.
Tamm Bridge	Short-term	Reconfigure bridge arrangement	$232,089	FPF, City Streets, City Traffic, MODOT	Project Cost	Barrier R&R, Fence R&R, SW, pavement markings, stop signs.
	Long-term	New underpass alignment	$1,645,436	FPF, City Streets, City Traffic, MODOT	Project Cost	Excavation, new underpass construction, realign trail.
Skinker Boulevard	Short-term	Improve crossings, bike ramps	$2,892,055	FPF, City Streets, City Traffic	Project Cost	Curb, Landscaping, Pavement markings, SW, Bike Path, Brick Pavers, Bumpouts
	Long-term	Signalization and turning volume studies	$150,000	FPF, City Streets, City Traffic	Project Cost	
Lindell Boulevard Realignment	Short-term	Pilot test. Coordination with other site-specific projects: Union Entry, Lindell Boulevard Realignment, West Pine Entry/new left turn off Kingshighway Boulevard should be evaluated and executed in coordination.	$99,400	FPF, City Streets, City Traffic		

PROBABLE OPINION OF COST | GREAT STREETS PROJECTS

PROJECT	TIMELINE	SUB-PROJECT	CAPITAL COST	STAKEHOLDER RESPONSIBILITY	ASSUMPTIONS	NOTES
	Long-term	Construction	$4,267,349	FPF, City Streets, City Traffic	Project Cost	Curb, landscaping, pavement paint, bike path, bumpouts
Kingshighway Boulevard		Coordination with other site-specific projects: Union Entry, Lindell Boulevard Realignment, West Pine Entry/new left turn off Kingshighway Boulevard should be evaluated and executed in coordination.	$2,314,080	FPF, City Streets, City Traffic	Project Cost	Pavement Paint, Bumpouts, ADA Domes
UNDER-UTILIZED STRUCTURES						
Steinberg Ice Rink Restaurant			$7,920,000	FPF, City Planning	Project Cost	First floor interior and façade renovation 16000 SF @ $250/SF, new 7000 SF structure on roof @ $400/SFand 7000SF roof deck @ $110/SF.
Cabanne House			$600,000	FPF, City Planning	Project Cost	General repairs/upgrades, 3000SF @ $200 SF
Fish Hatchery			$1,200,000	FPF, City Planning	Project Cost	Basic historic renovation, roof, waterproofng, HVAC, ADA etc.
SYSTEM-WIDE IMPROVEMENTS						
Bike and Pedestrian System Improvements						
Bicycle Share Preparations			$5,134	FPF, bike share vendor	Per 10 bikes	5 dockless bike share racks, new paving, signage
Path/Trail Connections			$120		Per LF	10' wide shared asphalt path with cetner stripe
Lighted Routes in the Park			$171	FPF	Per LF	Lights at 70ft on center, fixture cost $10,000 ea.
Circulator System Improvements						
Circulator	Short-term		$8,500,000	FPF, Metro	Project Cost	High End Capital Costs
Bus stop	Short-term		$2,000		Per location	Access improvements, fixed signage

PROJECT	TIMELINE	SUB-PROJECT	CAPITAL COST	STAKEHOLDER RESPONSIBILITY	ASSUMPTIONS	NOTES
	Long-term		$30,000		Per location	Access improvements, "smart" shelter and fixed signage and interactive info kiosk. Cost can be offset by advertising
Green Stormwater at Bus Stops	Long-term		$50,000		Per location	
Priority bus lane	Short-term		$25		Per LF	Thermoplastic full lane coating only
PARKING AND TRAFFIC IMPROVEMENTS						
In-Park Streets- restriping			$10		Per LF	Restripe center line, parking bays, sharrows
In-Park Streets			$241,140	FPF, City Streets	Per Speed Table	Curb, ADA Domes, Cobble Stone Table, Drainage, Paint.
Additional 3-hour parking signs			$100		Each	New signs, attached to exsiting light pole
Parking occupancy: Alternative 1-lean smart counter		Total	$92,500		Per parking lot	Lean smart parking, using video processing or in/ out counters based on number of entry/exit lanes
		Zoo South Lot (paid)	$12,500		3 in/2 out lanes	
		Zoo North Lot (paid()	$10,000		2 in/2 out lanes	
		Upper Muny Lot	$15,000		3 in/3 out lanes	
		Lower Muny Lot	$10,000		2 in/2 out lanes	
		Twin Lots	$15,000		3 in/3 out lanes	
		Science Center	$5,000		1 in/1 out lane	
		SLAM (free)	$10,000		2 in/2 out lanes	
		SLAM Garage (Paid)	$5,000		1 in/1 out lane	
		Miss Hist Mus.	$10,000		2 in/2 out lanes	
Parking occupancy: Alternative 2: Space detection		Total	$400,000			Assmes 1 vehicle detector per space @ $400-500 ea, allows for controls
		Zoo South Lot	$150,800		1,100 Spaces	
		Zoo North Lot	$311,600		377 Spaces	
		Upper Muny Lot	$90,000		779 Spaces	
		Lower Muny Lot	$180,000		225 Space	
		Twin Lots	$38,400		450 Spaces	
		Science Center	$193,000		96 Spaces	
		SLAM (free)	$120,000		386 Spaces	
		SLAM Garage (Paid)	$35,200		300 Spaces	
		Miss Hist Mus.	$44,000		88 Spaces	

PROBABLE OPINION OF COST | GREAT STREETS PROJECTS

PROJECT	TIMELINE	SUB-PROJECT	CAPITAL COST	STAKEHOLDER RESPONSIBILITY	ASSUMPTIONS	NOTES
	Parking occupancy sign- fixed with variable numbers		$3,000	FPF, MODOT	Each, per location	Standard street directional sign with LED
	Full LCD dynamic sign		$15,000	FPF, City Planning?	Each, per location	
Parking/Mobility TDM Coordinator			$190,000			Assumes 2 FTE (Manager and Assistant), salary, benefit and overhead cost
Green Stormwater at Crosswalks			$100,000		Per location	Both side of street
Green Stormwater at Intersections			$150,000		Per location	
WAYFINDING SYSTEM IMPROVEMENTS						
Signage		In-Park walking distance signage	$500	FPF	Each	Custom sign on concrete pylon
		Regional Wayfinding signs	$4,000	FPF, MODOT	Each	48 SF brown highway sign on square tube post
Data Application feasibility study			$300,000	FPF, City Parks		Allowance for feasibility study
Data Manager			$112,000			Assumes 1 FTE, salary, benefit and overhead cost

HOW QUICKLY CAN THE LOCATION-SPECIFIC PROJECTS BE IMPLEMENTED?

FAST — MED — SLOW

Lindell Traffic Study + Simulation
- West Pine / Lindell
- Kingshighway / Lindell
- Lake / Lindell
- Union / Lindell

Lindell Pilot Test
- Bike Lanes
- Parking
- West Pine / Lindell Closure
- Kingshighway Left turn to Lindell
- Grand Dr Lane Realignment
- Stop Sign/Signal at Lake

Lindell Reconfigurations
- Construction of Full Design

Union Roundabout
- Construction

Clayton Underpass
- On-Street Bike Lane

Clayton Underpass
- Off-Street Multi-Use Trail

Skinker Traffic Study
- Skinker / Lagoon / Forsyth
- Skinker / Wydown
- Skinker / Fauquier
- Skinker / Rosebury

Skinker Reconfigurations
- Crosswalk Improvements
- Signal Timing

Skinker Reconfigurations
- Bumpouts + Rain Gardens
- Parking
- Access Ramps
- Entry Plazas

Oakland / Tamm Traffic Study

Oakland / Tamm
- 3-Way Stop / Signal

Tamm Ave Bridge
- Complete Reconfiguration

Data Management
- RFP for Data Management Consultant

Kingshighway Reconfigurations
- Crosswalk Improvements
- Signal Timing

Kingshighway Reconfigurations
- Bumpouts + Rain Gardens
- Parking
- Entry Plazas

Lighting
- RFP for Lighting Consultant
- Lighting Inventory and Needs Assessment

Lighting
- Implement Lighting Plan

Festival and Parking Plaza at the Upper Muny

Forest Park Pkwy / Des Peres
- Intersection Improvements

Forest Park Pkwy / Des Peres
- Overpass / Underpass

Circulator Short-Term
- Pilot Study
- New Routes
- Fare changes

Circulator
- Congestion Avoidance Strategies

Parking
- Parking / TDM Coordinator
- Enforcement Plan

Parking
- Parking Occupancy Sensors
- Parking Availability Signage

Park Streets
- Re-striping

Park Streets
- Speed Tables

New Sidewalk Connections

Studies / Data Collection

Location-Specific Projects

Direct Relationship

Indirect Relationship

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APPENDICES

APPENDIX A: DATA MANAGEMENT FEASIBILITY STUDY RFP

OBJECTIVE

It is recommended that prior to implementation of a data management framework and the associated technologies of parking management, smart signage, data mapping and transit integration that complete technology feasibility study be completed by a team comprising some or all of the following:

- Software consultant with experience in cloud based software development and UI design ad experience in working with public agencies and transit systems.
- IT Consultant/Engineers with experience in delivering hardware solutions to parks and institutions.
- Transportation engineer with specific experience in information technology related to parking and transit
- Consultants with experience in delivering/ recommending data driven solutions to park clients.
- Landscape Architect/Park Planner

NARRATIVE

Based on recommendation for the Forest Park Great Streets Study, FPF is seeking proposal from qualified software developers, technology consultants, engineers and planners to provide a feasibility study for design, and implementation of an integrated hardware and software solution to enhance Forest Park visitor experience. The eventual system will support strategies to manage traffic, congestion and parking by assisting users in choosing how to arrive at and move around the park. A goal is to discourage the number of personal car trips in favor of alternatives within the park.

The study will examine available technologies, costs, physical impacts, management approach and implementation phasing of the hardware and software system.

The system will integrate wayfinding, traffic and parking management, transit system information, user statistics, concessions, events, sales, PR and marketing. The software solution will be capable of delivering separate user and manager experiences on multiple platforms and will be capable of being easily and cost effectively managed. A data management environment will be capable of integrating inputs from multiple data sources currently available, determined to be needed for the delivery of the system, or available in the future, and will also store the information securely. The hardware solutions supporting the above will incorporate data storage and communication hardware and remote sensing equipment. The system will meet all applicable local state and federal requirements for accessibility, data sharing, data protection and privacy. Recommendations will include hiring and training recommendations for FPF management staff and/or third-party service vendors.

The following is a generalized scope outline:

DATA COLLECTION

Review of data sources available or proposed to support the creation of the desired software solution. Review shall include availability, legal issues, required technologies and cost issues.

- Existing client or related public data sources
- Available third-party data sources
- New data sources and required technologies

DATA MANAGEMENT

Review range of technologies/morphologies for data management. Include hardware and cloud-based solutions.

- Backend and API
- Third party products (eg. function as a service, mapping platforms)
- Data storage, hardware and cloud based
- Physical sSpace requirements
- Management structure and personnel
- Recommendations

SOFTWARE UI DESIGN

- Owner side
  - *Desired outcomes/UI design*
  - *Management input*
  - *Implementation of proprietary and third party/Function as service solutions*
  - *User access control/permissions*
- Public side
  - *User interface look and feel*
  - *Integration with existing website and map products*
  - *Implementation of proprietary and third party/Function as service solutions*
  - *Development of new software products*
  - *User kiosk development*
- Recommendations

PHYSICAL INFRASTRUCTURE

- Data hardware
  - *Available vendors/technologies*
  - *Space requirements*
- Data collection and distribution
  - *Sensors*
  - *Available vendors/technologies*
  - *Connectivity*
- Power requirements
- Visual and environmental impacts
- Recommendations

IMPLEMENTATION

- Overall recommendations
- Costs
  - *Funding sources*
  - *Capital improvement plan*
- Timeline/phasing recommendations
- Management and maintenance recommendations

DATA SOURCES TO BE UTILIZED/ CONSIDERED

KEY PRIMARY DATA SOURCES

EXISTING DATA SOURCES-REAL-TIME

- Google/Waze/Bing traffic data
- Phone network data (anonymous individualized user data)
- Bike share data (Dockless vendors):
  - Hotspot (home base of bikes for vendor)
  - Location of available bikes
- Wi-Fi Traffic based on specific hotspots
- IP address or cookie infomration from websites
- Existing guided tour apps by Missouri History Museum, St Louis Art Museum, or web based apps such as Forest Park Forever's guided Park tours
- Metro Bus: GTFS route/location/arrival time/cost/service delay
- Metrolink: GTFS route/location/arrival time/ cost/service delay
- MODOT and City of St. Louis Traffic Management Centers

EXISTING DATA SOURCES-PERIODICALLY REPORTED

- Zoo/SLAM paid parking entries and exits
- Institution attendance (turnstile or ticket sales)
- Ticketed event sales
  - Presale
  - Day of event (mobile)
- Individual Metro bus route/circulator ridership
- Food sales (could be real-time)
- FPF Parking managment Parking Data
- Zoo Parking Management Data

POTENTIAL ADDITIONAL DATA SOURCES

GOAL: Make all periodically reported data real-time.

USERS:

- Create Geofences for specific attractions/ zones/institutions so visitor numbers can be determined simultaneously within each area. This would enable centralized collection of data without the need for each institution to separately collect and share this information.

CIRCULATOR

- Route/stop GPS location
- Circulator ridership/occupancy count
  - Boarding: number/location
  - Disembark: number/location
  - Full/crowded signal to trigger service change
  - Empty threshold to trigger service change.
- Vehicle Location
- Arrival time per destination
- Navigation to destination
- Special event temporary/dynamic additional stops/ GPS location and arrival time info.

PARKING OCCUPANCY

- In/out "clicks"
  - Zoo, SLAM paid lots
  - Large lots
  - Remote parking (future)
- Full/almost full threshold to trigger signage/ app updates
- Space occupancy sensors for multi-level parking structures
- Video analysis to track on street parking

PARKING ENFORCEMENT

- Parking duration in location (license plate scan), 3 hours zone
- Special permits

APPENDIX A: DATA MANAGEMENT FEASIBILITY STUDY RFP

BIKE PARKING
- Location
- Occupancy/Availability

BIKE SHARE (CITY DOCKLESS)
» Geo-fence (use and non-use area)
» Presence of bikes in no-go or no-park areas

USER COUNTS
- Dual path congestion

» Video occupancy scan
» Wi-Fi hotspot maps
» App GPS location

VENDOR SALES
- Location
- Vendor name
- Value
- Time

WEATHER/CLIMATE
- Temperature
- Precipitation
- Wind
- Humidity
- Allergy Info
- NWS Alerts

PARK MAINTENANCE:
- Locate/tag maintenance issue/incident
- User issue reports

PUBLIC RELATIONS:
- Announcements
- User feedback

STORMWATER
- Outflow to each discharge point (MSD monitoring may be sufficient)
- Retention volumes for non-potable irrigation

WATER USE
- Main meters
- Sub-meters
- Irrigation:

» Climate data
» Soil moisture
» Leak detection

- Water re-use flow meters

ENERGY USE (GAS/ELECTRIC)
- Main meters
- Sub-meters
- On-site energy produced

AIR QUALITY
- Monitors