CINCINNATI CURB STUDY

Uber

FEHR & PEERS

Cincinnati Curb Study

Prepared for:

City of Cincinnati
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Executive Summary

This study, funded by Uber Technologies as part of the Cincinnati Mobility Lab, and informed through coordination and guidance from City of Cincinnati staff, consists of an evaluation of three study areas to identify potential improvements to address mobility, circulation, and/or access issues.

Site Identification

City staff identified seven suitable corridors to potentially study, each with unique challenges and opportunities that would benefit from evaluation. Ultimately our team selected three locations within these sites for detailed evaluation. At each location, we collected data using a combination of in-person observations, video documentation for detailed reduction of activity, and traditional data collection methods such as segment traffic counts and intersection turning movement counts. We also reviewed data provided by Uber to help inform site selection and Uber-specific activity for each study location. This data was used to understand the activity at the curb and along each segment in a qualitative and quantitative way.

Data Collection & Analysis

We reviewed and analyzed the data to determine the level of activity and duration of passenger loading events. We used basic traffic engineering principles and industry best practices to understand the activity and how the relative modes interacted with one another.

Recommendations

Based on the data collected and analyses, we identified potential improvements to the case study locations that included changes to the curb space designation and broader circulation improvements to enhance mobility in some specific spots as observed in the field and supported by video documentation. Recommendations are context-sensitive solutions for the City to consider that would be expected to address traffic-related issues observed at each study location, such as decreasing vehicle queues, reducing delay to transit vehicles, or general undesirable or potentially risky behavior.

Our recommendations provide the City with data supported improvements to consider at each location. Further engineering is required for most of the improvements to be implemented. Stakeholder engagement to solicit input, feedback, and support would also lead to a more widely accepted set of improvements at each location.

Introduction

As the adoption of ridesharing via Transportation Network Companies ("TNC"s such as Uber, Lyft, etc.) increases, ridesharing pick-ups and drop-offs are adding to the many use cases for safe and efficient curbside access for passengers and drivers.[1] This is most evident in urban areas, where the demand for curbside access competes with the largest variety of other uses such as vehicle parking and commercial loading.

In Cincinnati, like in many urban cities, the demand for the curb space as a means to provide access to people is evident on numerous corridors, contributing to issues with mobility, access, and circulation for a variety of transportation modes.

This study, in which Fehr & Peers served as a transportation consultant to Uber, was conducted to evaluate data from a variety of sources to develop a suite of recommendations to improve the productivity of the curb space with the expectation that a more effective curb space, combined with a broader set of improvements, could help address key mobility and circulation issues at a few locations in Cincinnati.

Together with Uber and City staff, we selected three locations in Cincinnati identified as key corridors with anecdotal evidence of passenger loading activity occurring without the corresponding amount of supply contributing to delay to other transportation modes. At each location, we collected and analyzed a variety of data to better understand existing conditions and used those findings to identify potential changes to the curb space and broader area-wide circulation to improve mobility.

This study, prepared as part of the Cincinnati Mobility Lab initiative, used concepts, themes, and strategies identified in a variety of literature about curb space management. Some background information about these items are included in the following sections.

[1] The curbside is typically the space between the pedestrian realm and the travel way, serving various uses including parking, bus stops, commercial loading, passenger loading, and landscaping.

Cincinnati Mobility Lab

This study is one component of a broader partnership between Uber and Cincinnati to work with the Cincinnati regional agencies to ensure that the benefits of new transportation options are widely shared. In addition to this study, this multi-year commitment includes additional elements, including:

- **Expanded Uber Presence**: A renewed commitment to a local presence in the Cincinnati Region including a dedicated Uber partnership manager for this project.
- **Data Sharing**: Bringing Uber's data sharing platform (Uber Movement) to the Cincinnati Region including coordination with regional agencies.
- **Transit Study**: Fehr & Peers and Uber are currently working on transit study with two local transit agencies, SORTA and TANK, and sharing data that will assist them in their efforts of developing a strategy for the future of their service.
- **Employers & Commuting**: Announcing the creation of an employer forum with the Cincinnati USA Regional Chamber to help shape the future of commuting.
- **Cincinnati Mobility Summit**: Uber, along with Harvard professor Stephen Goldsmith, organized a forum to discuss how cities can manage transportation mobility, digest complex data sets, and embrace new forms of technology in a way that removes the traditional barriers to transportation.
- **Meals on Wheels**: Uber will partner directly with local Meals on Wheels chapters to realize operational improvements and opportunities for flexible volunteerism.

Literature Review

In response to the growing competition for curb space, some cities are developing policies and principles around how to use, regulate, and re-purpose their curb space to make the best and most effective use of the space for a variety of uses and user groups. Many cities / agencies are developing policies and frameworks in response to the changing needs and uses of curb space. This section includes a selection of recent studies and reports, some co-authored by Fehr & Peers, that we have reviewed to help inform our work on the topic of curbside management.

ITE Practitioner's Guide

Fehr & Peers in partnership with the Institute of Traffic Engineers (ITE) developed a "Practitioner's Guide" to document the various policies, studies, and guidelines that some cities are developing with respect to curb space management. This Guide was published in November 2018.[2]

[2] The report can be found here: https://www.ite.org/pub/?id=C75A6B8B-E210-5EB3-F4A6-A2FDDA8AE4AA

One theme to emerge from this Guide is the new way that cities are defining the functions or uses of the public right-of-way and most notably curb space. Seattle's framework is a good example; it categorizes curb space under six primary functions:

- **Mobility** (general purpose travel lanes, bike lanes, bus lanes) – The movement of people and goods, including sidewalks, bicycle lanes and protected bikeways, dedicated bus or light rail/streetcar lanes, and general purpose vehicular travel lanes.
- **Access for People** (bus stops, bike parking, passenger loading zones) – People arriving at their destination or transferring between different modes of transportation. This includes transit stops, passenger loading zones, taxi zones, short-term parking, bicycle parking, and curb extensions.
- **Access for Commerce** (delivery/goods loading) – Goods and services reaching their customers and markets primarily through commercial vehicle or truck loading zones.
- **Activation** (parklets, food trucks, public art) – Provision of vibrant social spaces that encourage people to interact and congregate. Uses that drive activation include food trucks, restaurant patios, parklets, public art installations, seating, and street festivals (including farmers markets).
- **Greening** (plantings, rain gardens, bio-swales) – Enhancements to aesthetics and environmental health such as planted boulevard strips, streets trees, planter boxes, rain gardens, and bio-swales.
- **Storage** (parking, bus layovers, construction) – Provision of storage for vehicles and equipment, including bus layover spaces, reserved spaces for specific uses such as police or government vehicles, longer-term on-street parking, and construction vehicles.

Considerations for the Cincinnati Context

The ITE Practitioner's Guide introduces concepts and case studies that other cities in the United States are currently developing and putting into place. This serves as an excellent resource for the City of Cincinnati to review to inform their own policy, priorities, and programs.

The Shared-Use City: Managing the Curb

The International Transport Forum (ITF)[3] recently released a report presenting an overview of curb management challenges that cities around the world are increasingly faced with, as new shared mobility services and urban goods deliveries increase. Through quantitative modeling and experts' input, the ITF analyzed the relative efficiency, contribution to city policy objectives, and implications on city revenues of shifting curb space use away from parking towards passenger and commercial loading. The study recommends that cities allocate curb space for shared mobility services, though this should be based on an overall strategic re-assessment of the priorities regarding curb access and use by different modes. Additionally, the report states that cities should consider pricing the curb to retain current revenues from paid on-street parking. The report also suggests that curb space should be flexible and dynamic to adapt to different uses and users, including new mobility services such as rideshares, over the course of the day. Finally, the model showed that, when shared mobility services have better access to the curb, pressure on traffic could decrease as the percentage of shared rides increases.

San Francisco Curb Study

In September 2018, Fehr & Peers finalized a curb study in San Francisco (SF Study) that explored the concept of curb productivity in terms of access for people, developed a metric to understand relative effectiveness for several modes to provide access to the curb, identified strategies that could increase curb productivity by reconfiguring existing curb space, and created design templates to showcase examples of how curb space can be reallocated based on demand and local context. Some of the findings and work products developed during the SF Study are summarized here, as some of the concepts are relevant to this study and will help the reader pick up where the SF Study left off.[4]

Considerations for the Cincinnati Context

The San Francisco Curb Study conducted an assessment of existing conditions using a thorough data collection and analysis process, and developed recommendations for key study locations using data from the field and from Uber. The same process was used for this study, with some modifications to that process based on City input and the local context for the study locations.

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[3] International Transport Forum (2018). The Shared-Use City: Managing the Curb (Rep.). Retrieved https://www.itf-oecd.org/sites/default/files/docs/shared-use-city-managing-curb_3.pdf

[4] The full report can be found on our website: http://www.fehrandpeers.com/sf-curb-study/.

Curb Productivity

The SF Study defined curb productivity as the **importance, worth, or usefulness of a specific curbside designation in delivering people to/from the curb via a vehicle**. The concept of curb productivity was used to understand and evaluate the relative passenger loading between different modes. In the case of the SF Study, the modes included passenger cars, on-street parking, buses, and in some cases, taxis and shuttles.

Curb Productivity Index

To quantify potential curb productivity, we developed a metric, referred to as the **Curb Productivity Index (CPI)**, which represents the productivity of a specific curbside designation based on the observed demand. This may be commercial loading, passenger loading in private vehicles and/or TNCs, bus loading, parking, taxi loading, etc.

The CPI is a function of observed activity, time, and space taken up by the vehicle designation. The CPI is based on the observed activity at a location and indicates how many people could be served by 20 feet of curb (the approximate length of a typical on-street parking space) when this curb space is designated to a specific use/mode. A high CPI means the specific mode would be expected to serve more people in a given length of curb compared to a mode with a low CPI.

This index was helpful to illustrate the relative activity between active passenger loading and buses (high CPI) and on-street parking (low CPI). The CPI for several case studies were calculated for the San Francisco sites. Although a helpful tool to understand relative curb productivity of various modes, the CPI was not the only calculation or metric used in the SF Study to identify recommendations to reallocate curb space.

Passenger Loading Curb Demand

Another concept developed in the SF Study to help determine how to allocate curb space to various uses was the passenger loading curb demand. Using observations about number of simultaneous loading events and the theoretical space required to accommodate the maximum number of passenger loading events, we were able to estimate the amount of curb space to designate for specific uses (such as passenger loading) to accommodate the observed demand.

The SF Study detailed specific details about how vehicles access the curb, including the distance to enter and exit a passenger loading space. The details of this concept are discussed in more detail as part of the analysis methodology in the next section of this study, expanded to explain the curb space access needs for valet and taxi vehicles.

Strategies to Improve Curb Productivity

As part of the SF Study, we developed **three basic strategies to improve curb productivity**. By accommodating a greater proportion of passenger loading demand at the curb and thereby reducing the frequency of double parking, these strategies aim to reduce friction and increase safety in the travel lane.

Relocation

This strategy consists of relocating curb space along a block while keeping the overall amount of space dedicated to each use as a constant. No net removal of parking, nor increase or decrease of loading zones is required. This strategy would be expected to be easier to implement from a public or political perspective since the overall inventory of curb space doesn't change. One common example of this strategy would be consolidating multiple small loading zones (each 30 feet or less) into one large loading zone could allow for multiple small trucks or the occasional large truck.

Conversion

This strategy consists of converting curb space along a block in a way that adjusts the amount of curb space dedicated to various uses. This strategy can be used to improve curb productivity when demand for a particular mode is shown to be underserved by the existing curb space allocation. For example, if many vehicles on a particular street are double-parking when picking up or dropping off passengers, it could indicate that curb space for passenger loading is not sufficient and removing parking spaces to include a passenger loading zone would likely increase curb productivity. midblock

Flexibility

This strategy consists of converting curb space, implementing technology, and modifying infrastructure to change the curb use as demand for that space fluctuates throughout the day. This strategy has the potential to serve more people over a typical day when implemented and monitored to maximize its effectiveness. For example, this strategy could be applied by establishing a zone that operates as commercial loading during the day, passenger loading during commute hours, and parking overnight. Establishing this flexible curb space would be most effective in area with a mix of land uses with overlapping curb space demand.

Templates for Changing Curb Designation

The SF Study developed templates for various types of roadways using the results from the study. The case study locations were chosen based on the moderate to high rideshare demand observed and to represent

a variety of roadway typologies. While the specific recommendations may not be transferable to other locations, the approach to identify appropriate strategies to improve curb productivity by changing the curb designation for each location could inform similar roadway and land use contexts in other cities. The five case study locations comprise a transportation hub, a commercial corridor, a high-density office neighborhood, a street in the financial district, and bicycle corridor.

Additional Considerations When Changing Curb Designation

While reallocating or reconfiguring curb space designations are the most direct ways to address curb demand and productivity, there are numerous additional considerations when reconfiguring the curb, shown below:

Since this study focuses on passenger loading activity, it does not examine these additional considerations in detail. For example, the time periods observed generally reflect peak times for passenger loading activity, which is different from peak periods for commercial loading activity or peak commute periods.

Similarly, other considerations such as existing infrastructure, city policies, and safety were taken into account at a broad level when identifying potential opportunities. These policy issues, as well as public input, will likely be key topics for discussions and negotiations in implementing physical changes to the curb and the roadway. The implementation of these changes would largely be driven by agency staff rather than through partnerships with transportation operators. Before any of the recommendations presented in this study are implemented, further analysis based on City review and comment, community engagement, and other detailed design may be required.

In addition to the physical changes to the curb or street configuration, other strategies to consider to improve passenger loading conditions are active management or enforcement by the appropriate personnel, and potentially, geofencing. Active management or enforcement, often associated with event centers and airports, can ensure that traffic keeps moving to avoid backups as well as provide more eyes on the street and curb in order to prioritize safety. Geofencing is a proactive measure that rideshare companies can implement to help riders and drivers find loading zones and steer clear of challenging situations, particularly at large events and airports.

Site Review & Selection

Seven corridors were identified as potential study locations by the City. We reviewed each potential site to identify the most appropriate locations to evaluate as part of this study:

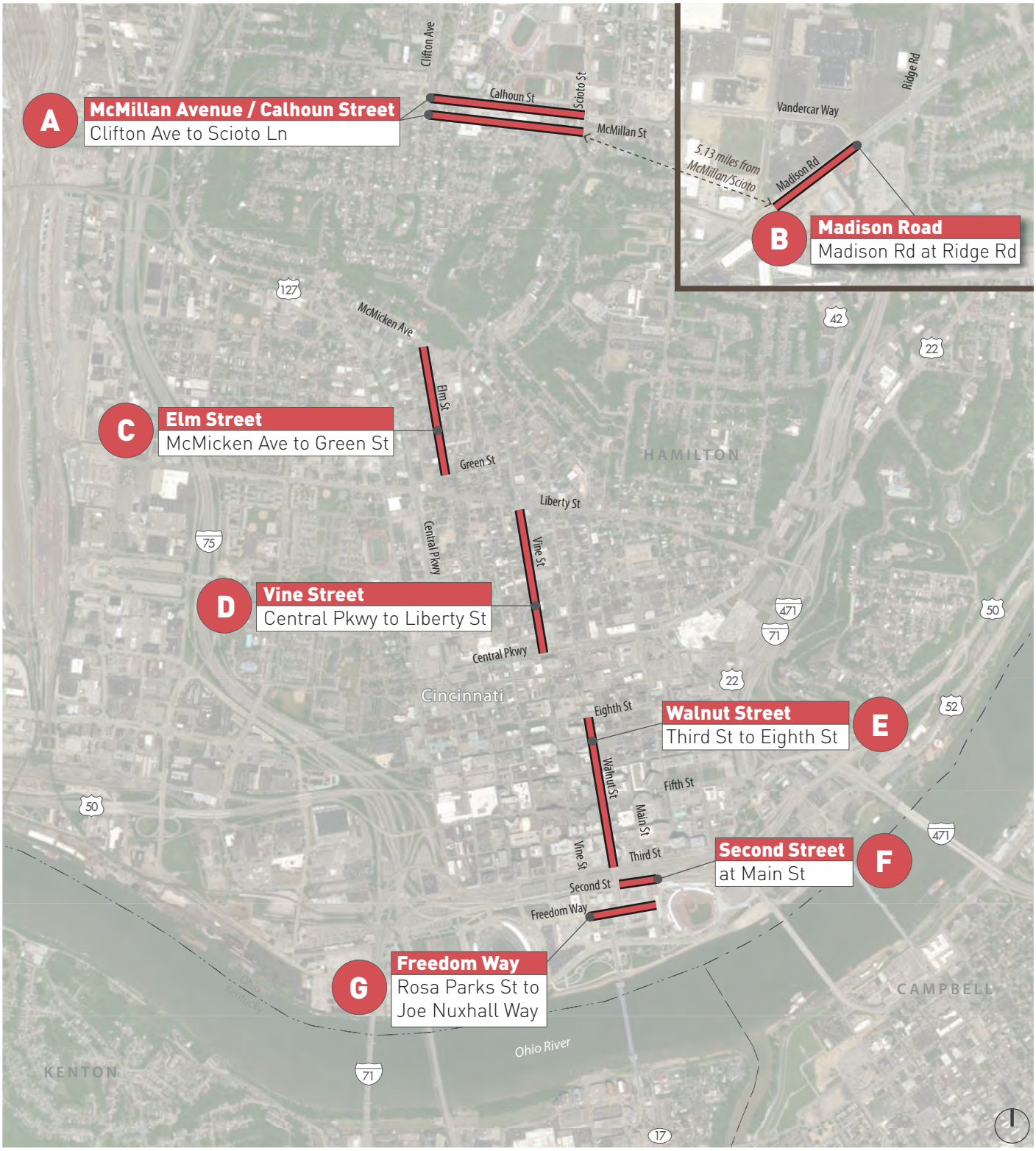
- McMillan Avenue and Calhoun Street between Scioto Lane and Clifton Avenue
- Madison Road at Ridge Road
- Elm Street between Green Street and McMicken Avenue
- Vine Street between Central Parkway and Liberty Street
- Walnut Street between Eighth Street and Third Street
- Second Street at Main Street
- Freedom Way between Walnut Street and Main Street

These locations are presented on the map in **Figure 1**. A brief description of each location and why it was considered as a potential study location is described below.

Site Descriptions

A. **McMillan Avenue and Calhoun Street between Scioto Lane and Clifton Avenue:** McMillan Avenue and Calhoun Street are a couplet of one-way streets just south of the University of Cincinnati; Calhoun Street runs westbound and McMillan Street runs eastbound. These streets are lined with low density development, often ground floor restaurants or retail with one or two stories of residential development above. Bus routes 31 and 17 travel along these corridors. Focusing on these streets would provide insight into the loading behavior of college students and may be indicative of "young adult" travelers.

B. **Madison Road at Ridge Road:** Madison Road at Ridge Road is positioned adjacent to two large attractors, Crossroads and MadTree Brewing. Crossroads is a large church with daily programming, and MadTree Brewing is a brewery with a large taproom. The context is suburban, with large parking lots for both sites, large commercial stores, and low-density residential development surrounding the intersection.



Potential Case Study Sites

Figure 1

Potential Case Study Locations

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C. **Elm Street between Green Street and McMicken Avenue:** Elm Street is located in the Over-the-Rhine neighborhood. It includes more industrial buildings (generally two to four stories) than Vine Street, but still maintains a mix of residential and retail uses. Rhinegeist Brewery, located between Henry Street and Eton Place, is a large attractor along the corridor. The Cincinnati Bell Connector (CBC) and two bus routes run along Elm Street. This site provides an opportunity to assess the impacts of loading activity on CBC, as the bus routes along this corridor are infrequent (particularly in comparison to the Walnut Street site).

D. **Vine Street between Central Parkway and Liberty Street:** This section of Vine Street, through the Over-The-Rhine neighborhood, represents a mid-density urban commercial corridor. The street-level is mixed with retail and residential land uses. This segment of Vine Street has one travel lane in each direction, on-street parking on both sides of the street, and abundant transit service (multiple local bus routes and Metro Plus service).

E. **Walnut Street between Eighth Street and Third Street:** Walnut Street is a one-way two-lane arterial with on-street parking and loading intermittently. This segment represents a typical downtown location in the central business district, with high-rise office buildings, restaurants and retail, through-traffic, and transit service (both bus and CBC service). The highest concentration of activity along this corridor is between Sixth Street and Eighth Street. The Aronoff Center, an arts center with multiple theaters, is located between Sixth Street and Seventh Street and hosts several performances per week.

F. **Second Street at Main Street:** The intersection of Second Street and Main Street is located at the northwest corner of the Great American Ballpark. Second Street is a four-lane, one-way arterial; it is a well-utilized route during the PM commute period for access from downtown to the regional freeway system to the east, including Interstates 71 and 471. Near Freedom Way, it has similar land use patterns to the corridor south of Second Street. Second Street parallels Interstate 71, so there are no land uses immediately north of Second Street. Similar to Freedom Way, this site represents event-based loading activity.

G. **Freedom Way between Walnut Street and Main Street:** This one-block segment of Freedom Way is adjacent to the Cincinnati Reds stadium, the Great American Ballpark. The street segment is lined with restaurants and retail, as well as a hotel. The area experiences high vehicle and foot traffic before and after Cincinnati Reds games, as well as on weekend evenings, and would be a proxy for event-based and nightlife loading activity. No transit service runs along Freedom Way.

Site Selection

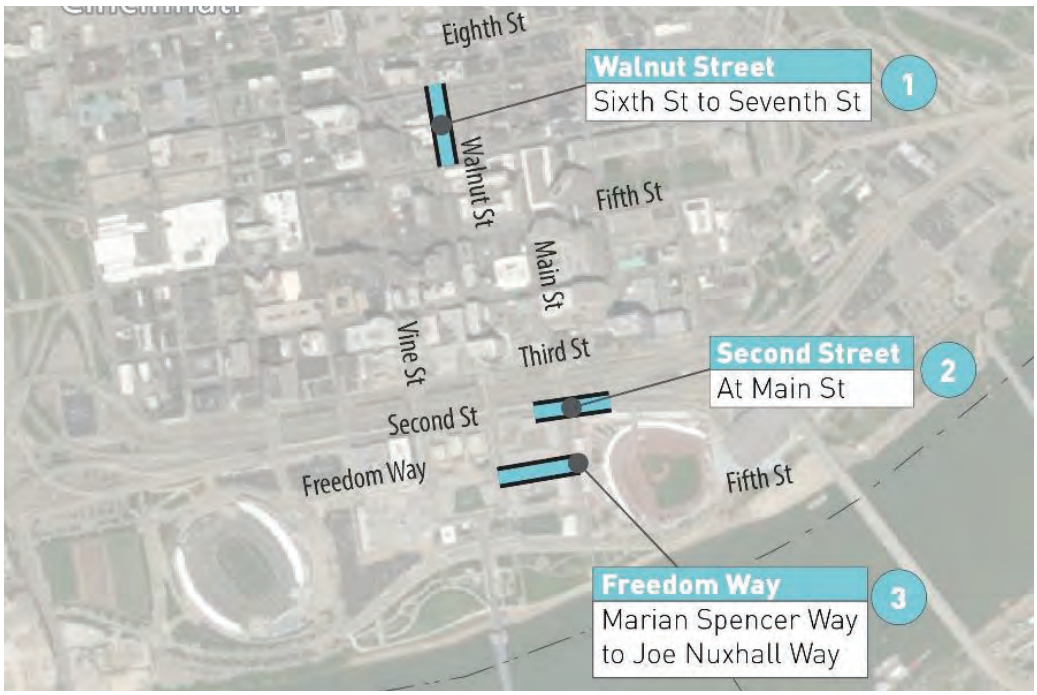
Fehr & Peers, Uber, and City of Cincinnati staff reviewed the potential corridors above and identified three corridors for further study. Each site was selected based on a combination of factors, including City staff priorities, levels of rideshare activity, and anecdotal evidence of misalignment between passenger loading demand and curb space supply as a contributing factor in safety or accessibility issues. The selected study locations are illustrated in **Figure 2**. Reasoning for their selection are as follows:

1. **Walnut Street between Seventh Street and Sixth Street** – This segment is located along a busy downtown corridor with a history of observed vehicle delay and queues along the corridor. It was selected for study to understand the source of the delay and identify potential improvements to alleviate vehicle delay and queues, thus improving transit reliability by improving the corridor for buses and the CBC.

2. **Second Street at Main Street** – This location was selected due to the special circumstances and operational issues related to Reds baseball games. This intersection is the destination for several types of motorists to baseball games, and also provides direct access to multiple interstate routes from the downtown area. This study seeks to understand the activity at this location and identify improvements to accommodate activity in a safe and manageable way.

3. **Freedom Way between Marian Spencer Way and Joe Nuxhall Way** – This location, adjacent to the Great American Ball Park, is of interest due to the heavy pedestrian and vehicle activity during nights and weekends. The high level of passenger loading and pedestrian activity make this a safety priority for City and law enforcement, who routinely monitor and close the street when activity is at its peak.

Figure 2. Selected Case Study Locations



Data Collection & Analysis

A variety of data collection methods were used to gather data for this study. Qualitative observations conducted at each of the three locations were supplemented by traffic counts and loading data provided by Uber. The data collection methods are listed below:

Initial Data Gathering – Reviewed readily available data, including Google Maps and Street View, transit service, local event schedules, and discussions with City staff.

In-Person Observations – Completed in-person observations to confirm roadway characteristics and curb space designation, identify areas of high activity, and understand travel and loading behavior during times of interest, informed by local context (e.g. event start and end times). This included discussion with police officers on patrol and traffic control officers (TCOs) around Ball Park area.

Video Data – Reviewed video and photographic data to document vehicle traffic, loading activity, and parking occupancy during peak periods.

Uber-Provided Data – Analyzed daily variations of pick up and drop off activity for each study location.

Initial Data Gathering

The following data were gathered using readily available means (i.e. Google Maps) and supplemented through field visits. The following information was gathered at each study location:

- Number of travel lanes in each direction
- Presence and type of bicycle facility
- Bus and streetcar stop location and length, if applicable
- Transit service, including number and frequency of routes, if applicable
- Curb space use allocation (e.g. parking, valet, metered loading, taxi, bus stop, etc.)
- On-street parking conditions (i.e. supply, type, day/time restrictions)
- Local event information, including frequency, duration, start and end times of Cincinnati Reds games and Aronoff Center events, as well as venue capacity and attendance.

In-Person Observations

In-person observations were conducted at the locations and times presented in **Table 1**, focusing on peak periods associated with event ingress, event egress, and evening/nightlife activity.

Table 1. Observation Periods

Date	Walnut Street / Aronoff Center	Second Street / Main Street Great American Ball Park	Freedom Way Nightlife
Thursday, June 7th	-	Pre-game: 11:20 AM – 12:20 PM Post-game: 3:40 PM – 5:10 PM	-
Friday, June 8th	Pre-event: 7:00 PM – 8:00 PM Post-event: 10:00 PM – 11:00 PM	Pre-game: 6:30 PM – 7:00 PM Post-game: 11:00 PM – 12:00 AM	Nightlife: 11:00 PM – 12:00 AM
Saturday, June 9th	Pre-event: 7:00 PM – 8:00 PM Post-event: 10:00 PM – 11:15 PM	Pre-game: 4:00 PM – 4:15 PM Post-game: 7:00 PM – 8:00 PM	-

In addition, interviews were conducted with Cincinnati police officers and traffic control officers responsible for traffic control and public safety at the Second Street at Main Street intersection and along Freedom Way. These interviews confirmed which observations were unique, one-time occurrences, and which observations were indicative of typical behavior in this neighborhood.

Video Data

To capture the nuances of curbside activity, video data was processed from multiple locations around each study area, including video from permanent cameras operated and monitored by the Cincinnati Police Department (CPD), as well as additional video cameras at the intersection of Second Street at Main Street, where the CPD video did not fully capture the zones of interest. Video cameras recorded all activity for approximately six hours.

Once recorded, we reviewed the videos and quantified the following activity types: vehicle turning movement and pedestrian counts, loading activity, and on-street parking occupancy.

Turning Movement and Pedestrian Counts

Intersection vehicle turning movements and pedestrian counts were collected at five locations during the evening peak periods:

- Walnut Street at Sixth Street
- Walnut Street at Seventh Street
- Walnut Street midblock crossing (at the Aronoff Center)
- Second Street at Main Street
- Freedom Way at Joe Nuxhall Way

For Walnut Street, data collection was limited to one evening when there was a theater event (Saturday, June 9th). This time period represents the time period of localized vehicle and pedestrian demand associated with theater events, and does not coincide with weekday peak commute periods, which is typically when motorized traffic peaks along this corridor. Data collection times are summarized in **Table 2**.

Table 2. Vehicle Turning Movement Counts

Date	Walnut Street		Great American Ball Park	
	Event	Times	Event	Times
Saturday, June 9	10:20 PM theater show departure	10:15 PM – 10:45 PM*	No counts	No counts
Friday, June 22	No event	6:00 PM – 12:00 AM	6:00 PM ballgame	5:00 PM – 12:00 AM
Saturday, June 23	No event	6:00 PM – 12:00 AM	4:00 PM ballgame	3:00 PM – 9:00 PM

* midblock crossing only

Passenger Loading Activity

Peak period videos were reviewed to understand passenger loading activity at each site, including 30 to 60 minutes before and after an event. **Table 3** presents a breakdown of time frames reviewed and summarized and number of cameras used at each location.

Table 3. Loading Activity Observations

	Walnut Street / Aronoff Center	Great American Ball Park Second / Main	Freedom Way Nightlife
Date of Observation	Saturday, June 9, 2018	Saturday August 11, 2018	Saturday, June 9, 2018
Video Time(s) Used	7:30PM – 8:00 PM 10:20 PM – 10:50 PM	6:10PM – 6:40 PM 9:10PM – 10:40 PM	8:30 PM – 9:30 PM
Number of Cameras	1	2	2

Loading observations documented several attributes of each loading event, including vehicle type (passenger vehicle[5], taxi, commercial vehicle, or bus), type of activity (passenger loading event, commercial loading event, valet activity, or parking maneuver), location, dwell time, and other notable characteristics, such as whether the loading events impacted other transportation modes.

All additional metrics discussed in this report derived from analysis performed with these initial observations. Descriptions of secondary or output metrics are described alongside results in the subsequent chapters.

Parking Occupancy

On-street parking occupancy was collected for Walnut Street between Sixth and Seventh Street and on Freedom Way. On-street parking counts were conducted at 30- and 60-minute intervals during peak and off-peak observation times, respectively. At Walnut Street, parking occupancy counts were conducted between 4:00 PM and 12:00 AM on Saturday June 9, 2018. On Freedom way, parking occupancy counts were conducted between 6:00 PM and 12:00 AM on Saturday June 9, 2018.

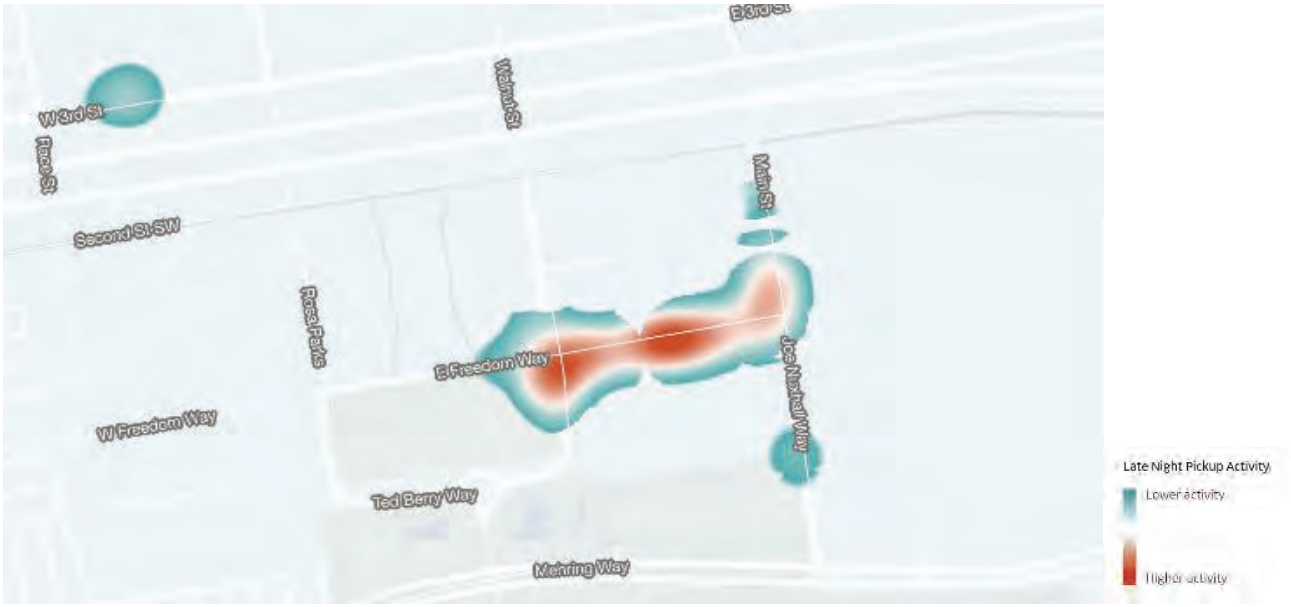
[5] Passenger vehicle in this context consists of private passenger and rideshare passenger loading. These uses are combined because our data collection efforts were unable to definitively distinguish between the two activity types. Activity by a specific vehicle type, such as taxi, commercial vehicle, and bus were able to be distinguished by our video and photo data collection methods.

Uber-Provided Data

Uber data both confirmed and supplemented the other data collected for this study. Uber data included heat maps of peak period activity within the study area and frequency of pickups throughout the course of a typical week:

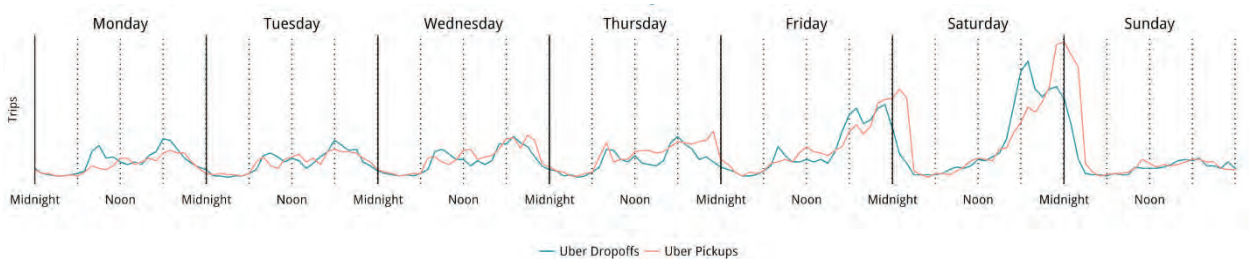
Peak period Uber activity – Peak period heat maps were used to review the concentration of Uber activity at each study site. An example is included in **Figure 3** illustrating pick-up activity density along Freedom Way from 9:00pm to 2:00am.

Figure 3. Late Night Pick-Up Activity Density Along Freedom Way (9:00 PM to 2:00 AM)



Uber activity for a typical week – Uber trip frequency was used to determine the peak periods of passenger loading for each case study location. An example of these charts are included in **Figure 4**.

Figure 4. Typical Weekly Uber Activity at Walnut Street



In addition to using Uber data to inform case study locations, we used this data to supplement our data collection results and to aid in our quality control of the data reduction process.

Vehicle Curb Productivity

As mentioned in the Literature Review section of this report, the SF Study developed a metric called the Curb Productivity Index that took into account vehicle activity, occupancy, size, and dwell time. For this study, we used a simplified version of that metric, referred to as the **Vehicle Curb Productivity**, or VCP, based on observed average dwell time of different modes and an estimate of the amount of curb space needed to accommodate that mode at the curb.[6] The equation for VCP used in this study is as follows:

$$Vehicle\ Curb\ Productivity\ = \frac{\boldsymbol{Vehicle\ Activity}}{\boldsymbol{Total\ Dwell\ Time\ x\ Curb\ Space\ Needed\ Per\ Vehicle}}$$

To put this into units that are applicable to street configuration, the **Vehicle Curb Productivity provides the relative utility of a given curb space based on the mode designated to use it.**

Passenger Loading Curb Space Demand

Using the activity observed at each location, this study seeks to identify how best to allocate curb space to better accommodate the various passenger loading activities at the curbside. In order to determine the potential reallocation of curb space, we need to define concepts to measure the passenger loading curb demand in both number of vehicles and lineal distance needed to accommodate the peak passenger loading demand. These concepts are discussed in more detail below.

Peak Curb Space Demand – Number of Vehicles

At each study location, video data was used to document all passenger loading activity, including when the loading activity occurred and how long it lasted. We documented the proportion of the time that was observed where multiple passenger loading events occurred, referred to in this report as the **number of simultaneous events**. This data is used to assess how often during the analysis period a certain number of passenger loading events occurred simultaneously.

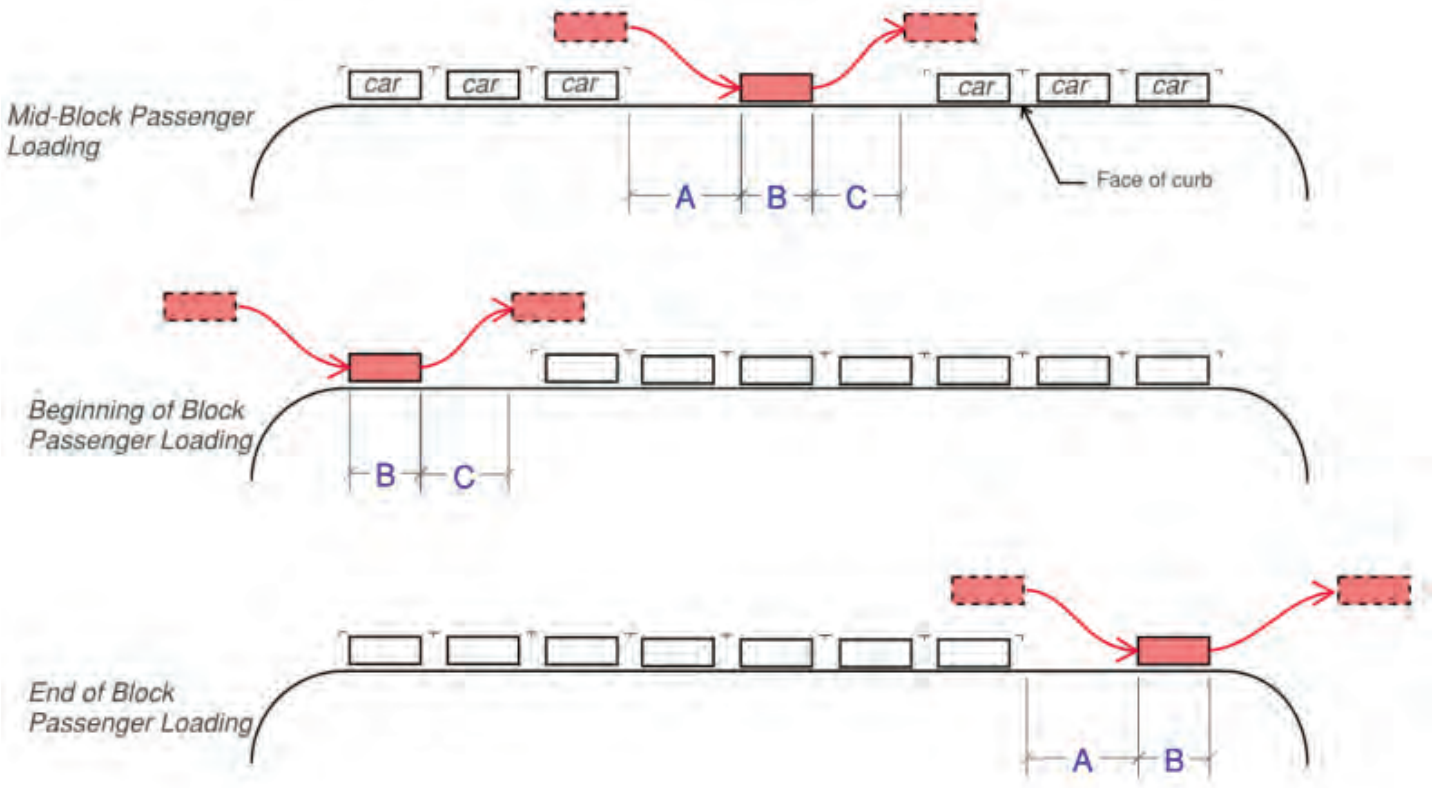
[6] *Vehicle occupancy* was not collected as part of this study due to limitations of the video quality during nighttime conditions. The *level of activity* for each mode was not part of the productivity calculation but is taken into account when the productivity results are used to determine recommendations for curb space reconfiguration.

Peak Curb Space Demand – Amount of Space

Once the frequency and quantity of simultaneous passenger loading events was documented, we developed a formula to calculate a range of how much space at the curb would be needed to accommodate all of that activity, taking into account motorist behavior (e.g. passenger loading doesn't parallel park in most cases, but would drive forward into a space or stop partially in the travel way) and the physical size of vehicles and the space needed to pull to the curb and back into the travel lane. Valet patrons would typically drive into a valet zone and pull up to the back of a car in front of them. Taxis would park in designated spaces and leave once a passenger arrives. These three passenger loading activity types can be modeled using a simplistic model of arrival and departure.

The following series of graphics illustrate the estimated curb space needed for a single passenger loading event on a typical midblock, near side of a block, and far side of a block to illustrate that where passenger loading is placed would affect the amount of space needed to accommodate loading operations.

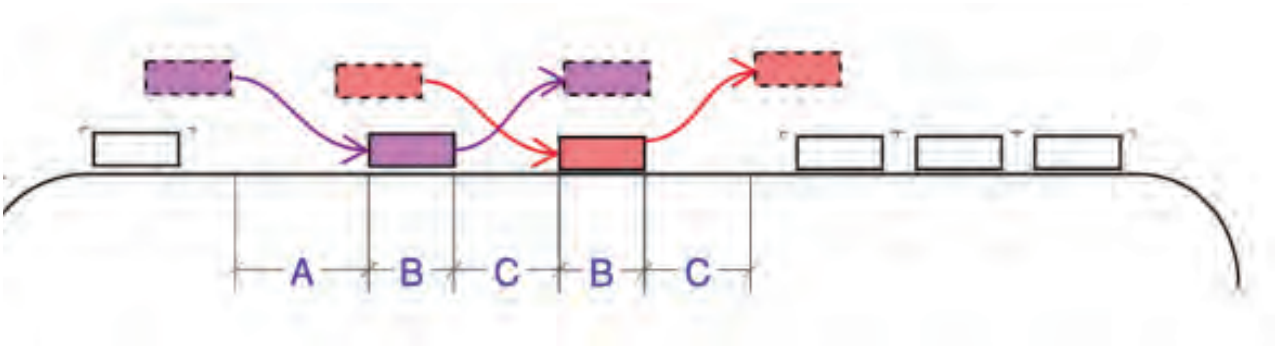
Key: A = the "entry distance", B = the vehicle length, and C = the "exit distance"



To determine values for A, B, and C, we modeled the vehicular maneuvers using the American Association of State Highway Transportation Officials (AASHTO) "P" Design Vehicle, which represents a typical passenger vehicle, commonly used in roadway and highway design processes. We reviewed our results and performed field observations to verify our findings. We found that using 20 feet for the values of A, B, and C would provide adequate space for a motorist to pull out of the travel lane completely and stop at the curb. Further modeling and field tests would be appropriate for any city that applied this methodology to determine the appropriate sizing of passenger loading events.

Independent Passenger Loading Operations

Using the above methodology, we developed a calculation to estimate space needed for multiple independent curbside passenger loading events, shown in the following graphic.



The calculation for curb space required to accommodate multiple independent a passenger loading events can be summarized with the following calculation:

Variables:

- n = the number of simultaneous events,
- A = entry distance
- B = vehicle length
- C = exit distance

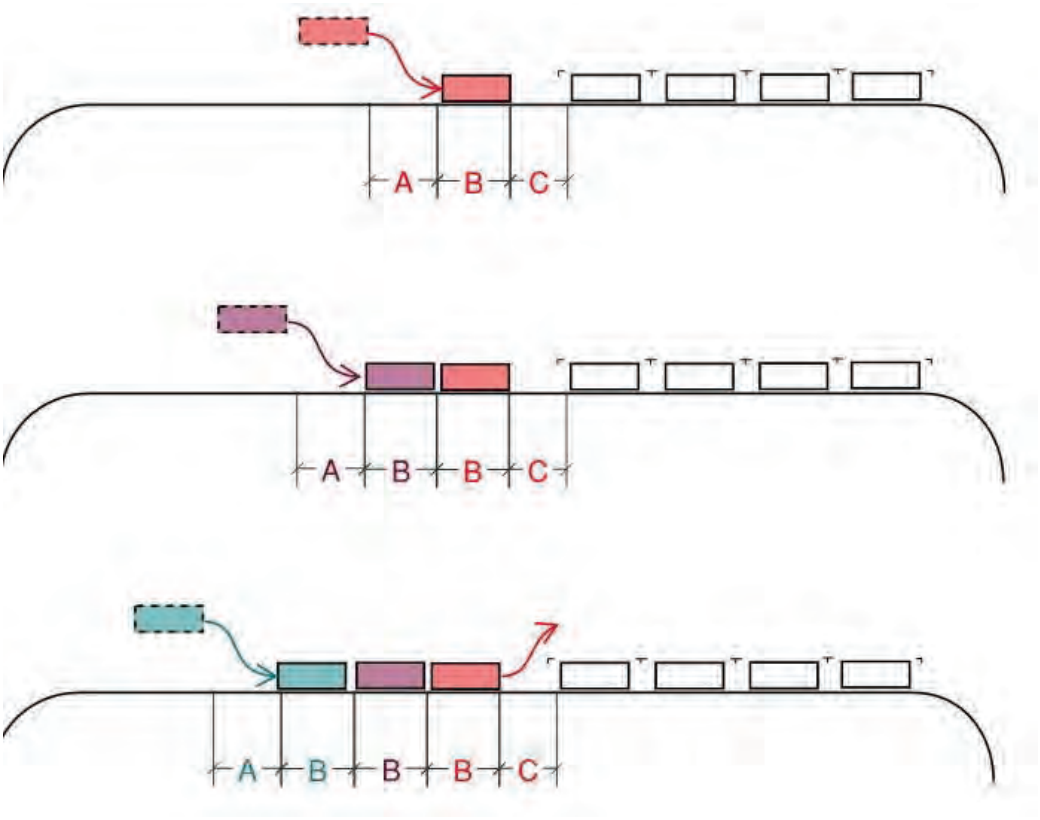
$$Curb\ Space\ Required\ for\ Independent\ Passenger\ Loading\ = \boldsymbol{A} + \boldsymbol{n}(\boldsymbol{B} + \boldsymbol{C})$$

Using 20 feet for the values of A, B, and C in the figures above yields the following estimates of required space to accommodate multiple passenger loading activities:

- One Passenger Loading Zone (midblock) = **60 feet**
- One Passenger Loading Zone (next to driveway, intersection, bus stop) = **40 feet**
- Two Passenger Loading Zone (midblock) = **100 feet** *(50 feet per vehicle)*
- Three Passenger Loading Zone (midblock) = **140 feet** *(47 feet per vehicle)*

First-In/First-Out Passenger Loading Operations

We used the same logic to estimate the space needed for multiple first-in/first-out curbside passenger loading events, similar to how a valet stand was observed to operate. The results of the first-in, first-out spatial requirements for multiple simultaneous events is illustrated below.



$$Curb\ Space\ Required\ for\ First\ In/First\ Out\ Passenger\ Loading\ = \boldsymbol{A} + \boldsymbol{n}(\boldsymbol{B}) + \boldsymbol{C}$$

Using 20 feet for the values of A, B, and C in the figures above yields the following estimates of required space to accommodate multiple passenger loading activities:

- One Valet/Taxi Loading Zone (midblock) = **60 feet**
- Two Valet/Taxi Loading Zone (midblock) = **80 feet** *(40 feet per vehicle)*
- Two Valet/Taxi Loading Zone (next to driveway, intersection, bus stop) = **60 feet** *(30 feet per vehicle)*
- Three Valet/Taxi Loading Zone (midblock) = **100 feet** *(33 feet per vehicle)*

The above concepts, assumptions, and equations are used later in this study to determine the curb space needed to accommodate the observed activity at each study location.

Limitations Acknowledgement

Like any methodology meant to simplify a complex phenomenon there are limitations to consider before application. With respect to the methodologies presented above and deployed in this study, there are four main reasons behind this; the first having to do with passenger loading demand and the remaining ones having to do with how to account for and allocate curb space based on that demand, which may be peaked rather than constant throughout the day.

1. The methodology necessarily simplifies arrival patterns and, particularly for multiple simultaneous passenger loading activities, idealizes driver behavior (e.g., assumes vehicles would pull to the front of the available curb space). Thus, the complexity of simultaneous passenger loading events (i.e., three or more) at one curb is not captured and limits the applicability of this methodology to locations with lower levels of passenger loading demand. As such, use of this methodology in scenarios with high simultaneous passenger loading demand at the same curb would not represent a suggested practice.

2. The methodology determines the passenger loading curb space demand based on the peak number of simultaneous vehicles observed (i.e., the amount of curb space to be allocated to passenger loading is determined based on the highest level of activity observed). However, this peak demand may occur one to a few times a day and/or for a limited time throughout the day.

3. When deployed in the following sections, we identify what changes to the study areas would allow accommodation of the peak passenger loading demand at the curb. As noted above, the curb changes required are based on the observed number of simultaneous passenger loading vehicles and the curb space required for different levels of vehicle demand. However, while the peak passenger loading curb space demand (in feet) identified for each case study would ensure all activity is accommodated at the curb, there is some variability in the total curb space needed based on how many zones are provided and/or where these are on the block.

4. The recommendations presented for each study location focus only on the observed block. However, curbside management decisions may require looking at a broader area to best allocate curb space for each use and, thus, other opportunities beyond those identified in this report may exist to allocate passenger loading (or other curb uses) on adjacent blocks.

With respect to the second and third points above, a city may choose not to design the curb space based on the highest demand, but rather, like other traffic engineering decisions, identify a threshold or heuristic to determine the optimal curb space allocation (e.g., allocate enough curb space to passenger loading demand based on the 85th percentile number of simultaneous vehicles). This would allow a city to balance passenger loading with other curb space demands and the desire to ensure efficient street operations.

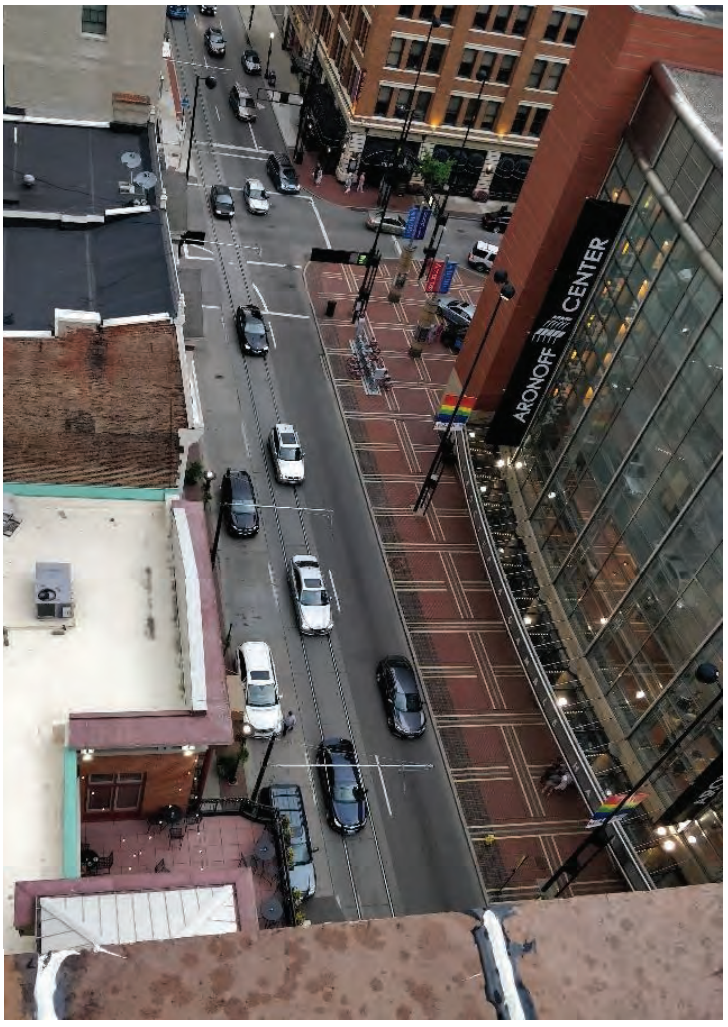
Case Study 1: Theater on Walnut Street

Transportation & Land Use Context

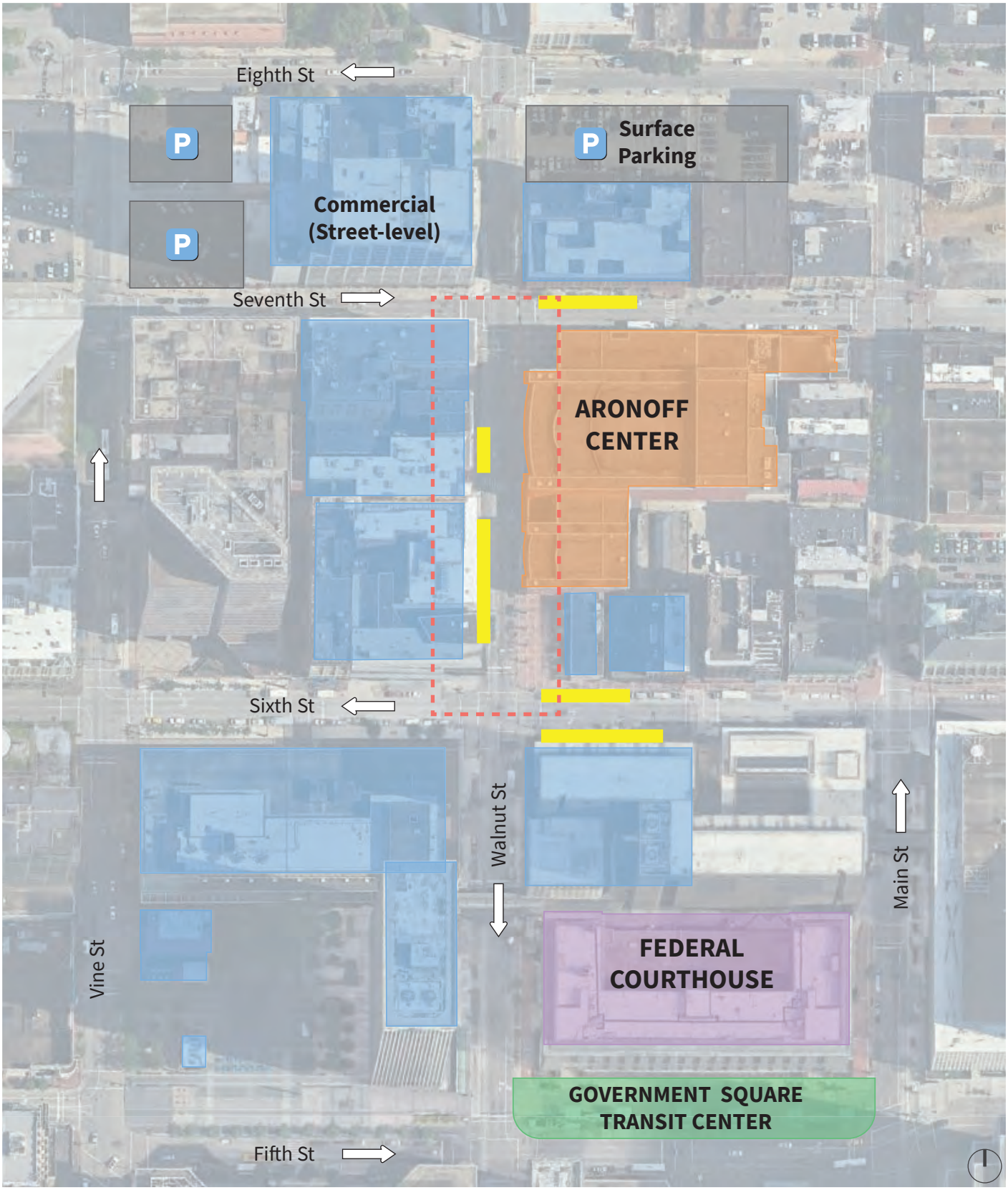
Roadway Description

Walnut Street is a one-way southbound street, running between McMicken Avenue and Second Street, with two to four travel lanes and parallel curbside parking or loading zones on most blocks, except where turn pockets exist. The corridor hosts a mix of land uses, including restaurants, a hotel, a church, the Aronoff Center for the Arts (herein referred to as the Aronoff Center), and the US Court of Appeals. An overview of the study area and nearby land uses is illustrated in **Figure 5**.

The Walnut Street case study location spans one block, from Sixth Street to Seventh Street. There are two travel lanes along this block, with a right-turn pocket at Sixth Street. The Cincinnati Bell Connector (CBC) runs on rail tracks in the center travel lane. **Figure 6**. displays the block and permitted curb uses between Seventh and Eighth Streets. There are two valet areas and a bus stop (6am-6:30pm) on the west side of the street. On the east side of the street, the curbside lane is a travel lane on the northern half and metered loading and a taxi stand (6pm-2am) on the southern half of the block. There are no driveways along this segment, but there is an alley on the west side of the street (called Gano Street) that connects Walnut Street to Vine Street. There is a bike share station with docks for 14 bicycles on the east side of the street just south of Seventh Street, and a midblock crosswalk (10 feet wide). Both intersections at Sixth and Seventh Streets are signalized.



Walnut Street between Sixth and Seventh Street, Aronoff Center shown on the right



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Focus Area

Valet Locations

Figure 5

Walnut Street Area
Land Use Context

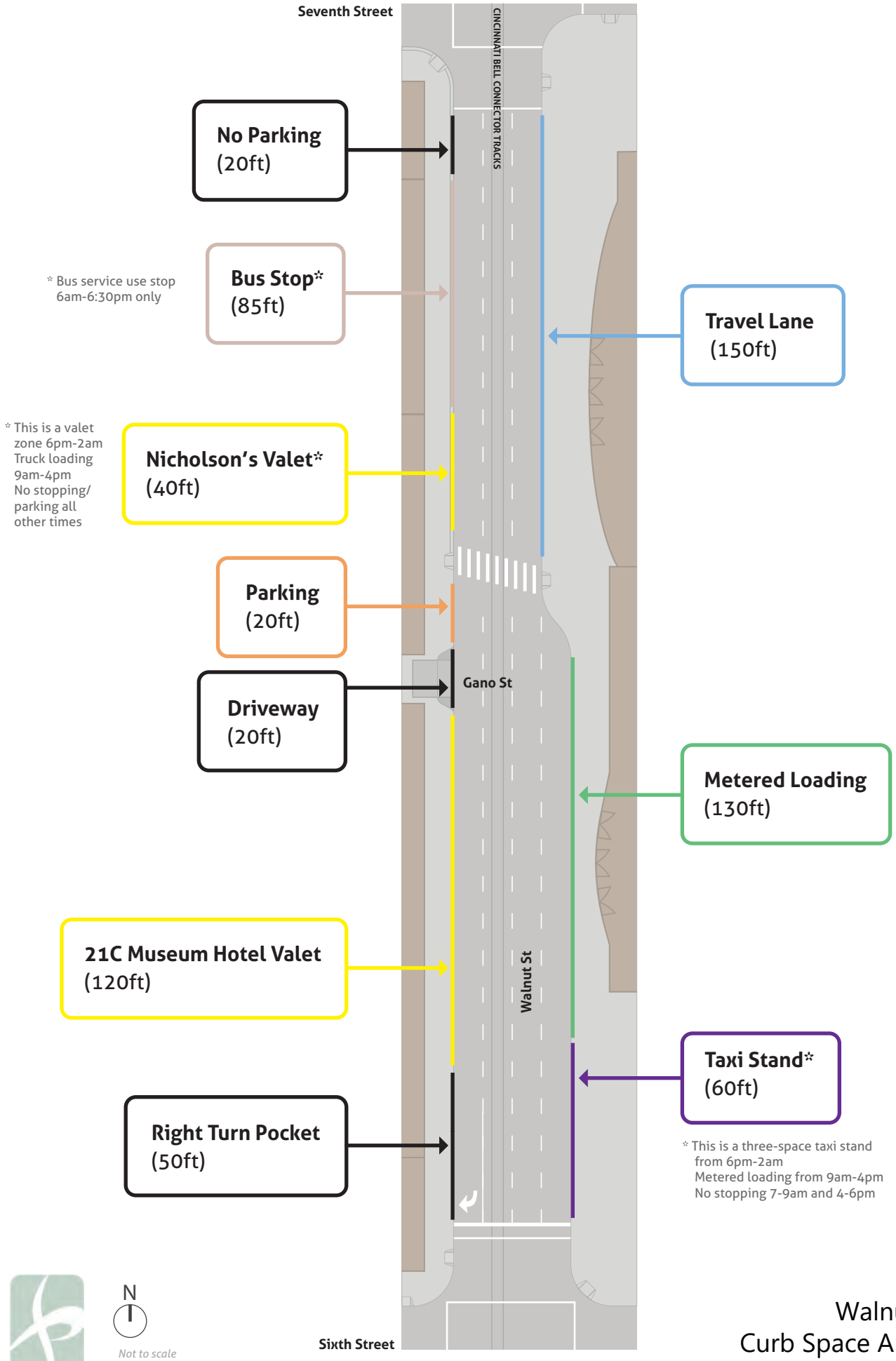

Figure 6

Walnut Street Curb Space Allocation

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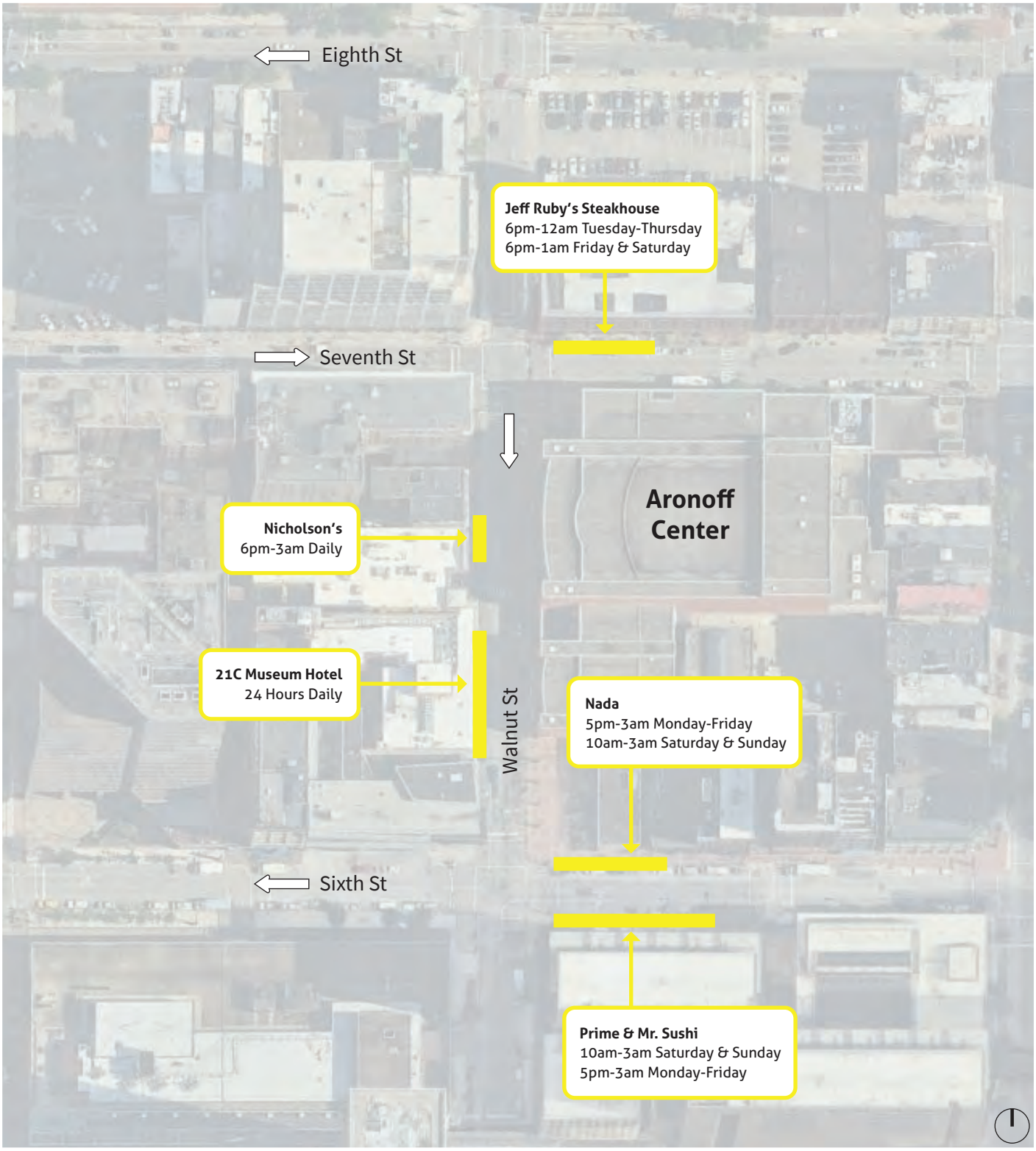
Area Parking and Valet

With more than 6,000 parking spaces within a two-block radius, there are a variety of parking options for guests attending performances at the Aronoff Center or other locations along this segment of Walnut Street. There are several independent valet operators on Sixth Street, Seventh Street, and Walnut Street. Valet stations are located adjacent to Nicholson's Gastropub, the 21C Museum & Hotel (and a restaurant called Metropole), Nada (a restaurant) and Jeff Ruby's Steakhouse. The location of these valet stands are illustrated in **Figure 7.** Pick-up and drop-off activity for Nicholson's Gastropub and the 21C Museum & Hotel occurs on Walnut Street. Nicholson's Gastropub valet service is located north of the midblock crosswalk, and the 21C Museum & Hotel's is located south of the midblock crosswalk. Nada and Jeff Ruby's Steakhouse valet services are located on Sixth Street and Seventh Street, respectively. Most valet service catering to Aronoff Center visitors opens one hour prior to typical performance time. However, these valets operate on evenings when there are no events scheduled to serve visitors to the area for non-theater patrons, such as restaurant-goers.

The Aronoff Center website indicates that valet parking is also available at the Aronoff Center itself and is available for most performances in the Proctor & Gamble Hall. This service is provided on the west side of Walnut Street, so all Aronoff Center attendees using this valet service must cross Walnut Street after they drop off their vehicles and prior to picking up their vehicles. This valet service is sponsored by the bar Nicholson's and is available Monday through Saturday from 6:00 PM until 3:00 AM. The valet permit application for the Nicholson valet states that operators "must not allow for long term parking within a valet zone, only drop off/pickup operations are authorized and any vehicle staging is limited to 15 minutes." The exact location of valet zone is described to be along "the west curb of 625 Walnut Street. The limits of the designated zone shall be marked with signage." Valet operators are also stipulated to "in no way interfere or interrupt the movement or operation of the streetcar."

The Nicholson valet stand, shown here before a theater event



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Valet Locations

Figure 7

Walnut Street Area Valet Locations

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Transit Service

Walnut Street serves several transit routes, including the CBC (shown in the image on the right) and local bus routes. There is one stop on the street, adjacent to the Gano Street alley on the west side of the street, and this stop serves three routes: 42X, 52X, and 74X. During the PM peak (5:00 – 8:00 PM), there are three buses per hour using this stop. None of these routes run after 10 PM.

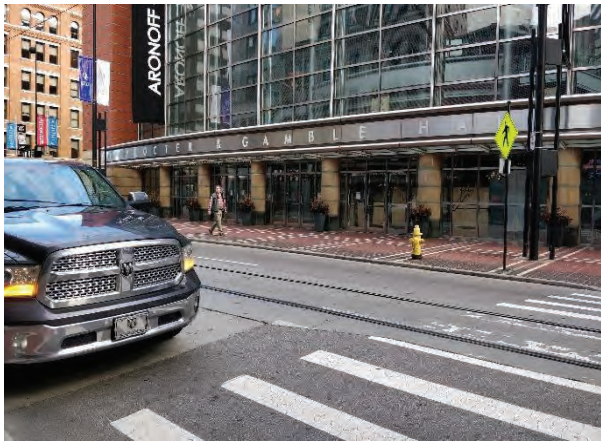
The CBC runs along Walnut Street, shown here travelling past the 21C valet stand

Other buses use Walnut Street, but do not stop along the segment between Sixth Street and Seventh Street. Eighteen buses are scheduled hourly to travel along this segment of Walnut Street during the weekday PM peak and 12 buses scheduled hourly along this segment during the weekend PM peak. In the late evening (10:00 PM – 12:00 AM), there are seven buses scheduled hourly both on weeknights and weekend nights. The CBC runs every 12 to 15 minutes, passing through the corridor four to five times each hour.

Transit stops along the remainder of the corridor are located just north of Seventh Street on the west side of the street (CBC stop) and just north of Fifth Street on the west side of the street (serving bus routes 21, 25X, 42X, 52X, 74X, and M+).

Aronoff Center

The Aronoff Center, located on the east side of Walnut Street, includes two theaters. The Proctor & Gamble Hall has 2,700 seats, and the Jarson-Kaplan Theater has 430 seats. Events are more frequently hosted in the Proctor & Gamble Hall than the Jarson-Kaplan Theater. In 2017, the Aronoff Center hosted 555 events, with a total of 457,168 attendees.[7] Events are held every Friday and Saturday night and frequently on Sundays. Events occur between two and five weeknights per week.



The Proctor & Gamble Hall, pictured here from the west side of the street (midblock crosswalk shown in the foreground)

[7] https://cincinnatiarts.production.carbonhouse.com/assets/doc/Cincinnati-Arts-Association-2017-Annual-Report-6008e294bb.pdf

There are separate entrances for the two theaters within the Aronoff Center. Both entrances are on Walnut Street; the Jarson-Kaplan Theater entrance is located south of the midblock crosswalk (where the sidewalk narrows), while the Proctor & Gamble Hall entrance is located just north of the midblock crosswalk.

Observations

Observations were conducted along Walnut Street on Friday, June 8th and Saturday, June 9th between 7:00 PM and 11:15 PM. On both nights, there was an 8:00 PM show in the Proctor & Gamble Hall and Jarson-Kaplan Theater. The Area Choreographer's Festival, hosted in the Jarson-Kaplan Theater, ended at approximately 10:00 PM, while Aladdin, hosted in the Proctor & Gamble Hall, ended at approximately 10:30 PM. After our in-person observations, we used video footage from the Cincinnati police department to verify some of our observations and to quantify activity along this stretch of Walnut Street.

Before Theater Events

Arrivals to the theater occurred over the hour prior to the event starting, with peak arrivals occurring between 7:30 and 7:55 PM. Some attendees approached the theater on foot, presumably from parking at a nearby lot or from nearby restaurants. Others approached in a personal vehicle, dropping it off at one of the valet stands located midblock along Walnut Street. A third set of people were dropped off by a vehicle most frequently in the north end of the block and proceeded to leave the area after dropping off the passenger(s). Vehicle parking on Walnut Street is sparse – just space for approximately five vehicles on the east side of the street at the south end of the block. These spaces experienced limited turnover during the time period prior to the theater events. At any given time, vehicle activity was relatively low, and did not disrupt traffic or transit flow along Walnut Street.

Pedestrian Circulation

Pedestrian activity was relatively high during the period prior to the theater events, with most people using the midblock crosswalk to travel to the theater (eastbound). A uniformed Traffic Control Officer (TCO) from the Sheriff's department was stationed at the crosswalk for one hour prior to the event, stopping vehicle traffic as necessary to permit pedestrians to cross the street. During peak pedestrian activity before the event, the officer prioritized the safe and effective crossing of pedestrians, which was observed to cause vehicle delay to southbound vehicles, with the queues occasionally extending beyond Seventh Street (four times during the one-hour observation period).

Passenger Loading Activity

A summary of the curbside activity observed before the event is illustrated in **Figure 8**.

Valet Operations – Frequent vehicle drop-offs were observed at both the 21C Museum & Hotel and Nicholson's Gastropub in the period prior to the theater event. Some of the drop-off activity at Nicholson's Gastropub was observed to be partially blocking through traffic on Walnut Street while accessing the valet stand. The data presented in Figure 8 shows that both the Nicholson and 21C Museum & Hotel valet stands had customers' vehicles parked in their valet zone for the duration of our pre-event observation period. We observed 14 valet events and 6 cars parked on the west side of this block for the duration of our observation. That means that one third of all valet activity consisted of parked vehicles in active valet zones, which is inconsistent with the valet permit application requirements.

Non-Valet Passenger Loading – On both the west and east side of the street, we observed 25 non-valet passenger loading events. 16 of these events occurred at the curb outside of the travel way, but nine occurred in the travel lane in front of the theater in the northeast quadrant of the block. For the duration of our pre-event observations, the spaces dedicated for taxis had vehicles parked that did not look to be official taxis.

Dwell Time Comparison – The average dwell time for active valet events (excluding the parked vehicles in the valet areas) for both zones was three minutes per vehicle. The average dwell time for other passenger loading events was about 35 seconds, which is about five times shorter than valet events. This is likely because pre-event passenger loading events primarily consist of passenger drop-offs, which is a shorter transaction as a vehicle stopping at a valet stand and getting a claim check.

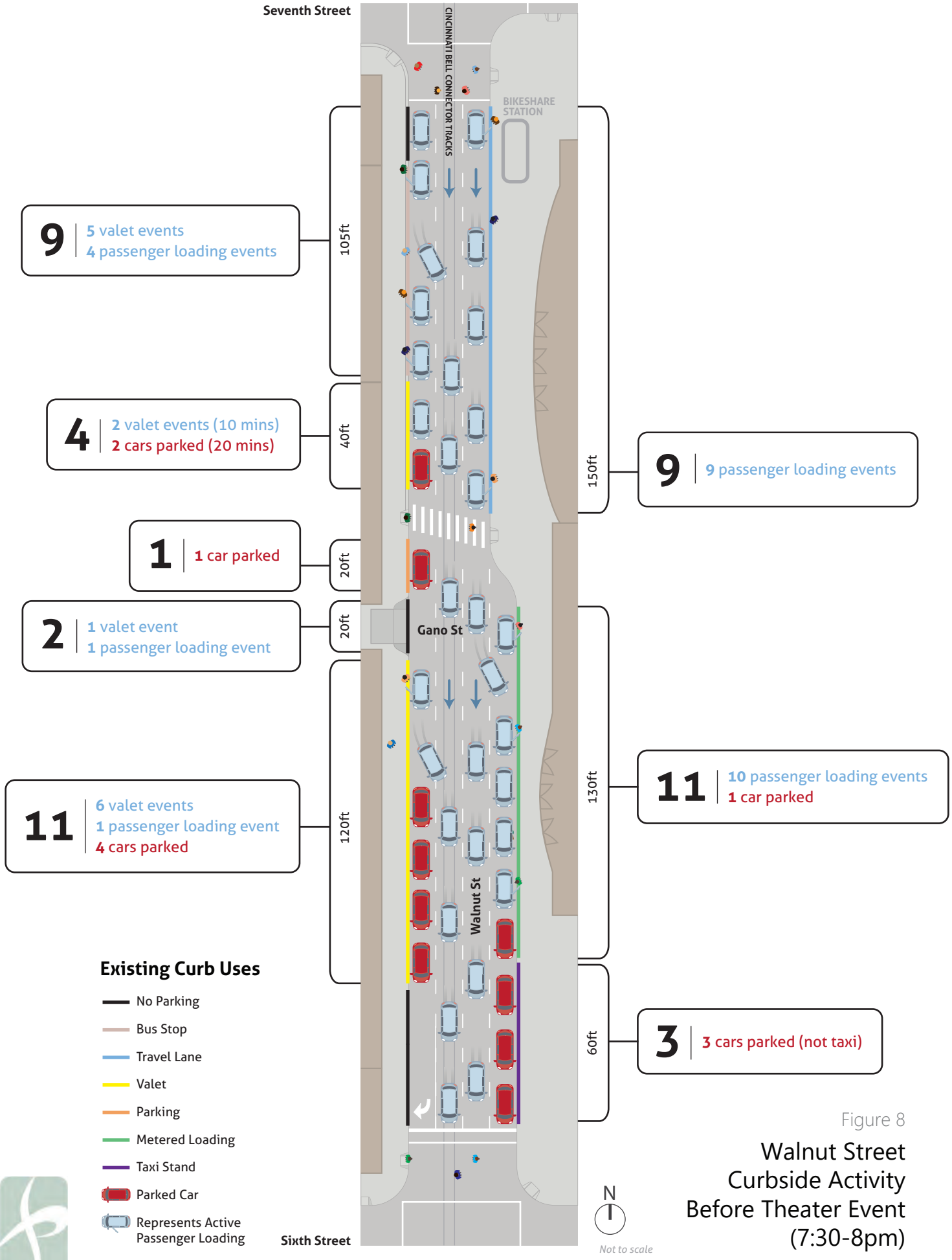


Figure 8

Walnut Street Curbside Activity Before Theater Event (7:30-8pm)

Observed activity on Saturday June 9, 2018

After Theater Events

In contrast to the arrivals, theater departures were concentrated in a short period of time. When the shows ended, (presumably) all visitors exited the theater. Peak curb demand lasted between 10:30 and 10:50 PM. After 10:50 PM, some visitors were still waiting for their ride (either a valet, taxi, rideshare, or personal vehicle), but traffic flow had normalized. By 11:05 PM, all theater visitors had cleared the area.

After the theater events, passenger loading often occurred directly in front of the theater entrances. Some of these pickups occurred in the designated passenger loading area in front of Jarson-Kaplan Theater (southern half of the block), but the majority of activity took place in the easternmost travel lane in front of the Proctor & Gamble Hall (northern half of the block), periodically disrupting vehicle traffic as the curbside lane is a through travel lane. Based on anecdotal evidence, it would be expected that demand for pick-ups near theater entrances is higher under inclement weather conditions and amongst attendees with limited mobility (small children or seniors). Valet loading occurred on the west side of Walnut Street (other valet providers were available on Sixth Street), both north and south of the midblock crosswalk.

Passenger Loading Activity

A summary of the curbside activity observed after the event is illustrated in **Figure 9** and described in detail below.

Valet Operations – The data presented in the figure shows that both the Nicholson and 21C Museum & Hotel valet stands had customers' vehicles parked in their valet zone for the duration of our pre-event observation period, albeit fewer total parked cars compared to the pre-event period. We observed 26 valet events on the west side of this block and observed 4 cars parked in that area for the duration of our observation, which as stated before, is inconsistent with the valet permit application requirements.

Backstage Valet patrons waiting for their vehicles after the theater event

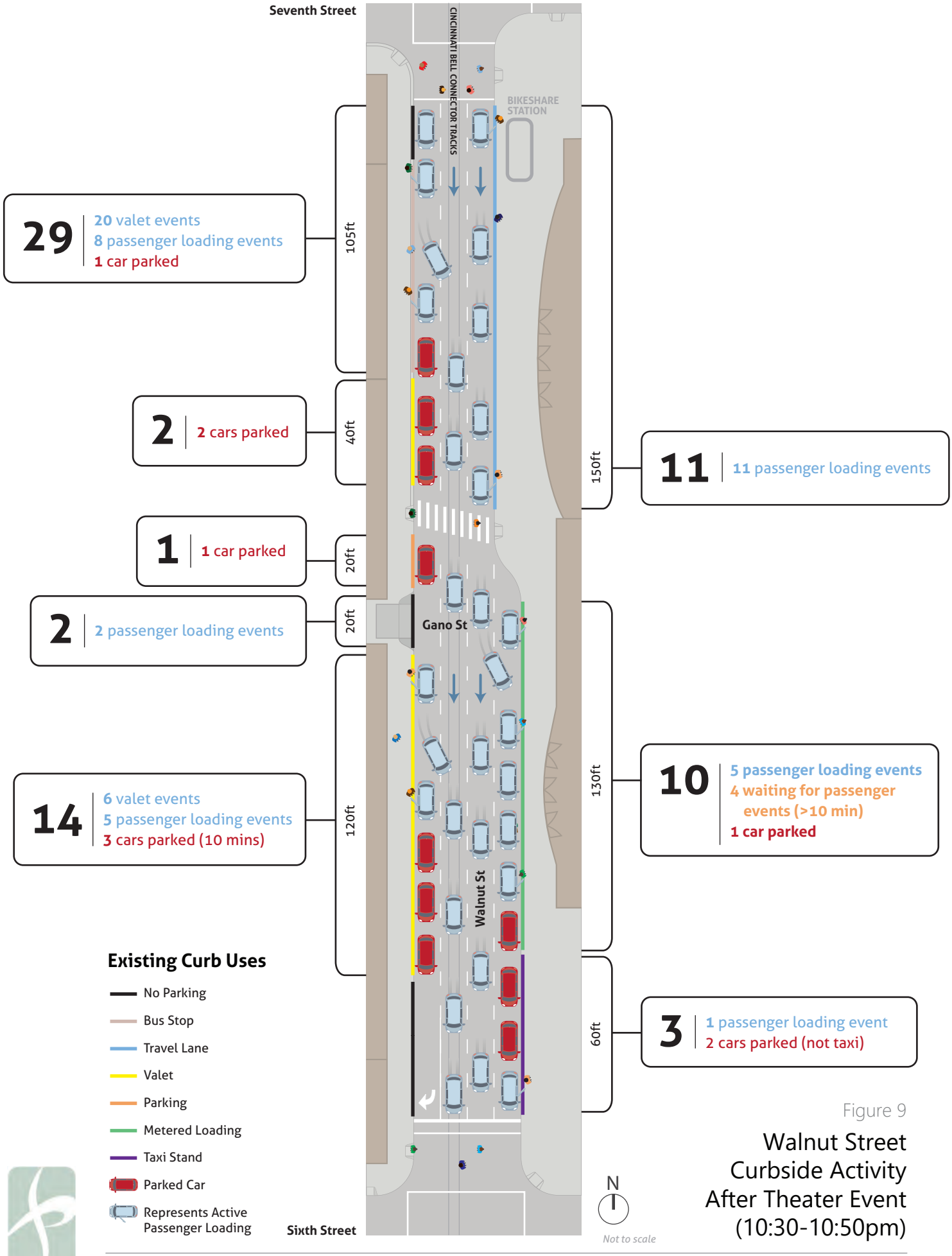


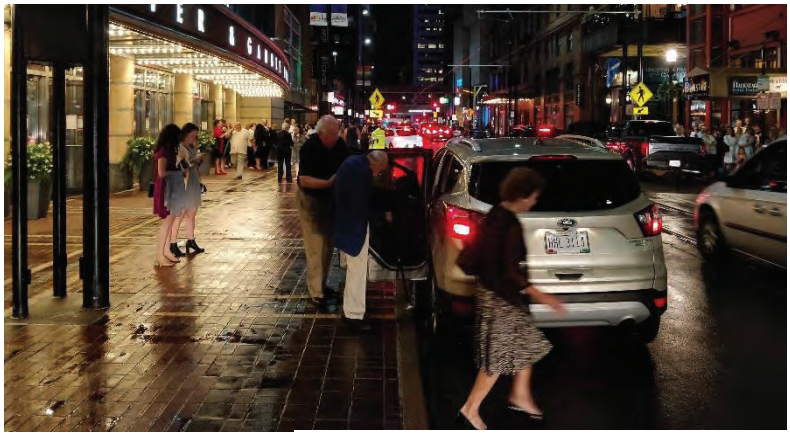
Figure 9

Walnut Street Curbside Activity After Theater Event (10:30-10:50pm)

Observed activity on Saturday June 9, 2018

Non-Valet Passenger Loading – On both the west and east side of the street, we observed 36 non-valet passenger loading events. Of these events, 25 of these occurred at the curb outside of the travel way, but 11 occurred in the travel way in front of the theater in the northeast quadrant of the block. For the duration of our post-event observations, two of the three spaces dedicated for taxis had vehicles parked that did not look to be official taxis.

Some passenger loading activity in the metered loading area on the east side of the block was observed to be passenger loading, but the dwell time for these vehicles ranged from 10 to 22 minutes. This loading has been categorized as "waiting for passenger" so as not to adversely affect the average dwell time of more time-efficient passenger loading observed elsewhere on this block.

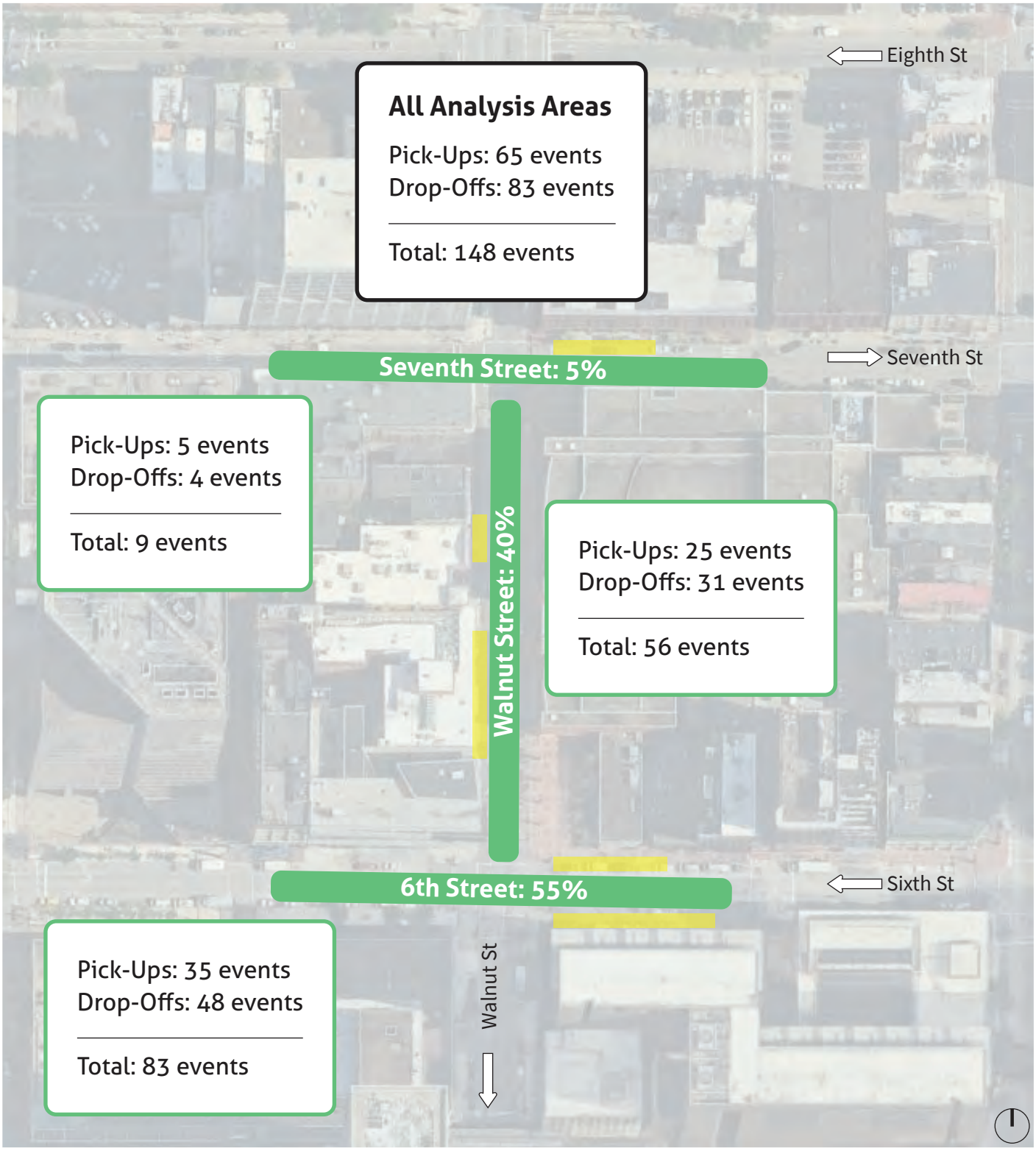


Some passengers were observed using the travel lane for passenger pick-ups after the event

Dwell Time Comparison – The dwell time observed for valet and other passenger loading events averaged just over two minutes, compared to an average dwell time of 40 seconds in the before-event period. The comparatively longer dwell time is likely due to the nature of before- and after-event passenger loading activity type. "Before event" activity was predominantly drop-offs and "after-event" activity was predominantly pick-ups. The pick-up events had a higher incidence of drivers waiting for passengers as noted above, compared to the before event activity drop-offs which happen with minimal dwell time attributed to drivers waiting.

Uber Activity

In addition to our observations described above, we were provided data from Uber summarizing the pick-up and drop-off activity by location to see how Uber activity contributes to the general amount of motorized vehicle traffic along this corridor. The activity by block is illustrated in **Figure 10**. As shown, the majority of rideshare activity occurred on Sixth Street during the evening of our observations.



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Valet Locations

Analysis Area

Figure 10

Walnut Street Area
Distribution of Uber Activity Before & After Theater Event
(6-8pm & 10pm-midnight)

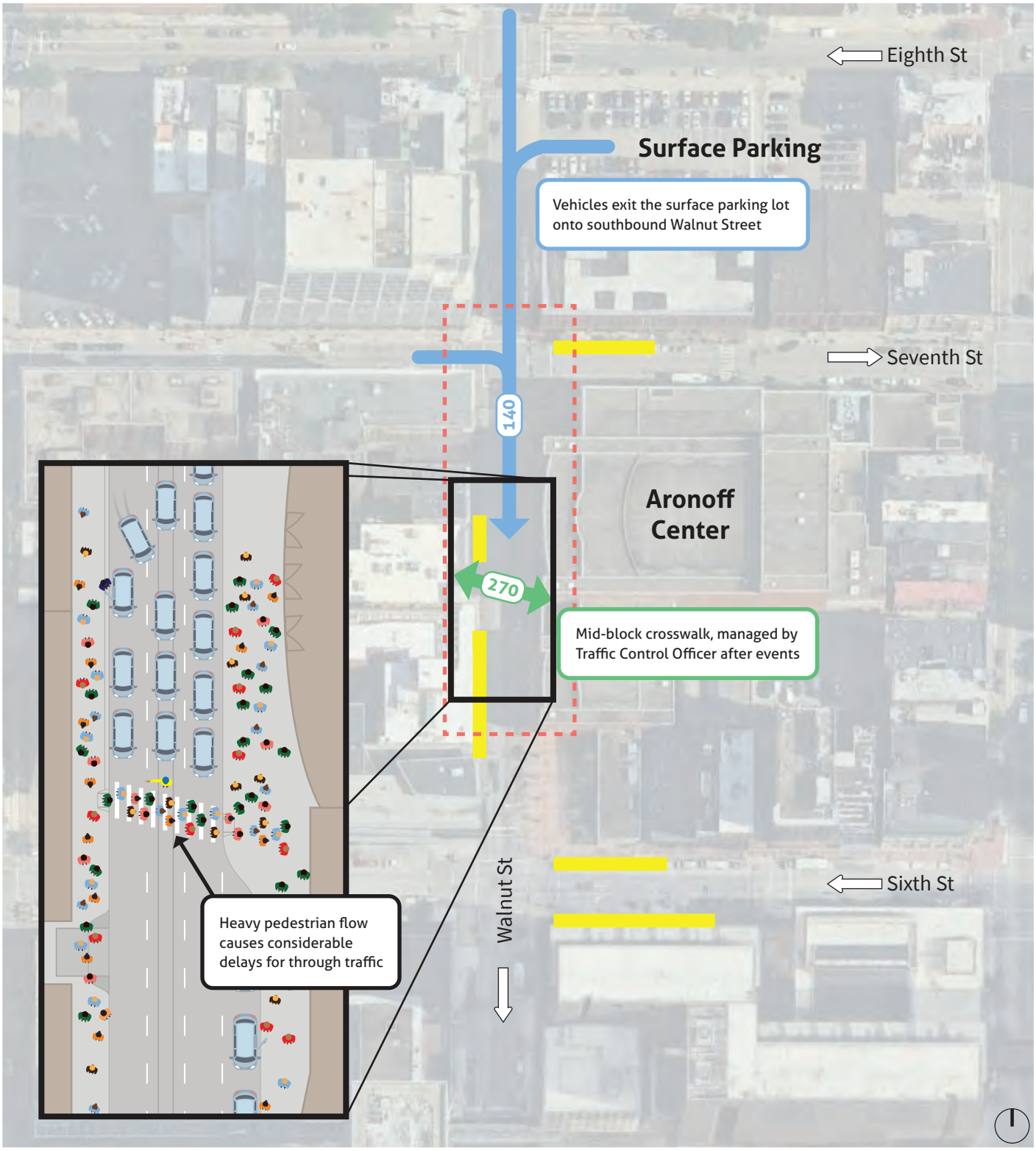
Vehicle Circulation

North of the midblock crosswalk: A TCO managed pedestrian crossings at the midblock crosswalk for approximately 30 minutes after the shows ended (10:25 to 11:00 PM) during the observation period. A high volume of pedestrians used this crosswalk, crossing to the valet stations on the west side of the street, nearby parking facilities, or to neighborhood bars and restaurants. Given both the higher than normal volume of traffic and pedestrian traffic during this time period, there was a continuous line of cars (also referred to as "rolling queue") starting at the midblock crosswalk extending to the surface parking lot located at the southeast corner of the Walnut Street / Eighth Street intersection. On a few occasions, multiple vehicles were unable to turn right from Seventh Street onto Walnut Street due to queue spillback and vehicles merging in and out of the valet area on the west side of the street. These vehicle queues also impacted transit vehicles, including both bus and the CBC. Several buses were observed along this route, although none made stops in the study area. The CBC delays were most notable at the station just north of Seventh Street, where the CBC was unable to access the station due to queuing vehicles. Additionally, there were some instances when a CBC was stuck in the vehicle queue just north of Seventh Street and unable to go through the intersection during several signal cycles. There were two to three trains scheduled during our window of observation, which was consistent with what we observed. A summary of our observations for circulation that contributed to traffic impacts described above are illustrated in **Figure 11**.

Passenger loading observed in the travel lane adjacent to the theater

South of the midblock crosswalk: South (i.e. downstream) of the crosswalk, vehicular traffic appeared to move freely dispersing into right-turning and through vehicles at Sixth Street.

There is a right-turn pocket at the south end of this block, just north of Sixth Street. The turn pocket has space for about two vehicles. The existing storage length seemed sufficient to accommodate demand during our observations.



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XX Pedestrians Crossing in Peak 15 Minutes

XX Traffic Volume in Peak 15 Minutes

Focus Area

Valet Locations

Figure 11

Walnut Street Area
Post Event Circulation Observations

Analysis

The activity and behavior observed before and after the event provided a snapshot of how large events at the Aronoff Center can have noticeable effects on access and circulation in the vicinity of the theater. For the before- and after-event periods, we conducted an analysis of the vehicle curb productivity and curb space allocation, which serves as the basis for our recommendations to reconfigure the curb space along the Walnut Street segment.

Vehicle Curb Productivity

Using the methodology presented in the Data Collection & Analysis section, we calculated the vehicle curb productivity for the activity observed in the before- and after-event period. We also documented the maximum number of simultaneous events for each mode. The results of the vehicle curb productivity during the before- and after-event are illustrated on the following pages.

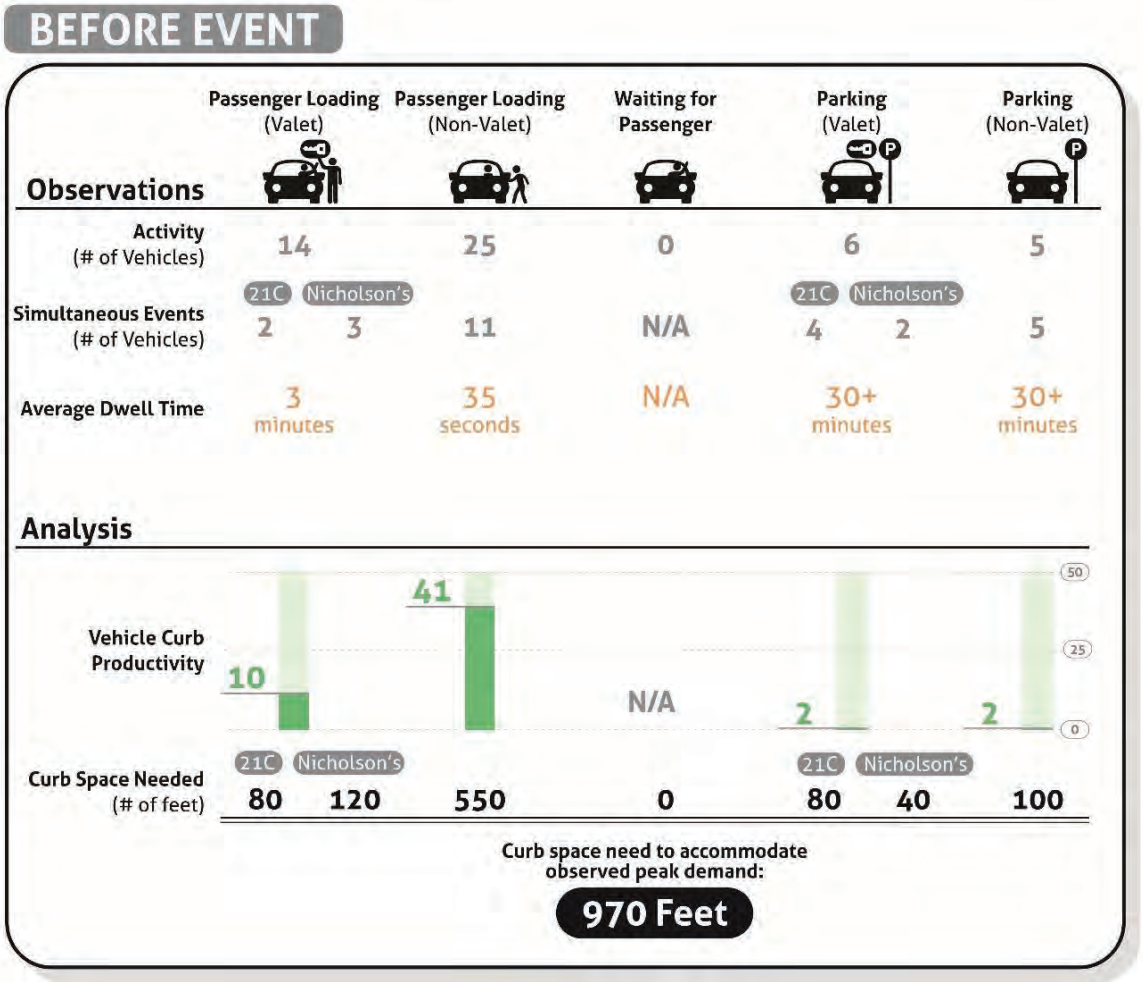
Well-utilized metered passenger loading zone outside of the Aronoff Center

Before Event

The chart below summarizes the activity and analysis results for the before-event period.

The results of the before-event analysis show that both active loading in the valet area and for non-valet activities are comparatively high (Vehicle Curb Productivity of 10 and 41, respectively). However, both the valet zones and other non-valet curb zones had parked cars, which led to low vehicle curb productivity results on the block level.

Also included in the chart is the simultaneous events observed by vehicle type during this period. Using the maximum simultaneous events and the methodology presented earlier about calculating the curb space needed to accommodate activity at the curb, 970 feet of curb would be needed to accommodate all observed activity on this block. Upon review of the existing curb space allocation (Figure 6), there is only approximately 475 feet of curb space on this block that is not used as travel lanes or driveways.

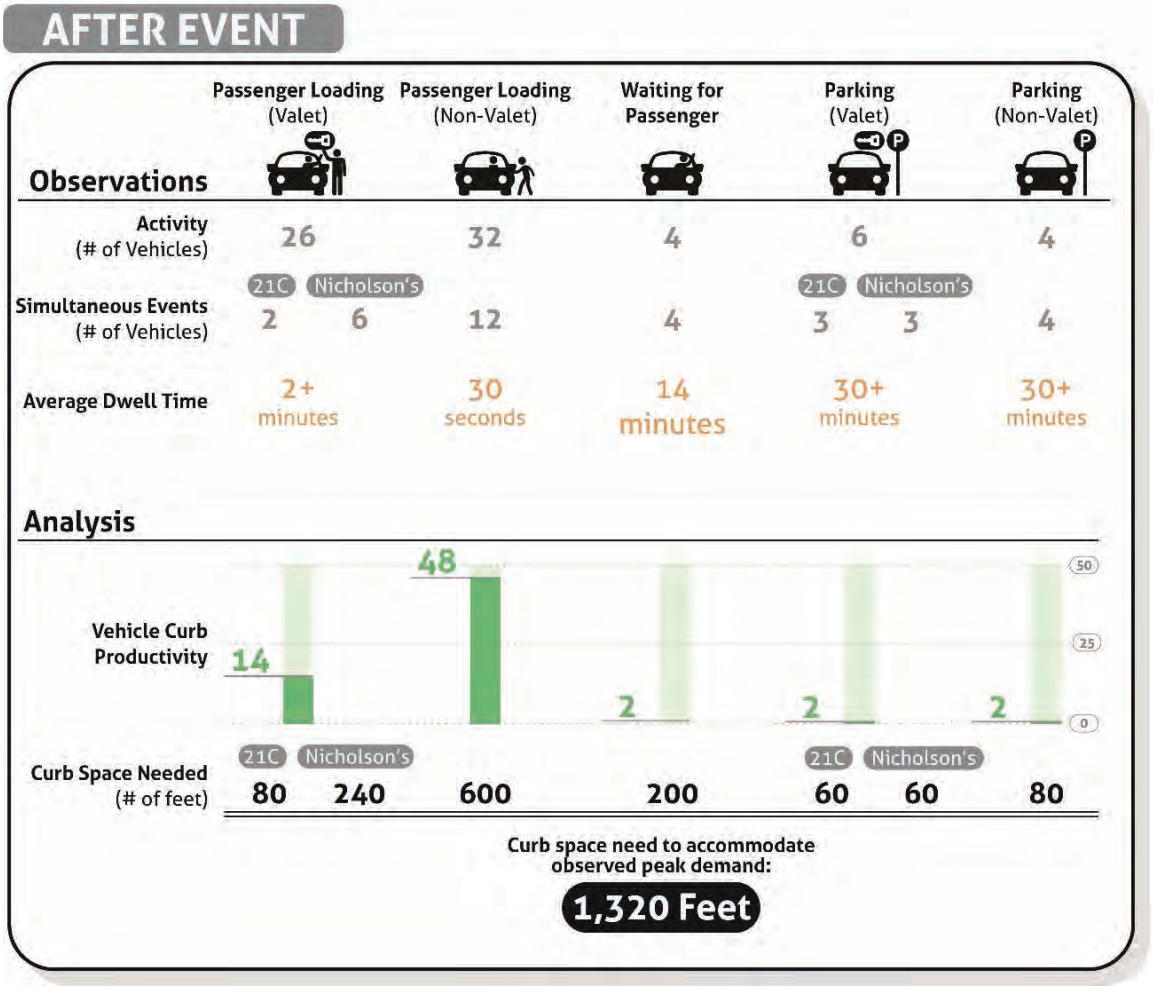


After Event

The chart below summarizes the activity and analysis for the after-event period. One key distinction about this chart compared to the before-event chart is the presence of "waiting for passenger" activity. "Waiting for Passenger" activity was evaluated separately from active passenger loading and parked vehicles to show the relative productivity of active passenger loading activity during this period.

The results of the after-event analysis show the same general results as the before-event analysis, specifically:

- Both active loading in the valet area and for non-valet activities are comparatively high (Vehicle Curb Productivity of 14 and 48, respectively).
- Both the valet zones and other non-valet curb zones had parked cars, which led to low vehicle curb productivity results on the block level.
- The amount of curb space needed to accommodate the observed activity would be 1,320 feet, which is substantially more space than is currently available on this block.



Curb Space Allocation

Table 4 provides a comparison between the calculated vehicle curb productivity and current curb allocation for each activity in the before- and after-event periods. Some key takeaways for this table are as follows:

- **Total Curb Space vs. Passenger Loading Curb Space** – The table shows that only 370 feet of the curb space on this block is currently designated for passenger vehicles. The remaining 105 feet consists of a bus stop and no parking zone, as illustrated in Figure 6.
- **On-Street Parking** – The table shows that 80 feet of the 370 feet designated for passenger vehicle uses is designated for on-street parking. Parking was found to have a VCP of 1 in both the before- and after-event periods. This means approximately 20% of space designated for passenger vehicle activity on this block is designated for uses that are found to have the lowest productivity.
- **Need for Reallocation** – The curb space on this block does not accommodate all of the observed activity on this block, nor does it reflect the proportional demand for each mode. Therefore, strategies to optimize the effective use of the curb space would be appropriate to improve the amount of passenger loading activity to occur at the curb, likely reducing delay to through traffic caused by passenger loading in the travel lane.

Table 4. Walnut Street Vehicle Curb Productivity & Space Allocation

Event Type		Vehicle Curb Productivity		Existing Curb Space Allocation
		Before Event	After Event	
Loading	Valet	**20**	**28**	**160 feet**
	Non-Valet	**103**	**120**	**130 feet** [1]
	Waiting for Passenger (> 10 min)	**0**	**4**	
Parking	Valet	**1**	**1**	**0 feet**
	Non-Valet	**1**	**1**	**80 feet**

Note:

[1] *The metered loading zone is designated for short-term passenger loading and is technically available for non-valet passenger when available. During the before-event period, active non-valet passenger loading was observed in this space. However, in the after-event period, when activity was higher, this zone was primarily used for "waiting for passenger" activity.*

Recommendations

Walnut Street between Sixth and Seventh Street is a very active corridor before and after large events at the Aronoff Center. The activity is highest immediately following large events, when pedestrians exit the theater on to Walnut Street. The midblock crosswalk effectively blocks through traffic for 10 to 15 minutes after events, creating queues that take up to 40 minutes to dissipate to get back to normal conditions. Guiding pedestrians to use crosswalks at signalized intersections would not be expected to be effective at controlling the crowds after events given the high demand for crossing at this midblock location. Therefore, recommendations to address the issues described above include improvements to the area-wide circulation as well as the under-utilized curb space on this block to reduce the impact the large event crowds cause for vehicles, including transit, on this corridor.

Our recommendations also include proposed modifications to valet zones, both on a block level and from a policy perspective. Valet service provides visitors with a direct, convenient way to visit the area without seeking out parking in remote facilities. Providing this service on Walnut Street is a productive use of curb space, and we recommend retaining valet zones. However, as stated in detail in the following section, we recommend clarifying the limits of these zones for valet operations and consider improvements to ensure compliance (e.g. improved enforcement, signage, and more prescriptive limits to be included in the permits for valet operations).

Below are three categories of improvements identified for Walnut Street, each with specific benefits, challenges, and expected effectiveness.

1. **Area-Wide Circulation Changes** – Includes wayfinding and traffic control for motorists in the area to avoid the congested block of Walnut Street when the peak event crowds are expected.

2. **Curb Space Designation Changes** – Changes to the designated uses of the curb space on this block would allow for better use of the curb to pick up and drop off passengers, increasing the likelihood of the travel lanes to be fully used for through vehicles.

3. **Policy-Related Changes** – Includes review and potential changes to City policies such as valet permit program, enforcement of passenger loading in non-designated spaces, and other changes that require input from various City agencies prior to implementation.

There is not a single recommendation that would be expected to alleviate the queuing of vehicles observed on this block. However, the following improvements would each be expected to have a measurable positive effect on traffic operations and safety if implemented.

Area-Wide Circulation Changes

The vehicle queues that spill back because of the midblock pedestrian crosswalk are also directly related to the number of vehicles travelling southbound on Walnut Street between Sixth and Seventh Streets. Given that all vehicles – including rideshare pickups, personal vehicle pickups, valet pickups, and vehicles traveling from parking lots north of the Aronoff Center – must travel southbound along Walnut Street, there is high demand to pass through this crosswalk after shows end. Any measures to move southbound vehicles to parallel/alternate routes would be expected to mitigate the queue caused by the midblock crosswalk. Based on our observations, improvements that would achieve this objective are illustrated in **Figure 12** and described below.

- **Wayfinding Signage** – Utilize changeable message signs in key locations, such as on Seventh Street west of Walnut Street facing eastbound motorists, and on Walnut Street north of Eighth Street facing southbound motorists. These messages should warn motorists of the conditions up ahead and direct those that that do no need to access the block on Walnut Street between Sixth and Seventh Streets to use parallel routes and other streets to get to the regional freeway network or other destinations in the downtown area.
- **Parking Facility Access** – The surface parking lot located at the southeast corner of the Walnut Street / Eighth Street intersection has two driveways, one on Eighth Street and one on Walnut Street. The driveway on Walnut Street forces motorists to go south, into the area congested after events. If the parking operator were to prohibit exits from the Walnut Street driveway, all vehicles that do no need to access the block on Walnut Street between Sixth and Seventh Streets would be routed to avoid the queues of vehicles that form in front of the Aronoff Center midblock crosswalk.

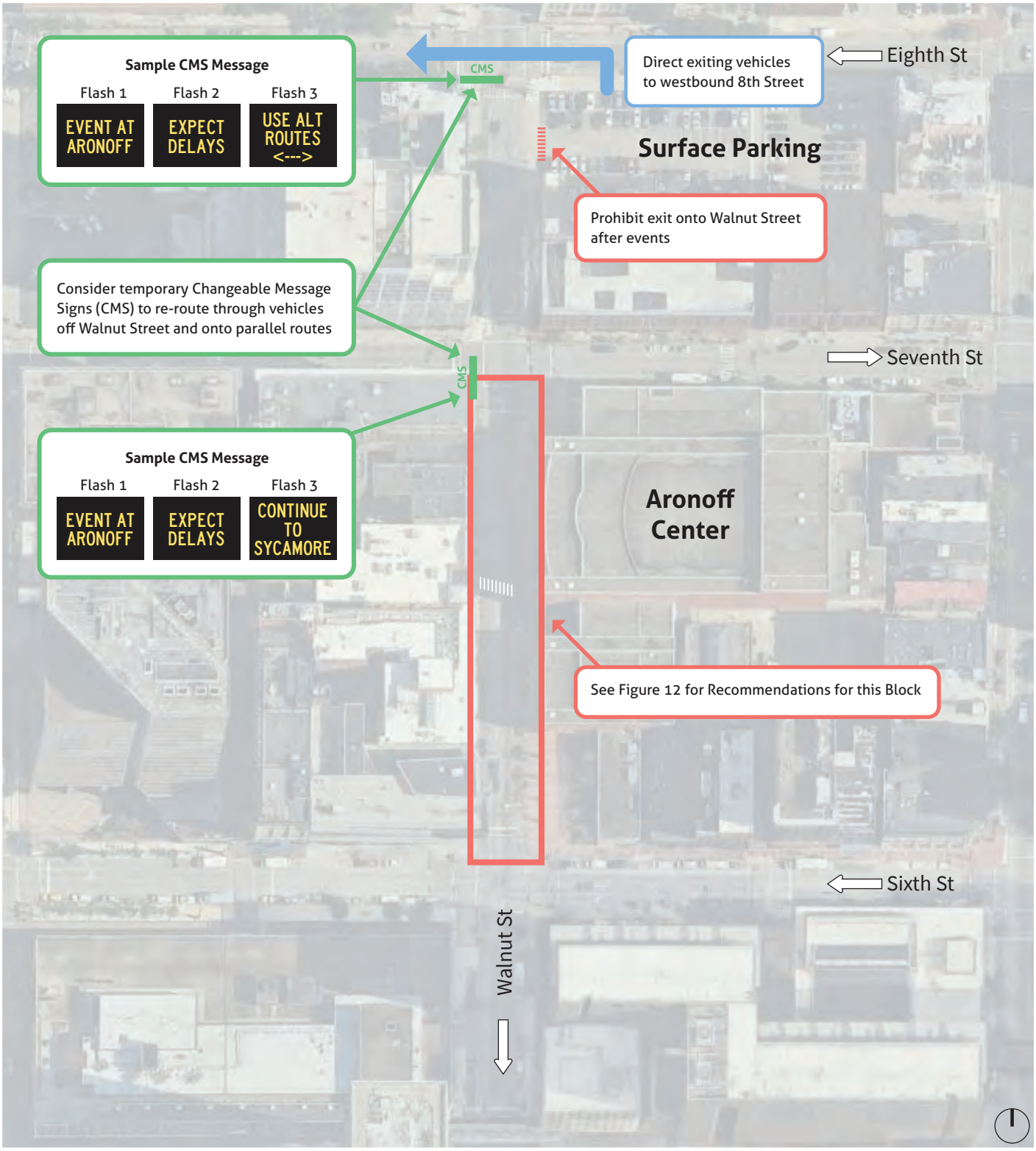


Figure 12

Walnut Street Area Circulation Recommendations

Curb Space Designation Changes

There is considerable valet and non-valet passenger loading activity on both sides of Walnut Street between Sixth and Seventh Streets. We observed more than ten cars parked on this block during each observation period. Any changes to the curb space designation that would promote the use of the curb space for active passenger loading would be expected to increase the efficiency of the curb with the upside of increasing the productivity of the curb and the adjacent travel lanes on this block.

Our recommendations for reconfiguring the curb space designation on this block is based on the results of our vehicle curb productivity analysis and our understanding of the various activity types and needs for the users of this block. Due to the high level of activity for passenger loading and lack of supply for adequate passenger loading space, our recommendations include installing new designated passenger loading zones. A summary of our recommended changes to curb space designations, and the rationale behind our recommendations is described below.

Summary of Recommendations

Our curb space designation recommendations, illustrated in **Figure 13**, are described below.

- **Reconfigure the northwest quadrant** (comprises a 'no parking' zone, a bus stop, and Nicholson's valet) to accommodate non-valet passenger loading activity and increase the space permitted for the Nicholson's valet. The resulting designation would be a time-of-day passenger loading zone of 85 feet (space for up to three concurrent passenger loading events) and 60 feet for the Nicholson's valet (up to four concurrent valet vehicles). We also recommend designating the area between the midblock crosswalk and Gano Street as overflow area for valet operations to temporarily store vehicles waiting to be moved off-street while valet operators process additional passengers north of the crosswalk.
- **Reconfigure the southwest quadrant** (comprises the 21C Museum & Hotel valet and a turn pocket) to accommodate non-valet passenger loading activity and decrease the space permitted for the 21C Museum & Hotel valet. The resulting designation would be a time-of-day passenger loading zone of 60 feet (space for up to two concurrent passenger-loading events) and 60 feet for the 21C Museum & Hotel valet (up to two concurrent valet vehicles).
- **Reconfigure the southeast quadrant** (comprises a metered loading zone and a taxi stand) to accommodate additional passenger loading activity. The resulting designation would be 130 feet of short-term passenger loading, and relocation and reduction of the metered loading zone to replace the 60 feet of designated taxi area.

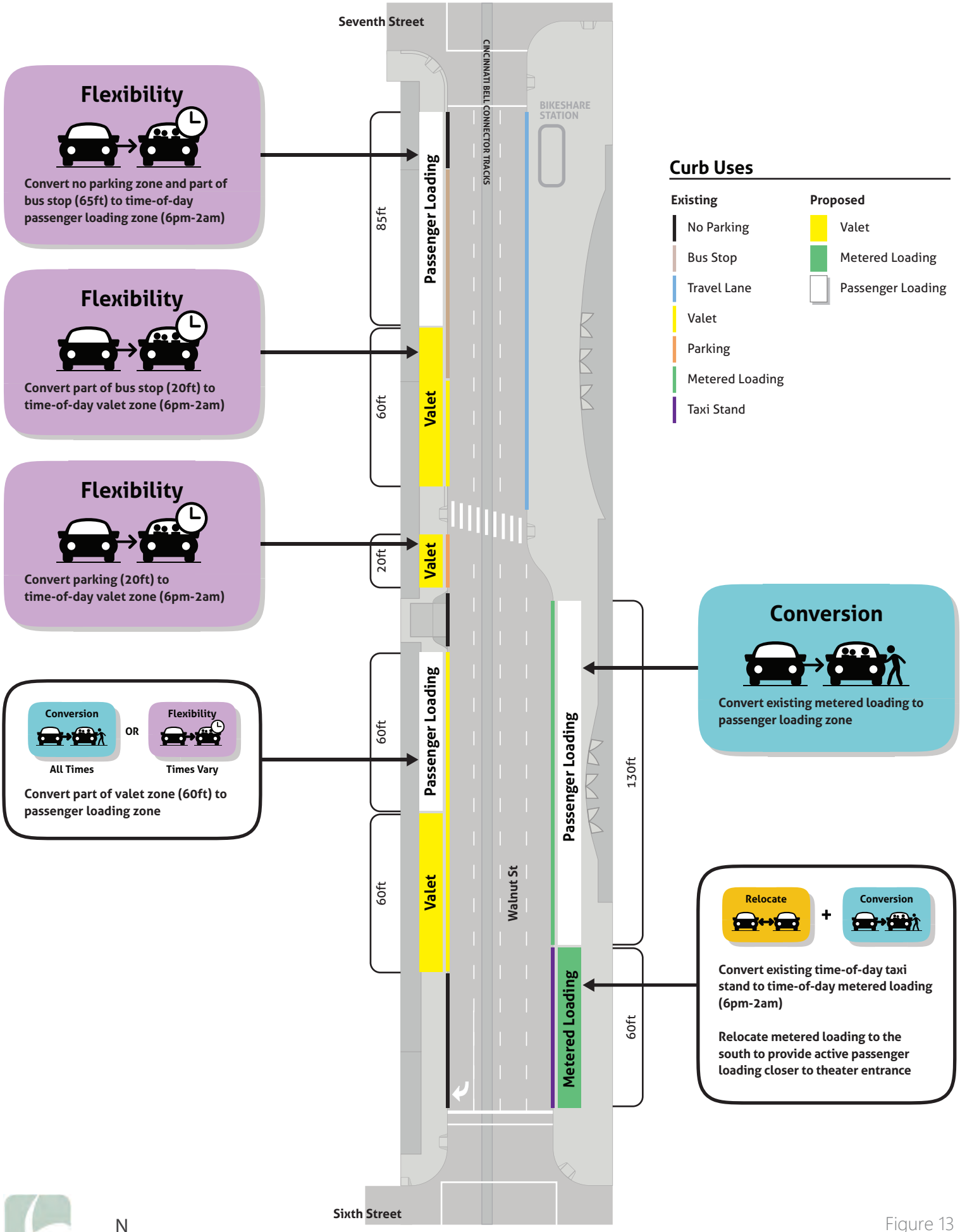


Figure 13

Walnut Street Curb Space Allocation Recommendations

Rationale for Recommendations

The reallocation of curb space takes into account a variety of factors, included the results of our analysis, observations from our site visits, and our interpretation of how motorists and passengers use this block of Walnut Street. The process used to develop our recommendations are summarized as follows:

- **Identify Necessary Curb Space Designations (the "Who")** – There are multiple curb users on this block, each with a specific purpose and reason for doing so. Removing valet zones or metered loading would not be an appropriate strategy. However, discouraging low productivity curb uses such as on-street parking, and removing the non-utilized taxi area would lead to a more productive curb.
    - **Resulting Recommendations:**
        - ✓ Maintain valet zones
        - ✓ Maintain metered loading zone
        - ✓ Remove on-street parking
        - ✓ Remove designated taxi zone
        - ✓ Establish passenger loading zones
- **Compare Space Needed versus Space Available (the "How Much")** – The results of our analysis showed that over 1,100 feet of curb space would be needed to accommodate observed peak demand (excluding parking), while only 475 feet of curb space is available on this block. Therefore, the curb space should be reallocated proportionally to each mode's relative demand and using the vehicle curb productivity as a guide.
    - **Resulting Recommendations:**
        - ✓ Increase designated passenger loading zone
        - ✓ Reduce valet zones and discourage valet parking in the valet zones
        - ✓ Reduce metered loading zone
- **Equitably Distribute Available Space (the "Where")** – Using engineering judgment, we identified the appropriate locations for each use. The valet locations are set based on the businesses they serve. Establishing a passenger loading zone that would have a high likelihood of being used by motorists destined for the theater is also important. Therefore, the resulting recommendations establish several separate passenger loading zones, in locations in close proximity to the theater entrances.
    - **Resulting Recommendations:**
        - ✓ Clarify the limits of the valet zones to discourage valet parking in the valet zone
        - ✓ Establish time of day passenger loading zone in space currently designated as a bus stop and no parking during nights and weekends when the bus stop is inactive and the theater demand is at its highest

- ✓ Relocate the metered loading further from the theater to provide more active loading zones closer to theater entrances

Expected Results

Changing the curb designations to increase the amount of curb space available for more productive modes would be expected to increase the overall productivity of the curb.

We estimated the amount of vehicles that could access the curb per hour with the existing and proposed curb space allocation. We found that more than four times as many passenger vehicles would be able to use the curb space to pick up and drop off passengers during the before and after-event periods with this reallocation.

These curb space changes would make the curb

4x

more productive

Keys for Implementation

To optimize the effectiveness of the above curb space designation changes, the following elements should be explored and included with any changes to the curb space designation:

- Signage for motorists delineating the spaces and areas where passenger loading is permitted
- Enforcement of valet zones to actively receive vehicles and move them to off-street parking facilities
- Improvements to the valet permit application that clearly establish the location and length of each valet zone
- Geofencing by Uber and other rideshare providers to guide passengers and drivers to designated passenger loading zones

Policy-Related Changes

There are numerous designated curb use types on this block that are guided by established City policies. These polices include valet operations, metered loading and taxi stands. Our observations found that the usefulness of these spaces could be improved by a variety of physical changes. However, the benefits could be realized by reviewing and refining policies related to these uses. Increasing enforcement, improving monitoring, or efficiently issuing violations could increase compliance, which would be expected to improve access and mobility on this block and throughout the City in addition to physical curb designation changes. The following policies are just some of the topics that could be reviewed and modified to improve compliance and could lead to improved access, mobility, and circulation.

- **Valet Operations** – During both observation periods, it was found that valet operators stored cars for a long period of time, seemingly in violation of the conditions set forth in the permit. We observed two valet operations, but there are numerous other operations in the City. The City Traffic Engineer reviews and monitors valet operations and cites violations when necessary. However, some modifications to the valet program could improve its effectiveness and allow the City to more actively manage these operations for the betterment of the broader downtown area. Some examples are as follows:
    - Require Valet Operators to provide data related to number of vehicles served, average dwell times, number of valet staff at each stand
    - Improved direction on the applications about the limits of the valet stand, including more specific City-approved signage to provide motorists with a sign style to expect when visiting downtown
    - Require valet operators to identify off-street parking facilities to be used for their customers vehicles.

- **Uniform Passenger Loading Zones** – City should consider establishing passenger loading zones that permit taxi, rideshare, and private vehicles ("passenger loading for all") in place of taxi stands, and improve signage to notify motorists of the time restrictions and use of each zone. By using area-wide technology, City could establish dynamic pricing and change curb use on a time basis using a variety of metrics to utilize the curb more efficiently.

Case Study 2: Second & Main – Baseball Games

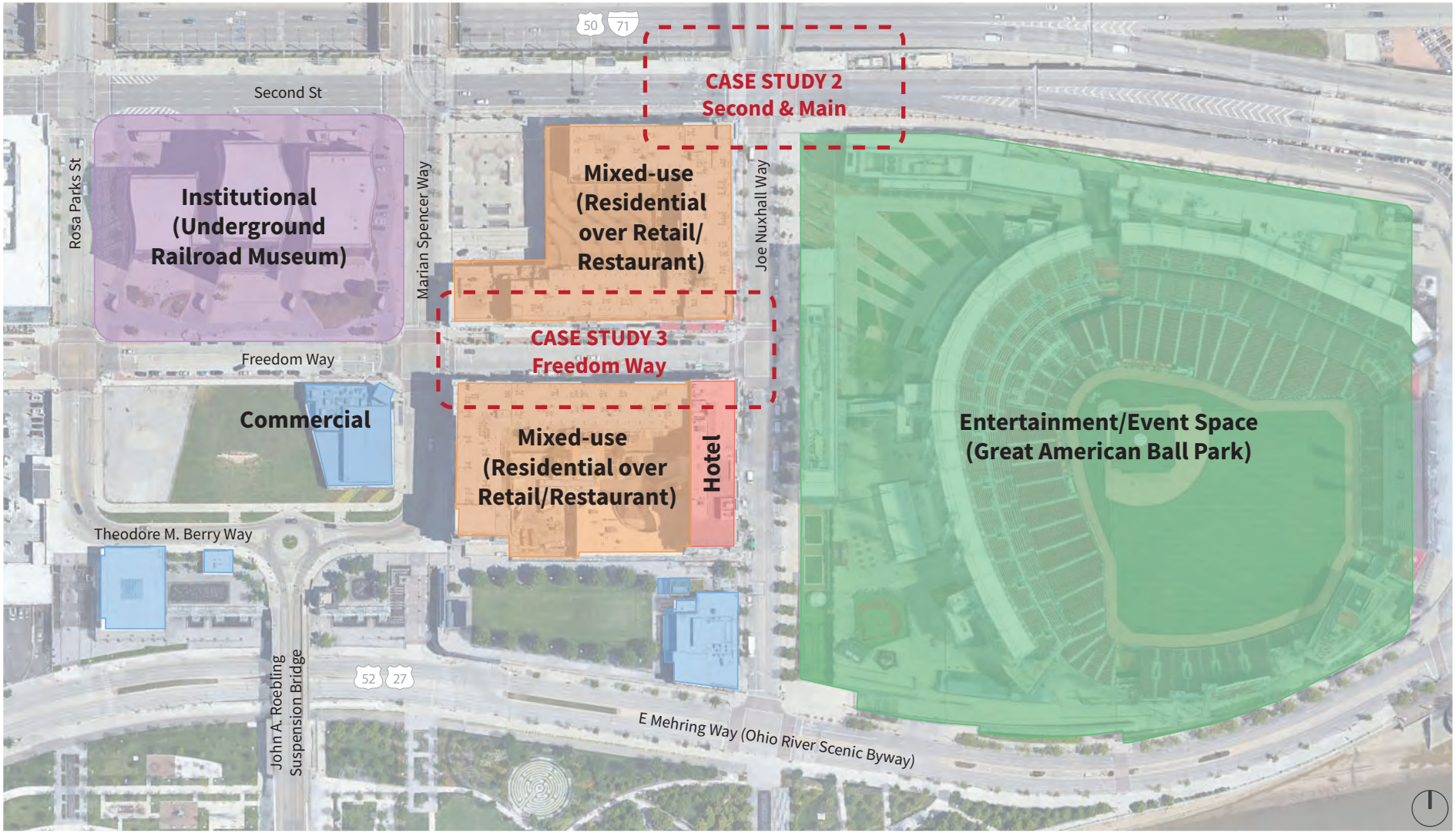
Transportation & Land Use Context

Roadway Network

The intersection of Second Street / Main Street is a signalized intersection located between Interstate 71 and the Ohio River, at the northwest corner of the Great American Ball Park, where the Cincinnati Reds Major League Baseball team plays. There are no land uses on the north side of Second Street; the roadway runs adjacent to Interstate 71. South of Second Street, there are restaurants and bars west of Main Street and the ballpark is southeast of the intersection. A map of the area around the Ball Park – referred to as The Banks – is shown in **Figure 14**.

Second Street runs one-way eastbound. Second Street has four lanes west of Main Street, with one left-turn-only lane, one shared left-through lane, one through lane, and one through-right-turn lane. East of Main Street, Second Street splits into three forks, including access to Interstate 71 northbound (one lane), Interstate 71 southbound (one lane), and local riverfront access (two lanes), from north/left lanes to the south/right lanes. Just east of Main Street, there is a hatched zone adjacent to the south/right curb that tapers from 10 feet wide along the 200 feet immediately east of the intersection. Parking is not permitted on Second Street on either side of the intersection. The CBC runs curbside on the south side of Second Street on the block east of Main Street. The curb space allocation of this area is illustrated in **Figure 15**.

Main Street changes names at Second Street; while it is Main Street north of Second Street, the roadway is called Joe Nuxhall Way south of Second Street. North of Second Street, Main Street runs one-way northbound, with three vehicle travel lanes. South of Second Street, Joe Nuxhall Way is a two-way roadway, with two lanes in either direction. The right northbound lane is a right-turn-only lane. Parking is not permitted on the Main Street or Joe Nuxhall Way segments that abut Second Street.

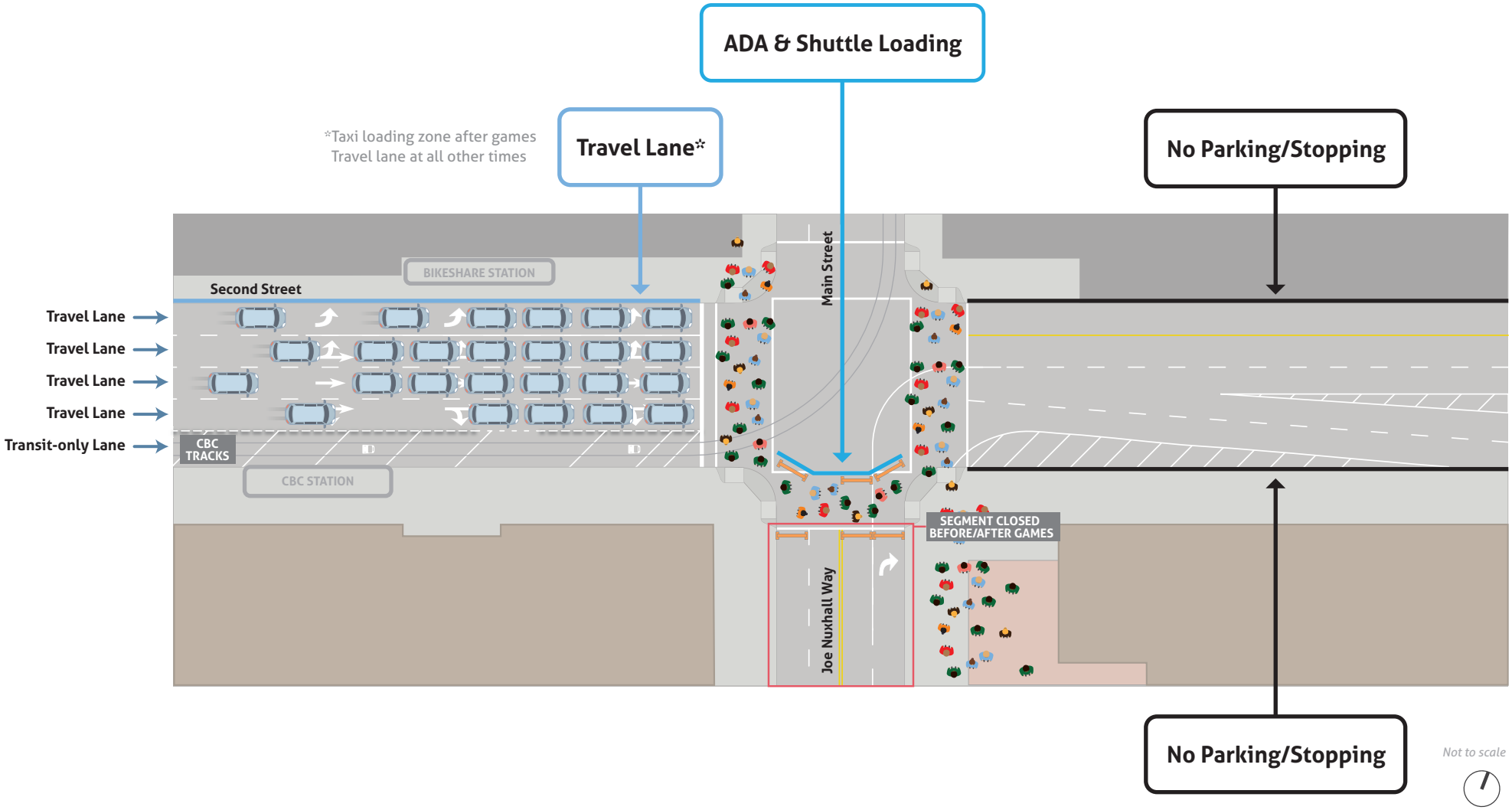


LEGEND

Study Area

Figure 14

The Banks
Land Use Context



Barricades

Figure 15

Second & Main
Curb Space Allocation During Baseball Games

Transit Service

The CBC runs eastbound on Second Street in a dedicated right-of-way to the right of the rightmost travel lane. At Main Street, the train turns left onto Main Street, still traveling in a dedicated right-of-way to the right of vehicle traffic. The train arrives every 12 to 15 minutes, passing through the intersection four to five times each hour.

Cincinnati Bell Connector making the turn onto Second Street before a baseball game

Parking Facilities

There is a large subterranean parking facility that extends between the Great American Ball Park and Paul Brown Stadium, providing a substantial amount of parking to serve the Banks neighborhood.

There is a driveway to the underground parking facility approximately 70 feet west of Main Street. At the time of our observations, this garage entrance was gated off and through discussions with police officers and TCOs, we learned that it is intermittently used for police vehicle access. We also learned that one reason this garage entrance was closed was due to conflicts with event passenger loading vehicles using this curb zone to pick up and drop off passengers, which intermittently blocked CBC trains before, during, and after baseball games and generally during nights and weekends when the restaurants are most active. It should be noted that we were told this by police officers and TCOs and did not observe these conflicts.

Pedestrian & Bicycle Facilities

There are wide crosswalks (16 to 20 feet wide) along each of the four crossings of the intersection and pedestrian signal head for all pedestrian crossings. There is a bike share station with docks for 19 bicycles at the northwest corner of the intersection. Pedestrian access to the underground parking is available approximately 200 feet west of the bike share station.

Great American Ball Park

The Great American Ball Park, home to the Cincinnati Reds, is located south of Second Street and east of Joe Nuxhall Way. The stadium hosts approximately 80 home games between late March and late September. At the beginning and end of the season (when the days are shorter), weekdays typically start at 6:40 PM. For the rest of the season, weekday games are typically at 7:10 PM, unless they are a day game, starting at 12:35 PM. Weekend home games start at a variety of times between 1:10 PM and 7:10 PM. The stadium has

capacity for approximately 42,000 attendees,[8] though average attendance for 2018 was approximately 20,000 attendees.[9]

There is a parking garage underneath the Great American Ball Park, and the garage is segmented into several sections, including the East Garage, Broadway Lot, East Central Riverfront Garage, West Central Riverfront Garage, and the West Lots. Each of the lots are priced between $10 and $20 on game days, with the "Central Riverfront" garages as the most expensive. Entrances to the garages are located throughout the study area, and the three primary vehicle entrances used for Cincinnati Reds games are located on Broadway at Second Street and along the Ohio River Scenic Byway both east and west of Joe Nuxhall Way. During games, on-street parking is permitted on Freedom Way, but the number of spaces are limited.

Circulation routes around the ball park and entrances to the major event parking facilities are illustrated on **Figure 16**. As shown, the eastbound Second Street is a shared route for motorists leaving the downtown area to access Route 71 and many of the motorists bound for Ball Park parking facilities.

The segment of Joe Nuxhall Way just south of Second Street is barricaded before and after Cincinnati Reds games. The segment is closed for the two hours prior to games, as well as for about 30 minutes after games end. During this time, this street is actively managed by Cincinnati police officers. Vehicles are not permitted to conduct pick-up or drop-off along Second Street west of Main Street/Joe Nuxhall Way and are instead ushered by the local police to conduct pick-ups and drop-offs in the south crosswalk of the Second Street at Main Street intersection, just north of the barricades. Based on discussions with stationed TCOs, this protocol represents a typical game day closure. However, special circumstances or events can sometimes change this protocol.

Based on the Cincinnati Reds website, "The accessible pickup/drop-off zone is located on Joe Nuxhall Way, from Second Street to Mehring Way, along the west side of Great American Ball Park. Cars, vans and small buses displaying a valid accessible placard or valid accessible license plate will be permitted to enter the pickup/drop-off zone beginning one half hour before gates open to approximately one hour after the conclusion of the game. Large school buses and large charter/tour buses are prohibited from entering this zone."[10]

Main gate at Great American Ball Park

[8] http://cincinnati.reds.mlb.com/cin/history/ballparks.jsp
[9] https://www.baseball-reference.com/teams/CIN/attend.shtml
[10] https://www.mlb.com/reds/ballpark/information/guide

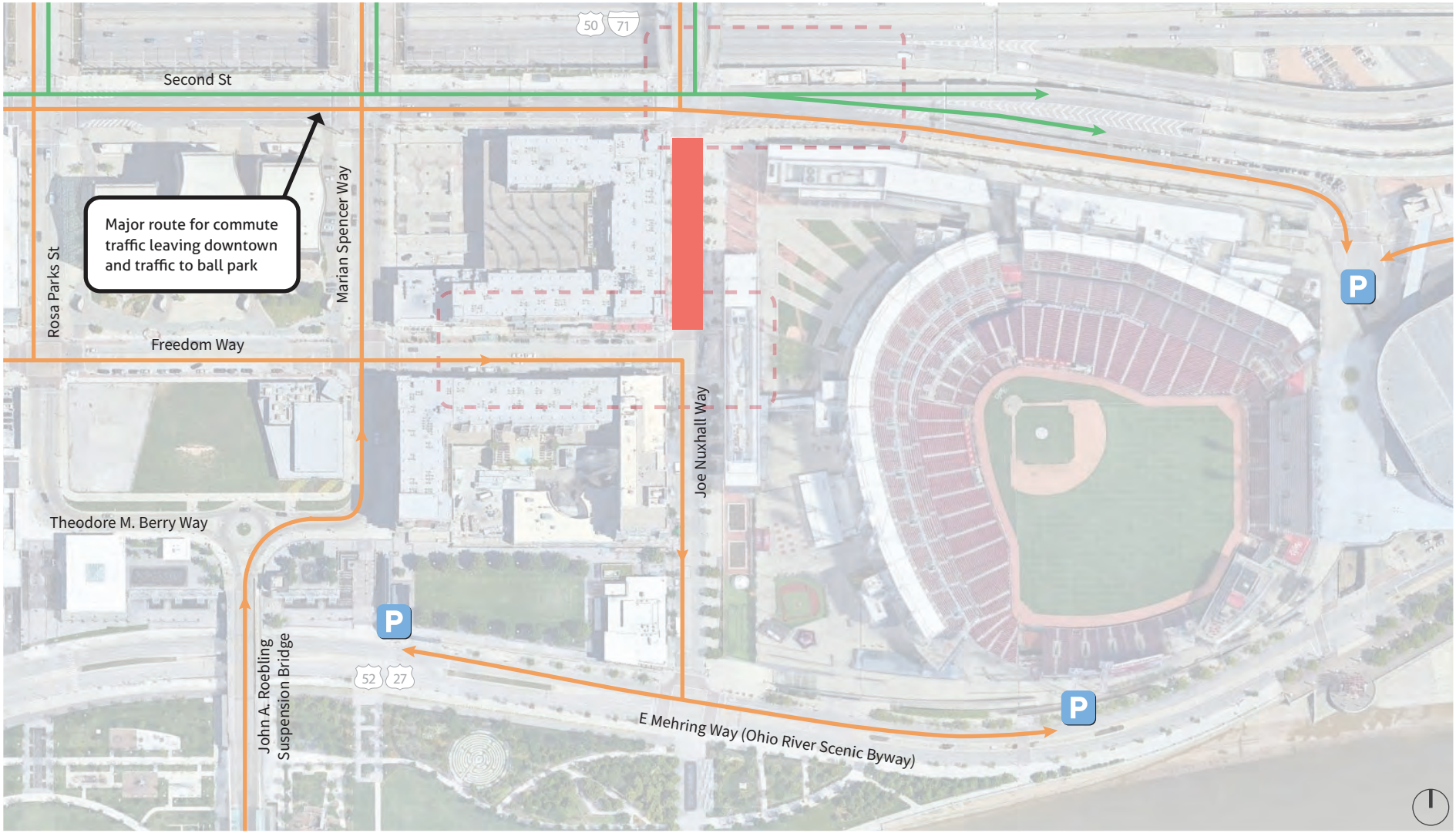


Figure 16

The Banks
Baseball Game Circulation and Parking Access

Observations

Observations were conducted at the intersection of Main Street and Second Street on Thursday, June Seventh, Friday, June 8th, and Saturday, June 9th, before and after baseball games:

Thursday – The Reds played the Colorado Rockies at 12:35 PM. The game was tied at the end of nine innings, and the teams played an additional four innings. The (total game time was 4 hours and 15 minutes. Observations were conducted from 10:30 AM until 7:00 PM.

Friday – The Reds played the St. Louis Cardinals at 7:10 PM. The game was tied at the end of nine innings, and the teams play an additional one inning. Observations were conducted from 5:00 PM until 12:00 AM. There were intermittent rain storms during the game, and some attendees were observed leaving early during these storms. The game time was 3 hours and 51 minutes, excluding a 36-minute rain delay.

Saturday – The Reds played the St. Louis Cardinals at 4:10 PM. The game did not go into extra innings. Observations were conducted from 2:00 PM until 9:00 PM. The total game time was 3 hours and 22 minutes. This game was a special event, Bike Night, in which the Reds partnered with Harley-Davidson Motorcycles. Secure motorcycle parking was available on Joe Nuxhall Way between Second Street and Freedom Way.

Pre-Game

Pre-game loading is generally comprised of drop-offs – personal vehicles, taxis, or rideshares are dropping off game attendees prior to finding a parking spot or another passenger. As a result, dwell time at the curb is generally relatively short. During weeknight games, game attendee arrivals often coincide with Cincinnati peak commute period ("rush hour"). Cincinnati commuters and game attendees travel through the same corridor, compounding motorist delay and queues along the corridor.

Cincinnati Commuters

Three interstate highways provide high-speed access in and out of downtown Cincinnati. Interstate 75 runs north-south along the west side of the city. Interstate 71 runs north-south along the east side of the city, then cuts west along the southern border of the city and crosses the Ohio River west of downtown. Interstate 471 runs north-south from south of Cincinnati to the city's southern border on the north side of the Ohio River, where it intersects with Interstate 71. Second Street provides access to northbound Interstate 71 as well as southbound Interstate 471. As a result, many commuters on the southeast side of the downtown access the highway via Second Street.

Parking Access

Three primary garage entrances are used for game attendees, with two entrances southwest of the ballpark on Ohio River Scenic Byway and one northeast of the ballpark off Second Street. Given the road closure on Joe Nuxhall Way, attendees driving to the more southern entrances must travel east on Freedom Way, and then south of Joe Nuxhall Way to access the parking lots. The high turning volumes at Freedom Way and Joe Nuxhall Way conflict with the high number of pedestrian crossings at this intersection.

Passenger Loading Activity

Taxi Loading – Taxi drop-offs occur along the north side of Second Street, just west of Main Street. There is no dedicated loading area along this curb; the taxi loading activity occurs in the eastbound left-turn only lane. In addition, there is no signage letting motorists know taxis are conducting drop-offs in this area. When motorists behind the taxis realize they are dropping off passengers, they then navigate around the loading taxi. Taxi dwell times are generally short, as nearly all loading activity prior to the game are drop-offs.

Non-Taxi Passenger Loading[11] – As mentioned above, vehicles are not permitted to pick-up or drop-off passengers along the south side of Second Street and are instead directed to the south crosswalk of the Second Street at Main Street intersection, just north of the barricades. Once passengers are dropped off, motorists can go straight onto on-ramp to the adjacent highways. In some cases, motorists make an unsafe eastbound left turn from this loading zone, passing through intersection to go north on Main Street.

Private Buses and Shuttles – Day time games have shuttles and buses for specific groups (such as elderly, school-aged children, mobility impaired or special needs patrons) that use the crosswalk drop-off area at Second Street and Main Street. In addition, charter buses pickup game attendees on the east side of Joe Nuxhall Way between Freedom Way and the Ohio River Scenic Byway.

TCOs actively managed the drop-off area along the southern crosswalk, prioritizing shuttles and ADA vehicles. Several private passenger and rideshare vehicles were observed using this space, although, as clarified by discussions with TCOs, they are not supposed to use this loading zone. In general, TCOs prioritize safety and traffic flow, and attempted to educate rideshare drivers when possible to avoid using this space to drop off passengers at future events. However, based on these discussions, the driver behavior remains ("they still do it").

[11] Non-taxi passenger loading consists of rideshare (Uber, Lyft) as well as private vehicles picking up friends and family. In general, the transactions observed looked to be rideshare transactions based on the observed behavior and use of phones to track vehicles. However, this study was not able to differentiate rideshare and private vehicle loading events.

Passenger loading activity observed before a baseball game is illustrated in **Figure 17**. The areas identified in green are locations where loading activities occur at the curb or in a zone under TCO control. These areas are defined as acceptable locations for activity to occur. Locations in orange and red represent areas where passenger loading activity occurs in a disruptive or undesirable way, whether it be in the travel lanes, requiring pedestrians to walk across train tracks, or to block pedestrian crosswalks. Before the baseball game, about 60 events were observed within the 30 minutes prior to the game starting. About 70% of events observed occurred in acceptable locations, but the remaining events (17 events) occurred in areas that blocked crosswalks, the CBC tracks, or occurred in the travel lane.

Pre-game shuttle dropping off passengers in the designated zone

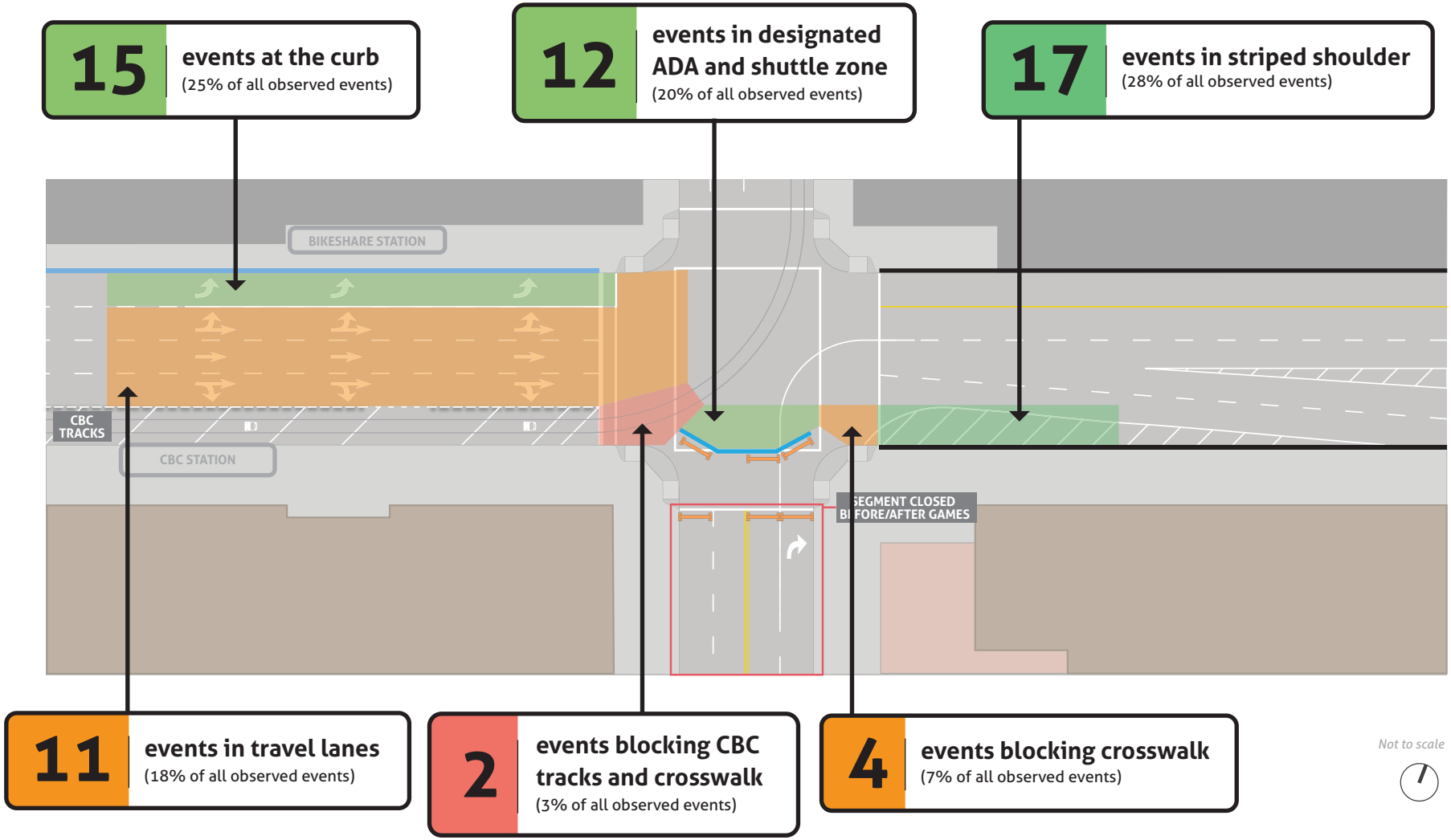
Post-Game

Post-game activity is generally more concentrated than pre-game activity. While people tend to trickle into the ballpark in the hour before the game, most attendees leave once the game is over. However, it should be noted that for particularly long games (such as extra innings) or inclement weather, some attendees may exit the ballpark while the game is still occurring.

Vehicle Queues

A continuous line of cars (also referred to as "rolling queue") was observed between the garage driveways along the Ohio River Scenic Byway north to Second Street. Vehicles generally traveled northbound on Joe Nuxhall Way, turned left and traveled westbound on Freedom Way, and then turned right onto Marian Spencer Way. The queues for this route occur at each of the three intersections (Freedom Way /Joe Nuxhall Way, Freedom Way /Marian Spencer Way, and Second Street / Marian Spencer Way). Queues generally did not clear during every signal cycle. Heavy pedestrian activity compounds the queuing; pedestrians cross against the signal, preventing vehicles from moving forward when they do have a green light.

At the Freedom Way/Marian Spencer Way intersection, there were southbound queues, which extended north beyond Second Street. At the Freedom Way/Joe Nuxhall Way intersection, it seemed many motorists in the eastbound direction were unaware of the game-related street closure on Joe Nuxhall Way. Some vehicles start in the left-turn pocket, and then have to merge back over to right-turn lane, while others make a u-turn so they can travel northbound along Marian Spencer Way



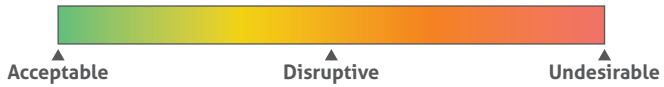


Figure 17

Second & Main
Passenger Loading Activity Before Baseball Game (6:10-6:40pm)

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Observed activity on Saturday August 11, 2018

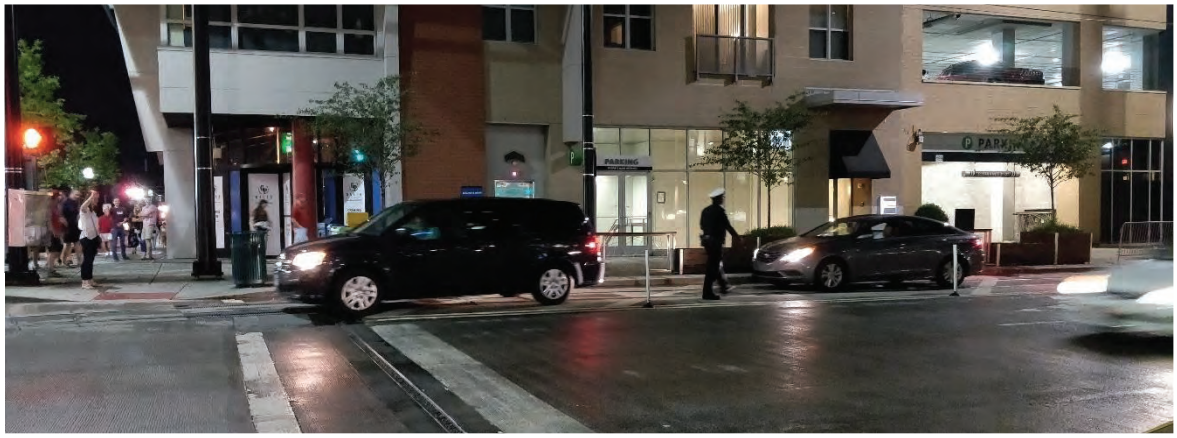
Passenger Loading Activity

Loading activity post-game generally consists of passenger pick-ups rather than drop-offs. Loading observations are summarized below:

Taxi Loading – Similar to pre-game taxi activity, taxis conduct pick-ups in left-turn lane of Second Street, just west of Main Street. These taxis have a high dwell time; several taxis line up at this location when they anticipate the game will end and wait for passengers. Personal vehicles traveling along Second Street planning to make a westbound left often find themselves behind taxi line. After some delay, motorists realize they must maneuver around the dwelling vehicles.

Non-Taxi Loading – Passenger loading activity occurs in the eastbound approach of the Second Street/Main Street intersection, and the south crosswalk of the Second Street at Main Street intersection. TCOs tended to encourage rideshare pick-ups to occur out of the travel lane near the crosswalk loading zone for safety and to not inhibit traffic flow. However, periodically rideshare pick-ups were observed in the eastbound travel lanes. These pick-ups were observed in each travel lane, including the dedicated CBC curbside lane (as shown in the image below). However, rideshare activity did not impact CBC during observations. Once motorists picked up passengers in the eastbound approach or crosswalk loading zone, they sometimes tried to make the left turn onto Main Street across all lanes, though many were forced to go through onto the highway on-ramp. In addition, some pick up activity occurred just past the crosswalk designated for loading, in the hatched zone on the east side of Main Street. Some rideshare pick up passengers in the small available spaces on both sides of the street along Joe Nuxhall Way between Freedom Way and the Ohio River Scenic Byway.

Passenger loading activity observed after a representative baseball game is illustrated in **Figure 18**. After the baseball game, about 60 events were observed within the 30 minutes after the game ended. About 60% of events observed occurred in acceptable locations, but the remaining events (25 events) occurred in areas that blocked crosswalks, the CBC tracks, or occurred in the travel lane.



Passenger loading event in the dedicated transit lane, with TCO approaching driver

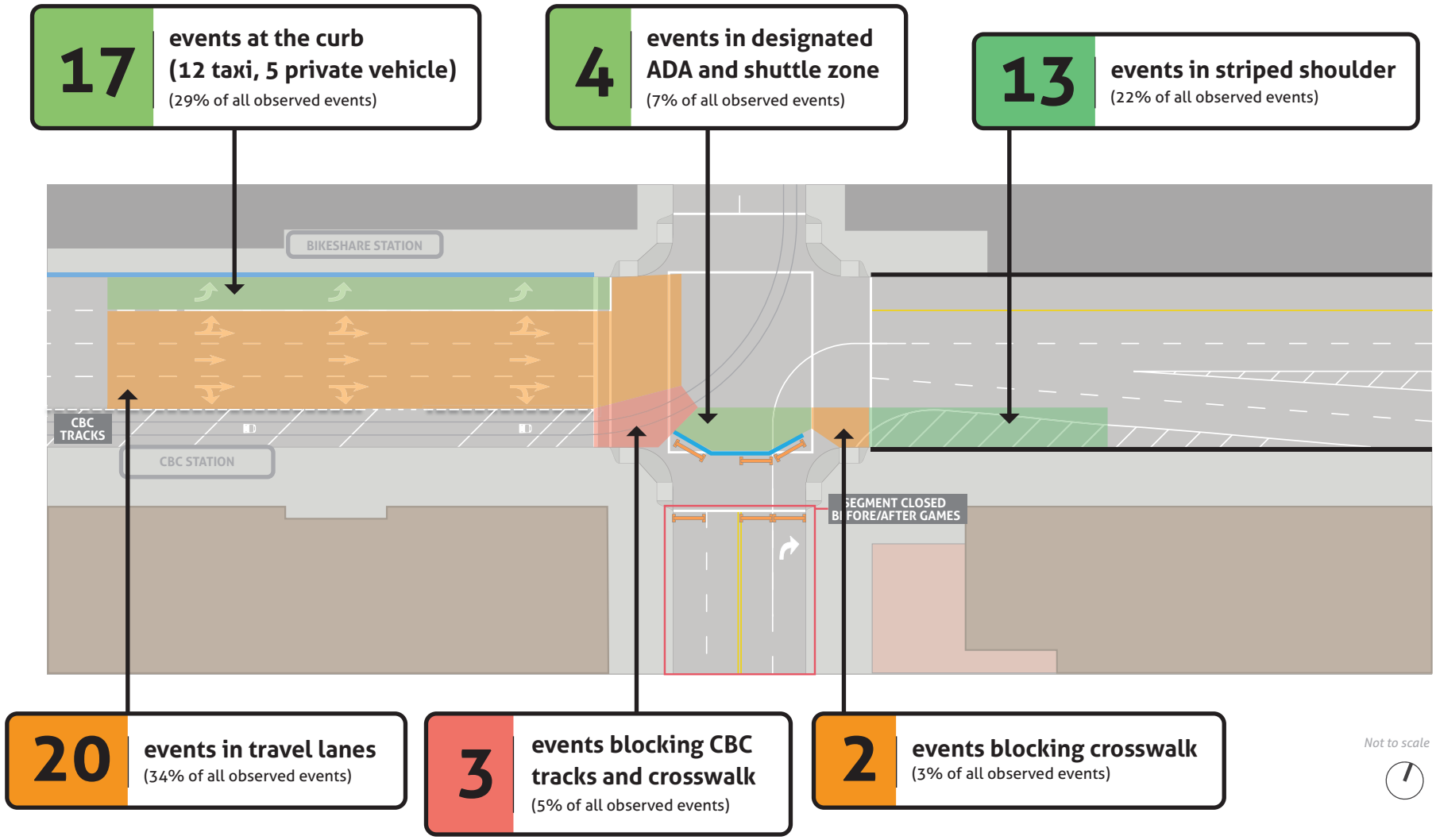


Figure 18

Second & Main
Passenger Loading Activity After Baseball Game (9:40-10:40pm)

Analysis

For the pre- and post-game periods, we conducted an analysis of the vehicle curb productivity and curb space allocation, which serves as the basis for our recommendations to reconfigure the curb space along the Second Street segment.

Vehicle Curb Productivity

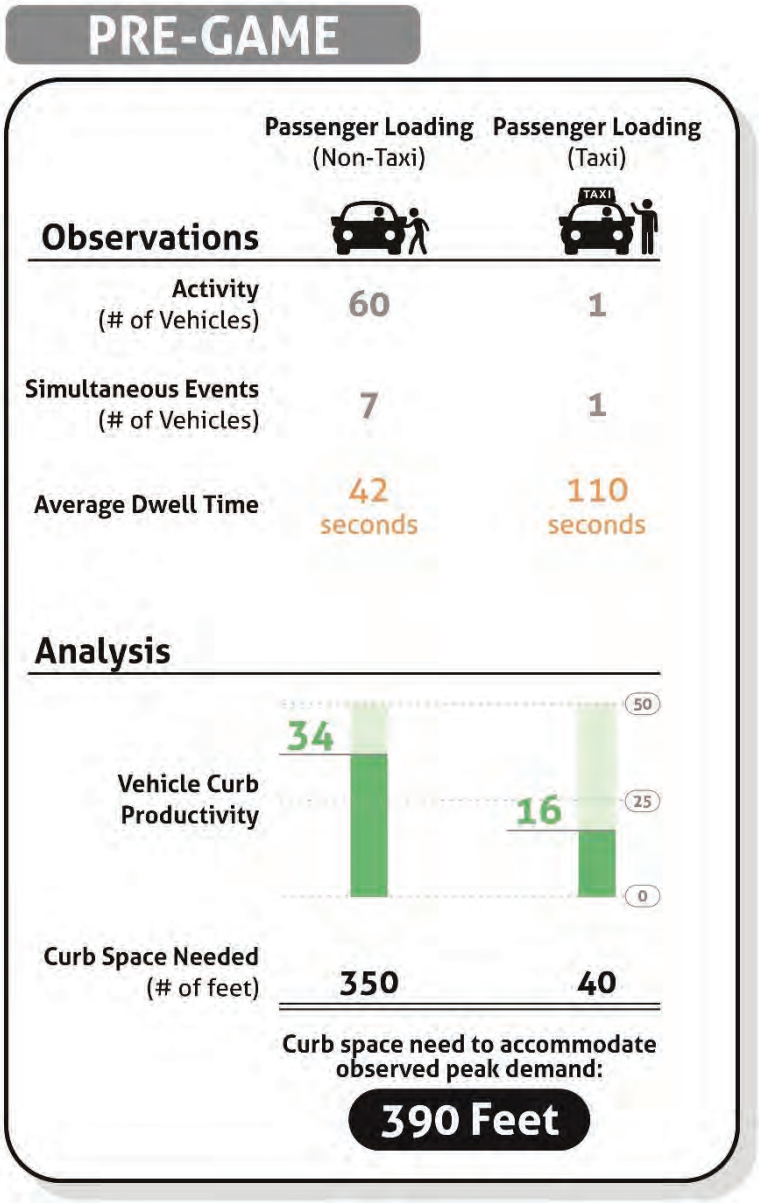
Using the methodology presented in the Data Collection & Analysis section, we calculated the vehicle curb productivity for the activity observed in the pre- and post-game period. We also documented the maximum number of simultaneous events for each mode.

Pre-Game

The chart to the right summarizes the activity and analysis results for the before-event period. The majority of passenger loading activity was by private vehicle with the exception of one taxi. The results of the analysis show that active loading has a comparatively high Vehicle Curb Productivity (value of 34).

During the pre-game period, there is no dedicated curb space for passenger loading or taxis, so all of the activity occurred in locations that are not preferred or designated for that type of passenger loading.

Also included in the chart is the simultaneous events observed by vehicle type during this period. Using the maximum simultaneous events and the methodology presented earlier about calculating the curb space needed to accommodate multiple passenger loading events, it is found that the overall curb space needed to accommodate all observed activity at the curb would be 390 feet.



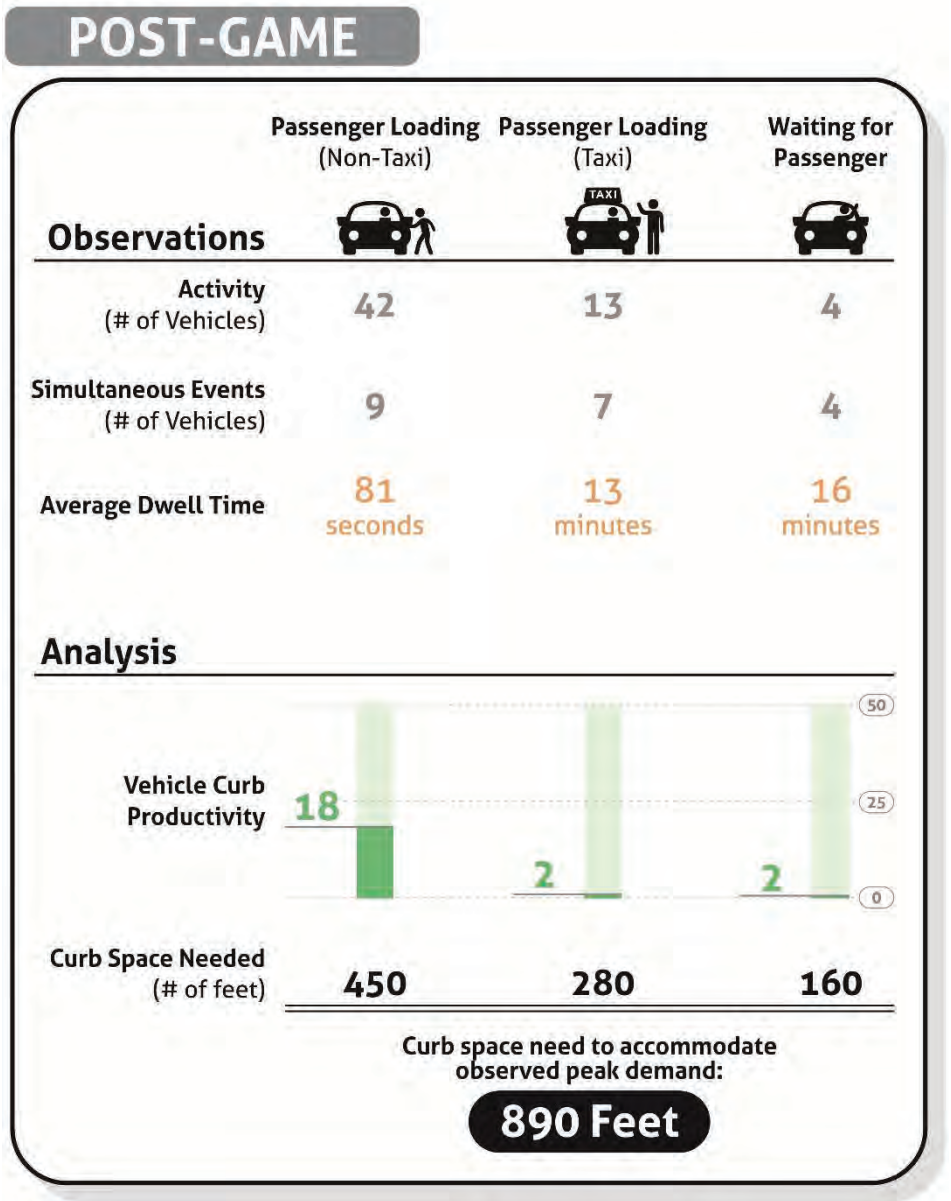
Post-Game

The chart below summarizes the activity and analysis results for the post-game period.

"Waiting for Passenger" describes vehicles that had a driver present, but did not move for over ten minutes, which in this circumstance consisted of a private vehicle stopped in the dedicated taxi zone west of the intersection or in the striped shoulder east of the intersection.

The results of the analysis show that active loading has a high Vehicle Curb Productivity (value of 18).

The chart shows that the curb space needed to accommodate the post-game passenger loading events would be 890 feet.



Curb Space Allocation

Table 5 provides a comparison between the productivity and current curb allocation for non- taxi, taxi, and "waiting for passenger" activity. This shows that the most productive activity (non-taxi passenger loading) doesn't have any designated curb space for that use, as our observations showed that this activity occurred in various undesirable locations.

Table 5. Second/Main Vehicle Curb Productivity & Space Allocation – Post-Game

Event Type	Vehicle Curb Productivity	Existing Curb Space Allocation
Non-Taxi Passenger Loading	**18**	**0 feet**
Taxi	**2**	**200 feet**
Waiting for Passenger (>10 minutes)	**2**	**0 feet**

Recommendations

The Second Street/Main Street intersection is a primary route for commuters leaving downtown and for passengers heading towards parking facilities for Red's games. Although the intersection operates with TCO control and delineates an ADA/shuttle stop adjacent to the stadium, there is insufficient curb space to accommodate passenger loading activities for the baseball games. In addition, there is no advance warning to motorists about where they should or shouldn't pick up or drop off passengers for games. Therefore, recommendations to address these issues should include improvements to affect area-wide circulation as well as identify appropriate curb side zones to accommodate the passenger loading demand in a safe and effective way. There are a few categories of improvements identified for the Second Street/Main Street intersection, each with specific benefits, challenges, and expected effectiveness. These categories are as follows:

1. **Establish Curbside Passenger Loading Zones** – Designating portions of the curb zone to allow for passenger pick-up and drop-off would allow for some of the many passenger loading events to occur in desirable locations, specifically at the curb with less disruption to traffic flow than currently occurs.

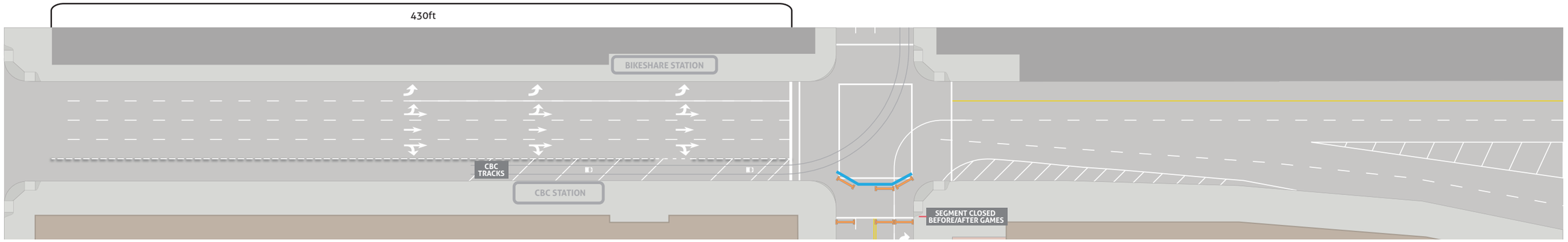
2. **Area-Wide Strategies** – Establishing loading zones at or around the Second Street / Main Street intersection would help, but additional locations for dedicated passenger loading zones would be needed to provide adequate curbside space for passenger loading zones, many of which would reduce the passenger loading traffic from all travelling to the already congested Second Street / Main Street intersection.

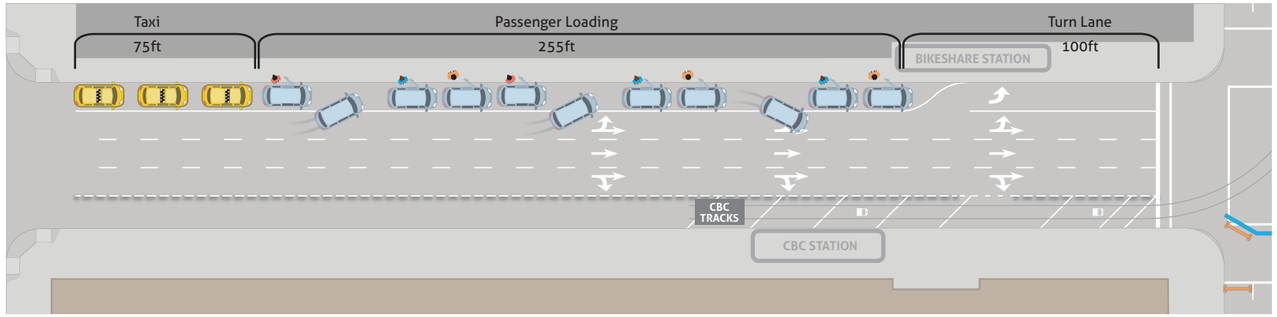
No individual recommendation can be expected to eliminate the queues of vehicles observed at this intersection on its own. However, the following improvements would each be expected to have a measurable positive effect on traffic operations and safety if implemented. Our proposed improvements to consider in each of the above categories is summarized below.

Establish Curbside Passenger Loading Zones

As stated in the previous section, there are considerable passenger loading drop-offs and pick-ups before and after baseball games. Based on our calculations, the pre-game activity would need about 400 feet to accommodate passenger loading activity at the curb, while almost 900 feet would be required to accommodate post-game activity at the curb. Since there is only a short portion of curb dedicated for taxis after the game on this block, there is not adequate curbside space to accommodate all passenger loading within the study area. However, there are potential improvements to both the west and east side of the intersection that would accommodate more passenger loading at the curb near the ball park, as described below.

- **West of the Intersection** – Establish passenger loading and taxi area along the curb by reducing the left turn pocket length and installing signage to explain the new curb designation. Based on the data observed, the length of curb for non-taxi passenger loading zone should be the majority of the curbside zone, as non-taxi passenger loading comprised of nearly 80% pf all passenger loading activity after the baseball game. The proposed reconfiguration is illustrated in **Figure 19**. As shown, there are two options, one with the taxis on the western side of the block and one with the taxis on the eastern portion of the block.
- **East of the Intersection** – Establish passenger loading in the area that is currently striped as a shoulder. The potential reconfiguration is illustrated in **Figure 20**. As shown, there are two options, one that would implement this via temporary delineation (signs and cones) or permanently by restriping the roadway and reducing the off-ramp from two to one lane.





WEST OPTION 1

Establish Additional Passenger Loading in Curbside Lane and reduce the storage capacity of the existing left turn pocket. The reconfigured block would consist of (from left to right) a 75 ft taxi zone, 255 ft passenger loading zone (ride-hail/ride-share and private vehicles), and a 100 ft left turn pocket.

Conversion

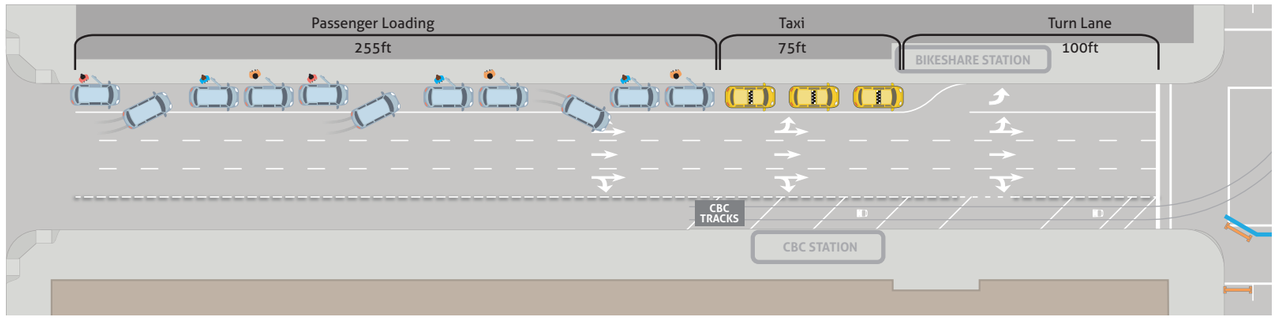
OPTION 1A

Convert curb lane to passenger loading at all times through permanent striping and signing

Flexibility

OPTION 1B

Establish curb passenger loading on event days through temporary devices and measures



WEST OPTION 2

Establish Additional Passenger Loading in Curbside Lane and reduce the storage capacity of the existing left turn pocket. The reconfigured block would consist of (from left to right) a 255 ft passenger loading zone (ride-hail/ride-share and private vehicles), 75 ft taxi zone, and a 100 ft left turn pocket.

Conversion

OPTION 2A

Convert curb lane to passenger loading at all times through permanent striping and signing

Flexibility

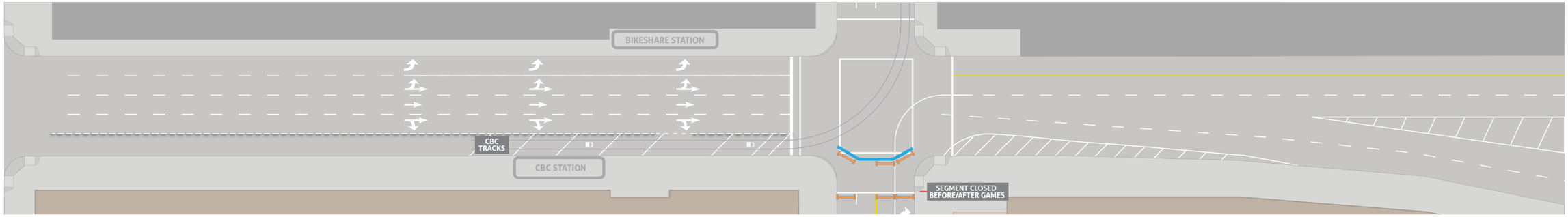
OPTION 2B

Establish curb passenger loading on event days through temporary devices and measures

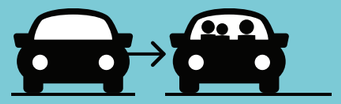
Note: Reducing the storage length of the left turn pocket is subject to further traffic operations analysis and may need to increase or decrease based on the results.

Figure 19

Second & Main
Curb Recommendations
West of Intersection

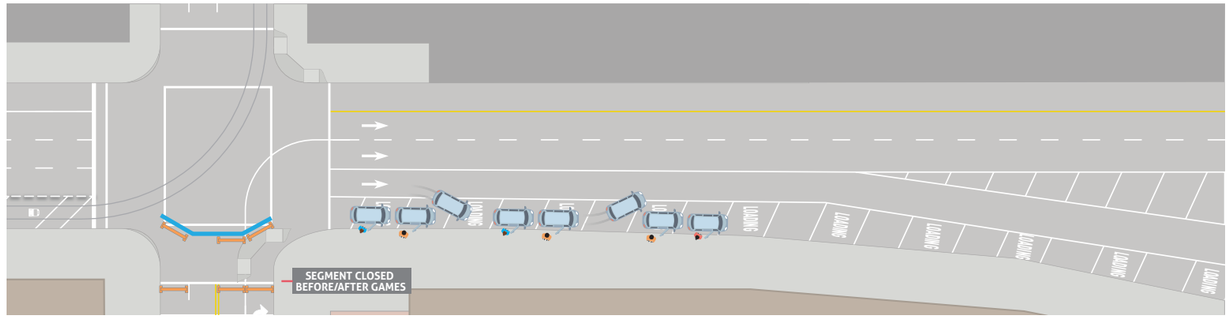


Conversion

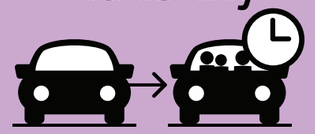


EAST OPTION 1

Reconfigure the roadway to provide one travel lane to the off-ramp, establish a curbside loading zone for ADA and shuttles.

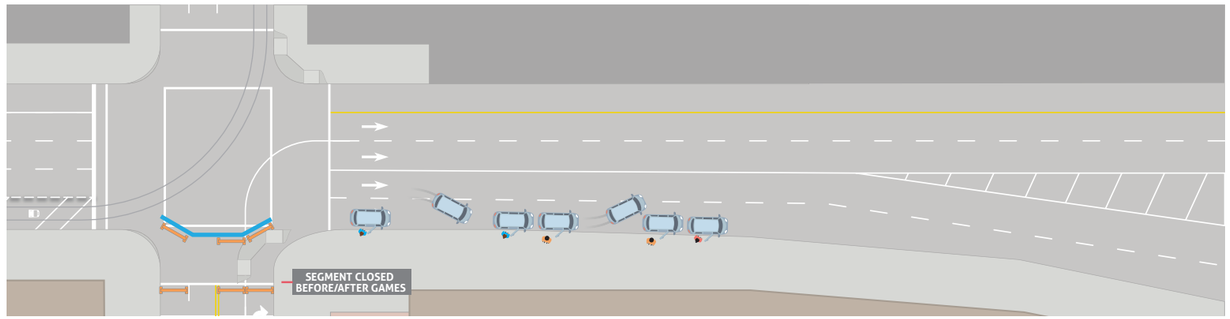


Flexibility



EAST OPTION 2

Reconfigure the roadway to provide two travel lane to off-ramp that allows for curbside lane to be used as a curbside loading zone for ADA and shuttles during events. Likely requires temporary signage and traffic control devices during each event.



Not to scale

Figure 20

Second & Main
Curb Recommendations
East of Intersection

Rationale for Recommendations

The following summarizes our rationale for the proposed curb space recommendations.

- **Identify Necessary Curb Space Designations (the "Who")** – Establishing curb side passenger loading zones before and after games would facilitate more efficient passenger loading operations.
    - **Resulting Recommendations:**
        - ✓ Maintain ADA and Shuttle Zone
        - ✓ Establish curb-side passenger loading zones
- **Compare Space Needed versus Space Available (the "How Much")** – The results of our analysis showed that about 900 feet of curb space would be needed to accommodate observed peak demand, while only about 600 feet of curb space is available in the study area. Therefore, the curb space should be reallocated proportionally to each mode's relative demand and using the vehicle curb productivity as a guide.
    - **Resulting Recommendations:**
        - ✓ Increase designated passenger loading zones
- **Equitably Distribute Available Space (the "Where")** – Using engineering judgment, we identified the appropriate locations for each use. West of the intersection, the north curb is the only appropriate location for curb-side loading. East of the intersection, the south curb is the only appropriate location for curb-side loading. Establishing well-delineated passenger loading zones is crucial to direct motorists where to go to pick-up and drop-off passengers.
    - **Resulting Recommendations:**
        - ✓ Include striping and signage to direct motorists to the designated passenger loading zones
        - ✓ Implement geofencing for hired rideshare vehicles
        - ✓ Consider wayfinding signage and additional zones outside of the study area (as discussed in the following section)

Expected Results

Although there is no designated passenger loading space at the curb in this study area, we found that a portion of the observed activity does use the curb, albeit not permitted. Being more explicit and direct about the appropriate locations for passenger loading would still be expected to increase the number of vehicles that would use the curb to pick-up and drop-off passengers.

These curb space changes would make the curb

2x

more productive

We estimated the amount of vehicles that could access the curb per hour with the existing and proposed curb space allocation. We

found that more than two times as many passenger vehicles would be able to use the curb space to pick up and drop off passengers during the pre- and post-game periods with this reallocation.

Keys for Implementation

To optimize the effectiveness of the above curb space designation changes, the following elements should be explored and included with any changes to the curb space designation:

- Signage for motorists delineating the spaces and areas where passenger loading is permitted
- Geofencing by Uber and other rideshare providers to guide passengers and drivers to designated passenger loading zones

Area-Wide Strategies

The vehicle queues at and around the intersection increases during periods when the baseball traffic and commute traffic all use Second Street, as measured in terms of observed queues and vehicle delay. To counter that overlapping demand for the Second Street corridor, there are some area-wide strategies that, if implemented, could reduce vehicle delay at the intersection and potentially distribute baseball game passenger loading activity to other roadways.

Some potential passenger loading locations are illustrated in **Figure 21**. Using wayfinding signage and geofencing for rideshare companies would be expected to increase the effectiveness of getting vehicles to use these spaces without heading towards the Second Street / Main Street intersection as a default destination for baseball pick-up and drop-off activities.

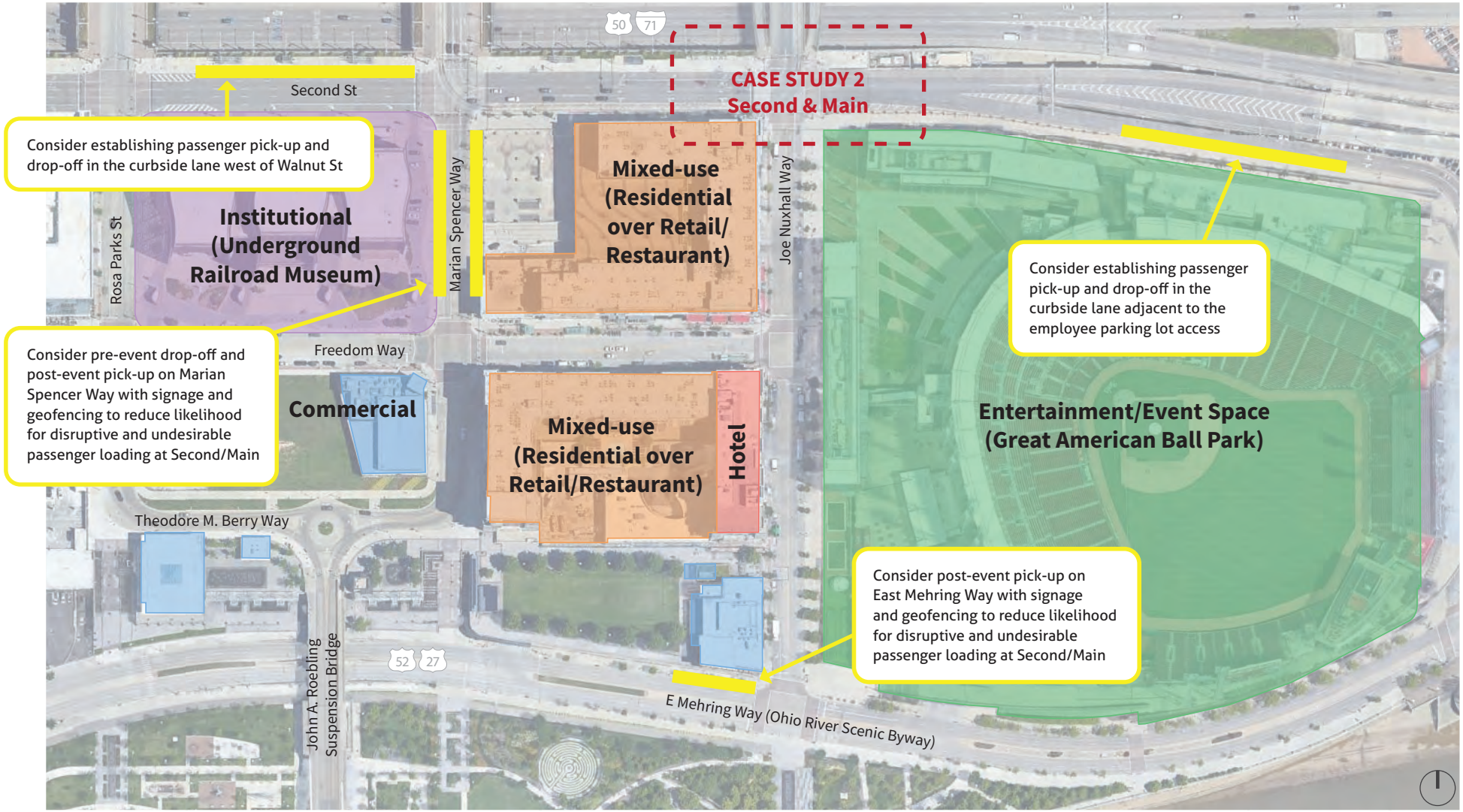


Figure 21

Baseball Game Recommendations Outside of the Study Area

Case Study 3: Nightlife on Freedom Way

Transportation & Land Use Context

Roadway Network

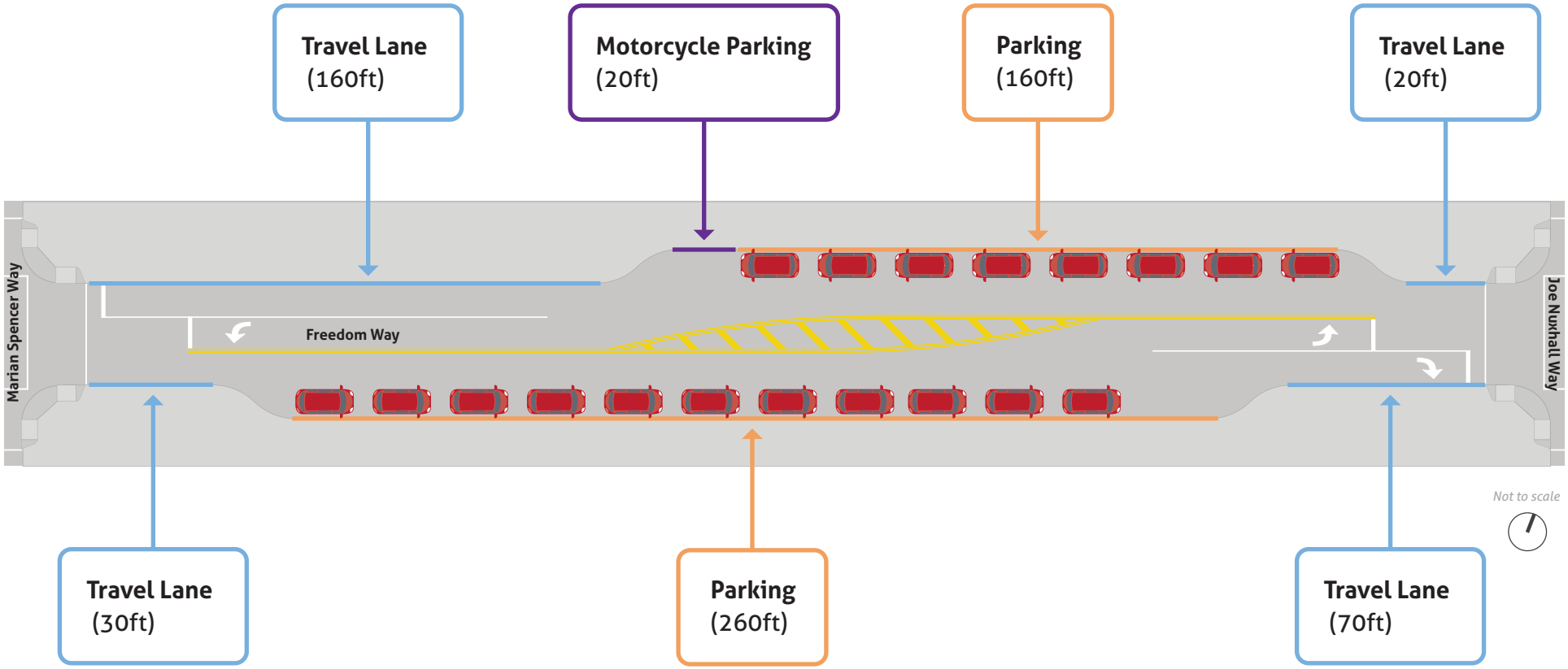
Freedom Way is a two-way street that runs four blocks from Elm Street to Joe Nuxhall Way. The Freedom Way case study location is the block between Marian Spencer Way and Joe Nuxhall Way. As shown in **Figure 14**, along the western block, between Rosa Park Street and Marian Spencer Way, the National Underground Railroad Freedom Center is located on the north side of the street and a park and restaurant are located on the south side of the street. Along the eastern block, between Marian Spencer Way and Joe Nuxhall Way, ground floor restaurants line both sides of the street with apartment buildings on the upper floors of the buildings.

Freedom Way has three lanes of vehicle traffic, one lane in each direction and a center turn lane and striped median. In the middle of the segment between Marian Spencer Way and Joe Nuxhall Way, there is a 150-foot-long hatched zone prohibiting vehicle travel. The hatched zone is often occupied by police vehicles or commercial loading vehicles.

The curb space allocation of the study area is illustrated on **Figure 22**. Metered parking is provided on both sides of the street with curb extensions at all intersection corners. The on-street parking is generally full, and there is limited turnover, presumably due to the by time increment pricing of the metered parking spaces compared to the flat fee pricing of the underground parking facilities. The Ballpark's underground garage has two pedestrian entrances (a stairway and elevator) on the north side of the block.

Periodic Closure

The ground-floor restaurants and bars are generally open every day from 11:00 AM or 3:00 PM through 2:00 AM or 3:00 AM daily. During busy evenings, typically Friday and Saturday nights, police officers closes Freedom Way from Marian Spencer Way to Joe Nuxhall Way using temporary barricades. This closure effectively closes the street to through vehicles so pedestrians can walk freely on the street, although vehicles parked on the street remain during the closure. During periods when this block is closed, parked vehicles may leave and exit this block with the assistance of the CPD (to move the barricades for motorists and then move them back into place). Based on discussion with police staff, these closures are not always planned or implemented at consistent times.



Existing Curb Uses

- Travel Lane
- Parking
- Motorcycle Parking
- Parked Car

Figure 22

Freedom Way
Curb Space Allocation

Observations

Observations were conducted on Freedom Way both before and during the street closure. Observations occurred on Saturday, June 9th, between 8:30 PM and 9:30 PM (prior to the street closure) and on Friday, June 8th, between 10:30 PM and midnight (during the street closure).

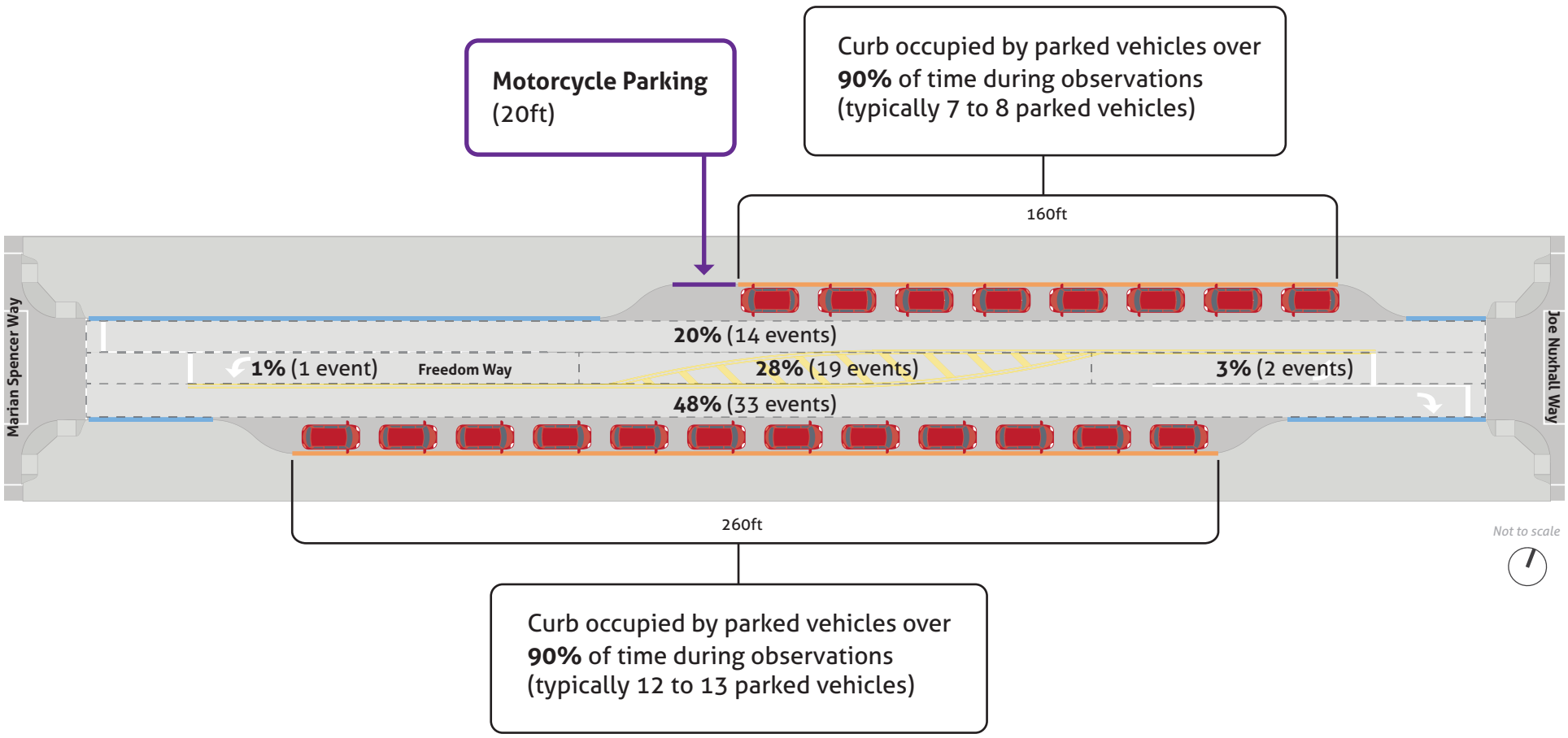
Pre-Street Closure

Prior to the street closure, this block of Freedom Way saw moderate pedestrian and vehicle activity. Most visitors were dropped off and picked up along the corridor, rather than parking or arriving on foot. Parking along both the north and south curb was almost always full, and low turnover rates were observed. Therefore, passenger vehicles, most often rideshares, frequently stopped in the middle of the travel lanes and in the median to load and unload passengers. Observed dwell times remained low in the travel lanes but would often last several minutes in the median. Pedestrians often crossed in the middle of the block to and from these rideshare vehicles.

Loading Activity

Overall, loading activity occurring in the travel only caused queues to extend beyond a few vehicles in a couple of instances. There were a few occasions when cars were unable to go around a vehicle stopped in the travel lane and in the median. Short queues were observed along the eastbound travel lane and eastbound left-turn lane, either due to a passenger loading event or other vehicles waiting for the signal at Joe Nuxhall Way. The relatively slow speed of observed vehicles on this block might be attributed to the high volume of rideshare vehicles that travel to and stop along this block for pick-up and drop-off activity, resulting in few pedestrian conflicts observed in the time period.

Observed passenger loading activity and parking conditions on Freedom Way before the closure is illustrated in **Figure 23**. During one hour before the street closure, approximately 70 passenger loading events were observed. During this time, the on-street parking was completely utilized on both sides of the street and thus all passenger loading events occurred in the travel lane, turn lanes, and in some instances, the striped median. Pedestrians getting into and out of cars in active travel lanes presents clear safety issues, in particular during nighttime periods, which have relatively poor street visibility in this area.



Existing Curb Uses

- Travel Lane
- Parking
- Motorcycle Parking
- Parked Car

Figure 23

Freedom Way
Passenger Loading and Curb Activity Pre-Closure
(8:30-9:30pm)

Uber Activity

The distribution of Uber activity in the vicinity of the study area before the street closure is illustrated in **Figure 24**. This shows that the density of activity on Freedom Way was high, but the surrounding streets also had high levels of Uber activity. In the two hours before the street was closed, nearly 200 Uber pick-ups and drop-offs occurred in the area (five blocks, about 3,500 square feet), which equates to an average of one event every 40 seconds although events were not be evenly distributed throughout the analysis period. Of those 200 Uber events, 71 pick-ups and drop-offs occurred on Freedom Way, between Joe Nuxhall Way and Marian Spencer Way.

Post-Street Closure

Post-street closure observations (i.e. after 10:30 PM) captured post-game activity at the ballpark as well as typical weekend evening activity along Freedom Way. Since the street was closed to vehicles during this time period, there were no observations of loading or parking activity. Pedestrians crossed the street both at the corners (Joe Nuxhall Way and Marian Spencer Way), as well as midblock. We were able to collect the same distribution of Uber activity after the closure, shown in **Figure 25**. Using the Uber data as a proxy for overall passenger loading activity, we found that the demand for passenger loading increased as the night went on and was relatively evenly distributed to the west and east sides of the block, with nearly 25% of all passenger loading activity in each quadrant (northwest, southwest, northeast, southeast) of the closed block.

Analysis

The following summarizes the results of our vehicle curb productivity analysis. Due to the fact that the street is closed, our analysis focuses on the pre-street closure period.

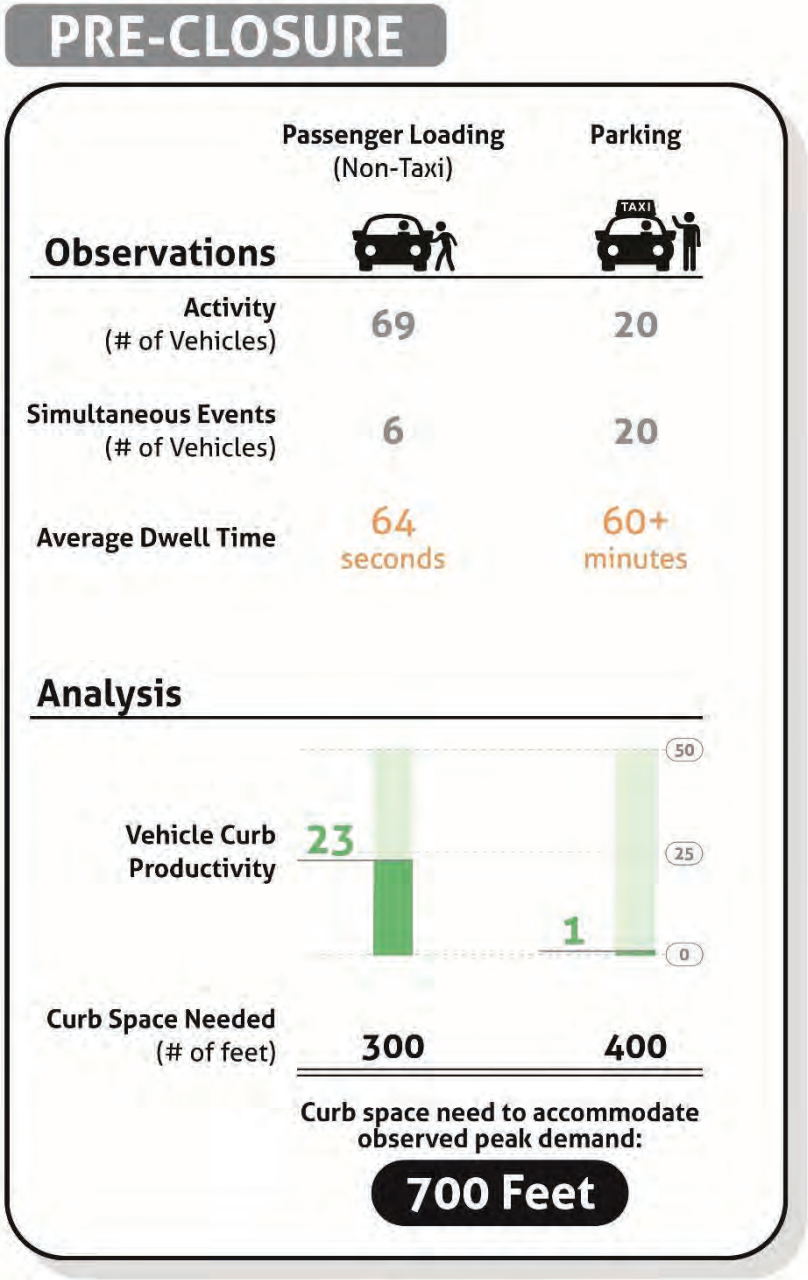
Vehicle Curb Productivity

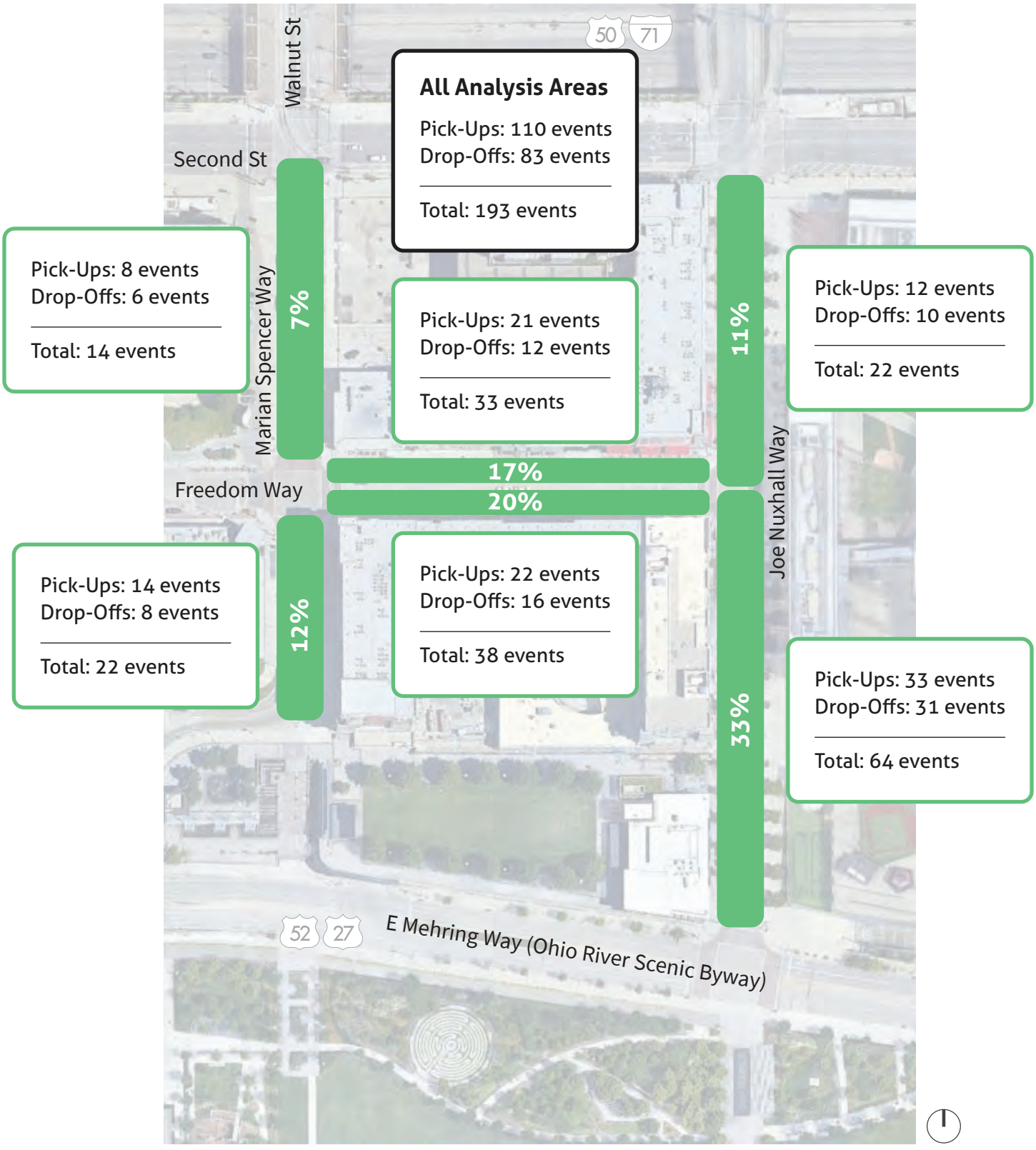
The chart to the right summarizes the activity by type, including the average dwell time and vehicle curb productivity of the street during the pre-closure period.

The results of the analysis show that passenger loading has a comparatively high Vehicle Curb Productivity (value of 23) but as stated above and shown in the table, the presence of well-utilized on-street parking resulted in the majority of passenger loading occurring in the travel lane and in the striped medians.

Also included in the chart is the simultaneous events observed by vehicle type during this period. Using the maximum simultaneous events and the methodology presented earlier about calculating the curb space needed to accommodate multiple passenger loading events, it is found that the overall curb space needed to accommodate all observed activity at the curb would be 700 feet.

there is only approximately 420 feet of curb space on this block (excluding motorcycle parking) meaning that the amount of curb space on this block is about 60 percent of what would be needed to accommodate all the observed pre-game activity at the curb.



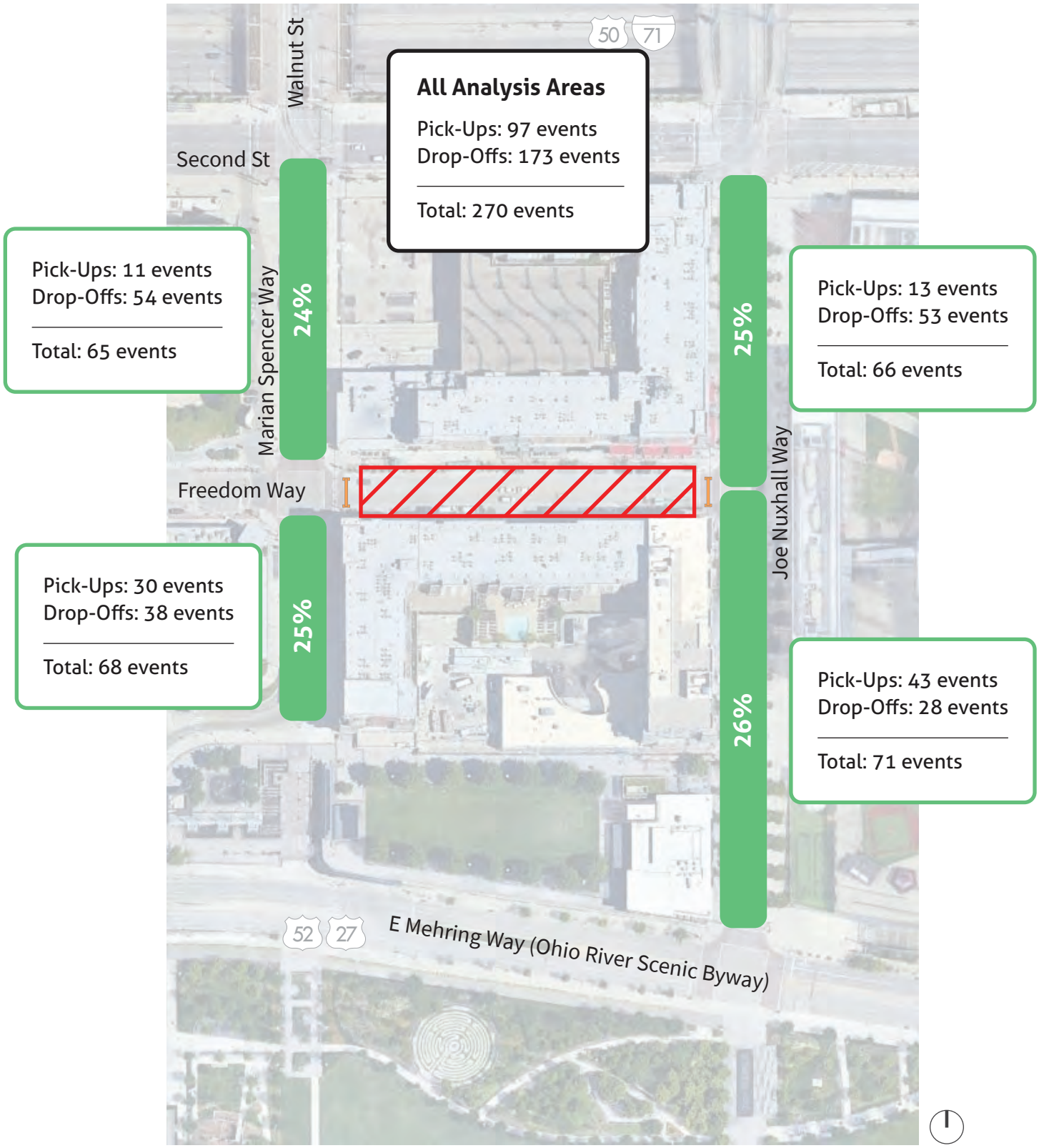


LEGEND

Analysis Area

Figure 24

Freedom Way Area
Distribution of Uber Activity Before Street Closure
(8-10pm)



LEGEND

Analysis Area

Barricades

Figure 25

Freedom Way Area
Distribution of Uber Activity After Street Closure
(10pm-midnight)

Recommendations

Freedom Way has a high density of Uber pick-ups and drop-offs, which, when combined with heavy pedestrian activity, leads police officers to close the street during periods when activity is at its highest. In discussions with some officers, the reasoning for the closure is primarily for safety. This study observed the field conditions and reviewed data from Uber to verify the high level of activity before and after the street was closed by officers. To provide a comprehensive set of improvements for the City to consider, we developed improvements in the following two categories to accommodate the passenger loading demand in a safe and effective way:

1. **With Freedom Way Open to Vehicular Traffic** – We have developed recommendations that, based on examples elsewhere, could lead to Freedom Way operating without a full closure and in a more safe and efficient manner compared to when the street was open all night and no additional safety measures were in place. These recommendations should be further refined based on stakeholder input and can be successful if there is support in the process, including support and enforcement from the CPD.
2. **With Freedom Way Closed to Vehicular Traffic** – In the event the recommendations for keeping Freedom Way open to vehicular traffic are not well received by some groups within the City departments, we have developed some recommendations that could improve passenger loading operations and safety with Freedom Way's existing intermittent closures to vehicular traffic.

The decision to keep Freedom Way open or to close it intermittently, is at the discretion of the police department with input from other City agency staff and stakeholders (such as the area business owners). The following improvements were developed to provide potential options to accommodate passenger loading in a safe manner, but each improvement requires further discussions with stakeholders to ensure all affected parties are in favor of measures that could have a measurable positive effect on passenger loading safety if implemented. Our proposed improvements to consider in each of the above categories is summarized below.

Measures to Facilitate Passenger Loading with Freedom Way Open to Vehicular Traffic

As shown in **Figure 24** and **Figure 25**, demand for Uber rides is high on a typical Friday or Saturday night. The majority of the land uses that are drawing visitors are on Freedom Way between Joe Nuxhall Way and Mariam Spencer Way, and thus the demand for passenger loading is concentrated on that block. By prohibiting on-street parking during specific times, passenger loading zones could be established and reserved for rideshare vehicles, taxis, and other passenger loading activity. Using our observations, we would recommend that a total of 260 feet be time-of-day passenger loading zones. Our proposed reconfiguration of the curbs on this block is shown in **Figure 26**. To accommodate traffic from both directions, we recommend providing 160 feet in the eastbound direction (south side of the street) and 100 feet in the westbound direction (north side of the street). These areas would be expected to accommodate up to seven vehicles actively loading at one time. If implemented, the City would be encouraged to monitor and determine if the loading zones are sufficiently sized to promote safe and effective passenger loading.

Rationale for Recommendations

The following summarizes our rationale for the proposed curb space recommendations.

- **Identify Necessary Curb Space Designations (the "Who")** – Passenger loading and parking were the only two curb activities on this block. If Freedom Way is to be kept open to traffic, the block would need to provide curb space to accommodate existing passenger loading demand for passenger loading activity to occur in a safer way than under existing conditions.
    - **Resulting Recommendations:**
        - ✓ Reduce on-street parking
        - ✓ Establish passenger loading zones
- **Compare Space Needed versus Space Available (the "How Much")** – The results of our analysis showed that 300 feet of curb space would be needed to accommodate observed peak demand (excluding parking). Since the block consists of 440 feet, there is sufficient existing curb space to accommodate observed peak passenger loading demand. However, to accommodate that demand, parking would need to be reduced,
    - **Resulting Recommendations:**
        - ✓ Reduce the amount of parking on the block from 420 feet to 120 feet
        - ✓ Establish 300 feet of passenger loading zones
- **Equitably Distribute Available Space (the "Where")** – The directional distribution of observed activity showed that twice as much pick-up and drop-off activity occurred in the westbound direction, therefore we recommended establishing 200 feet of passenger loading space on the south curb and 1200 feet on the north curb. The location of the passenger loading zones were

selected to provide loading space before on-street parking to discourage motorists from picking up and dropping off in the travel lane next to on-street parking.

Expected Results

Changing the curb designations to increase the amount of curb space available for more productive modes would be expected to increase the overall productivity of the curb.

We estimated the amount of vehicles that could access the curb per hour with the existing and proposed curb space allocation. We found that more than six times as many passenger vehicles would be able to use the curb space to pick up and drop off passengers during the before the closure with this reallocation.

These curb space changes would make the curb

6x

more productive

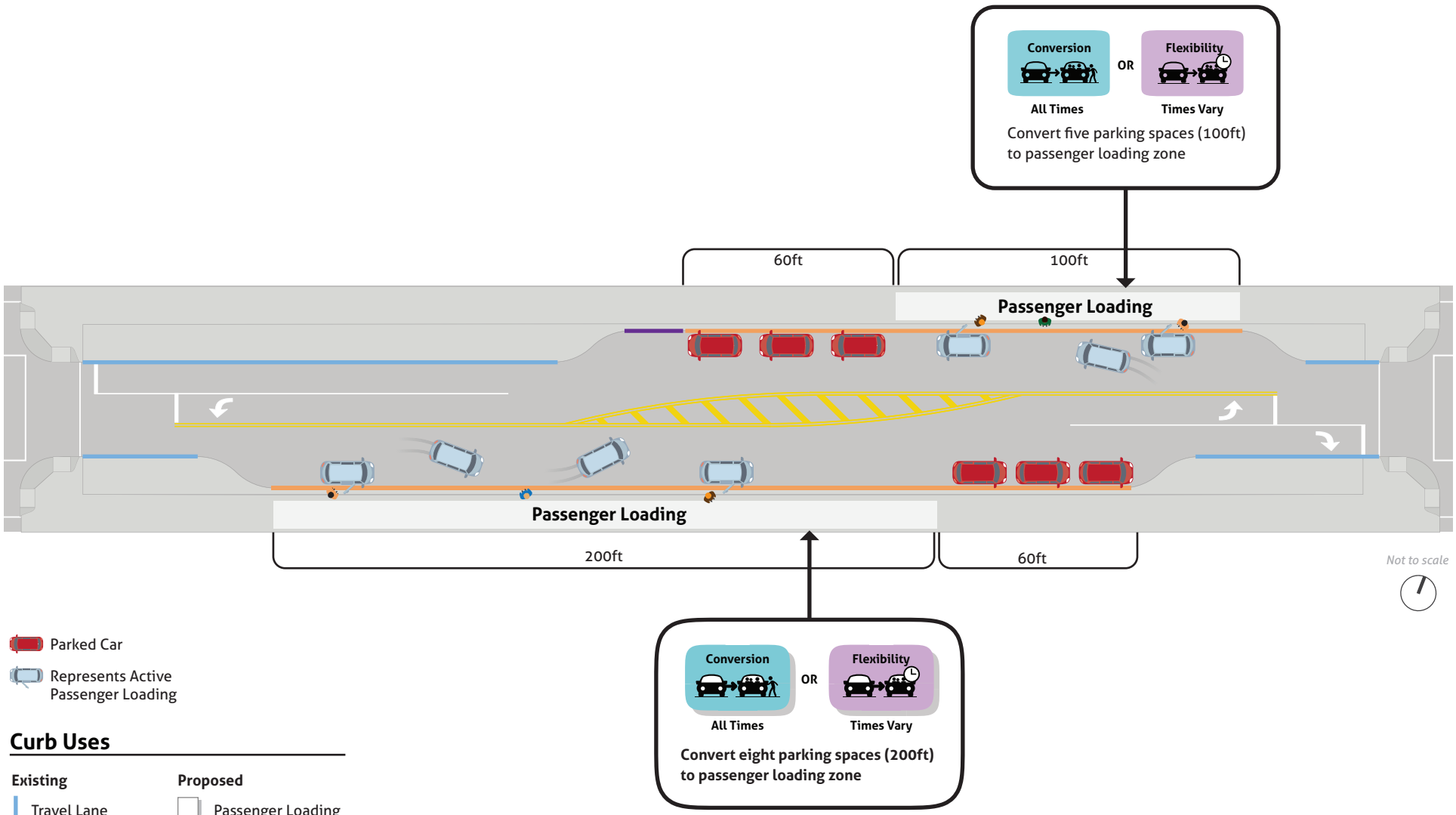
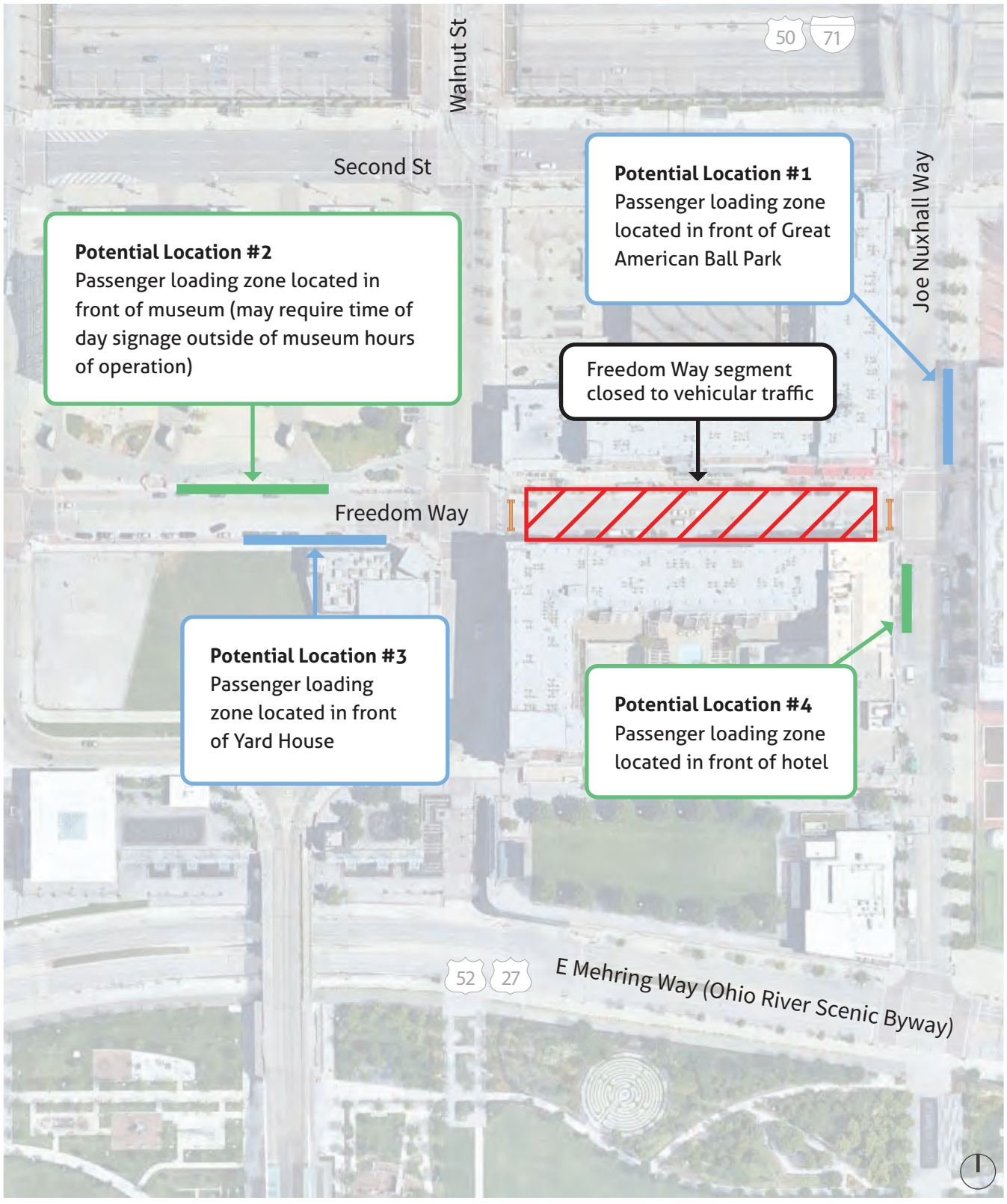


Figure 26

Freedom Way
Curb Space Allocation Recommendations

Measures to Facilitate Passenger Loading with Freedom Way Closed to Traffic

There is a possibility that even with the support of many stakeholders and City departments, that closing Freedom Way intermittently is the preferred course of action to promote safe access along Freedom Way. If that is the case, one strategy to further improve passenger loading activity in the area would be to establish time of day passenger loading zones on the side streets by prohibiting parking in some locations. Based on the Uber data showing the distribution of activity, it looks like the passenger loading activity is well balanced to the east and west of the block. As such, providing multiple zones based on outreach to local businesses would be the most equitable distribution to accommodate passenger loading demand in the area. Some of the approximate locations for passenger loading zones are illustrated in **Figure 27**.



LEGEND

Barricades

Figure 27

Freedom Way Area
Potential Passenger Loading Zone Locations with Street Closure

Conclusion

This study documents the data and methodology that led to our recommendations, providing the City with key information to make informed decisions about potential changes to their right of way to help alleviate some of the observed transportation challenges identified in this report. The following include some topics for further study to continue the process, as well as some key information about how to ensure effective implementation of improvements.

Topics of Further Study

This study provides the basis for our recommendations to address challenges and opportunities based upon observed conditions at each study location. Further study, outreach, and engineering is needed before many of our recommendations can be implemented. Suggestions for further evaluation include the following, subject to specificity based on which improvements the City intends to pursue:

- Additional data collection and analysis during other time periods (e.g. weekday peak commute hours, additional seasons) to determine potential time of day curb designations or to refine recommendations to accommodate other times of peaked curb usage
- Outreach with business owners, City staff, and elected officials to determine which recommendations would be desirable and/or acceptable to implement
- Additional design and recommendations for new and modified signage to notify the public about the revised curb designations
- Discussions with City officials to determine if increased or reallocated enforcement would be feasible to educate the public and enforce the changes to curb designation
- Discussions and agreements with rideshare providers to establish geofencing locations and schedule for activation
- Discussions with City staff to identify funding sources for additional planning, design, construction, monitoring, and maintenance of any improvements

Keys for Effective Pilot Improvements

Improvements that are supported by the community and based on sound engineering principles and applicable design standards have the potential to transform communities. However, some key elements to ensuring a successful implementation of any changes to the transportation environment include targeted effort from the agency and stakeholders. Some specific measures that would further ensure effective solutions include the following:

- Develop an effective line of communication with the community, targeting neighborhood groups, elected officials, schools, businesses, and other community-based organizations who will be using the transportation infrastructure on a regular basis.
- Consider targeted education and enforcement by agency staff including emergency responders (police, fire) to help deter violations or motorist behavior that would reduce the effectiveness of the implemented improvements
- Regularly monitor conditions to identify potential changes to further address the issues at each location, leveraging relationships developed in the two items above to work together with the community, stakeholders, and emergency services, to promote positive collaborative relationships and build trust with the community.