



# Dome Traffic Management and Events Strategic Plan: Literature Review

Source Photo: [www.cuse.com](http://www.cuse.com)



**Stantec**

Authored by: Stantec  
Consulting Services Inc.  
May, 2021

## Contents

<b>1.0 Travel Demand Management Background Research .....</b>	<b>1</b>
<b>1.1 Overview .....</b>	<b>1</b>
<b>1.2 Industry Reports.....</b>	<b>1</b>
Travel Choices and Links to Transportation Demand Management: Case Study at Ohio State University (Akar, Fynn, Namung, Transportation Research Record January 2012) .....	1
Mobility Lab.....	2
Victoria Transport Policy Institute.....	3
Leading Liability: Pilot Transportation Demand Management and Mobility Management Programs of Five Michigan Communities (2013 for Smart Growth America) .....	4
FHWA Active Travel Demand Management Program Brief .....	5
Park City Transportation Demand Management Final Report 2016 .....	7
Chase Center Transportation Management Plan (TMP) .....	8
Fiserv Forum Case Study .....	10
Dickies Arena Health & Safety Guidelines.....	11
<b>1.3 Stantec Consulting Services for Special Event - example studies/plans .....</b>	<b>12</b>
Belmont Arena Transportation Management Plan .....	12
Sarasota-Manatee Barrier Islands Traffic Study .....	13
Lake Tahoe Multimodal Corridor Management Plan .....	15
Other Studies.....	16
<b>2.0 TDM for Dome Area Traffic Management Plan.....</b>	<b>18</b>
<b>2.1 TDM Plan Creation Process.....</b>	<b>21</b>
<b>2.2 TDM Strategies for the Dome .....</b>	<b>23</b>
Communications .....	23
Advanced Parking Information.....	30
Travel Behavior .....	31
Improve Existing Facilities and Services .....	37
Parking.....	43
New Modal Options .....	49
<b>3.0 Conclusion .....</b>	<b>55</b>

## 1.0 Travel Demand Management Background Research

### 1.1 Overview

Travel Demand Management (TDM) is an evolving field, but relatively few strategies are documented in official reports, based upon our review of information over the past decade. This is especially true for applications to event operations and travel demand management. Searches for TDM plans post-technological changes in smart phone technology and smart mobility reveal very little in the way of industry-wide reviews or analyses of the effectiveness of different TDM programs or practices.

This review is intended to provide an inventory of best practices for TDM and traffic flow optimization for event venues. This review consists of documents published or referenced by the Federal Highway Administration (FHWA) in 2020 and webinars on traffic management for sports facilities. Stantec's extensive experience managing traffic and travel demand at sports facilities is also referenced in the summary of recommendations.

This document defines TDM as a series of activities that influence traffic demand by:

- Using resources and techniques to optimize the transportation infrastructure using operational strategies
- Changing user behavior (in mode choice, for example), and
- By providing alternative modes of travel and making travelers aware of their travel options.

### 1.2 Industry Reports

This section includes a synthesis of industry reports on event and general TDM programs and their effectiveness, as well as Stantec's own studies. Specific strategies and insights have been extracted that can be used to develop improvement strategies for Dome traffic management and operations study.

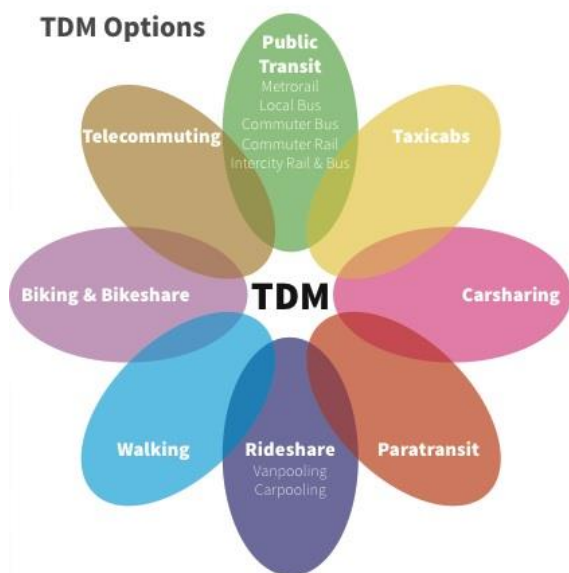
*Travel Choices and Links to Transportation Demand Management: Case Study at Ohio State University (Akar, Fynn, Namgung, Transportation Research Record January 2012)*

This research paper found that in a university campus context, proximity to bicycle lanes, trails, and bus stops increased the propensity to choose these modes. Students were more likely to travel by alternative modes than faculty and staff members. Individuals concerned about travel time, flexibility of departure time, safety, and the ability to stop on the way to and from campus were more likely to drive alone to campus.

### Mobility Lab

Mobility Lab is a research and communications center funded through a number of public agencies in Virginia to measure impacts of TDM strategies in Arlington County VA. As they note, "TDM is a strategy many places dabble in, but few have comprehensive programs."

They cite seven parts to a strategy to be able to shift trips, ranked from least powerful to most impactful:



1. Information
2. Marketing business benefits to employers
3. Comprehensive Programs with mutually reinforcing services
4. Incentives for transit and other modes
5. Disincentives for driving (such as congestion pricing, parking supply and pricing)
6. Ordinances and development conditions
7. Trip caps of maximum average vehicle occupancy

*Figure 1 TDM Options discussed by Mobility Lab*

Arlington has an active TDM monitoring program that has 5 goals to change travel behaviors through 18 measures. In a 2015 review of regional TDM programs, they found that Congestion Mitigation and Air Quality (CMAQ) measures accounted for 59% of the funding totals, but that research showed that people over 30 chose their modal travel based on factors that were not aligned with CMAQ requirements. The major factors were total travel time, travel time reliability, affordability and flexibility of the mode rather than traffic congestion or environmental impact.

The website can be viewed here: <https://mobilitylab.org/>

### *Victoria Transport Policy Institute*

The VTPI has an encyclopedic list of TDM or mobility management measures listed against specific objectives or intentions. This online resource lists every possible objective and corresponding TDM measure as well as the ranking of appropriateness to different stakeholders. The online encyclopedia lists options in four main categories:

- Improved Transport Options
- Incentives to use Alternative modes
- Parking and Land Use Management
- Policies and Programs

For Special Event TDM, a best practices list states that planning should:

- Consider transportation management in event siting and planning.
- Coordinate with stakeholders (transportation providers, hotels, resorts, tourist agencies) to provide and promote car-free visitor packages.
- Include information on alternative transportation modes in the marketing materials.
- Provide high occupancy vehicle priority for access and parking.
- Improve the pedestrian and cycling facilities to provide alternative mode access to those without a car.
- Plan for transportation system designed for resilience, with diversity, redundancy and efficiency.

The website cites a number of pre-2005 international and North American studies and papers.

The website can be viewed here: [www.vtppi.org/tdm/](http://www.vtppi.org/tdm/)

### *Leading Liability: Pilot Transportation Demand Management and Mobility Management Programs of Five Michigan Communities (2013 for Smart Growth America)*

Travel Demand management was one of the topics covered in this study for livable communities initiatives for five communities in Michigan. The study indicates that the leading practices include:

- Integrated TDM programs across multiple employers and institutions closely coordinated with the municipality and transit authorities;
- Strong regional leadership and coordination of transportation demand management strategies, often including mode split targets with regular measurement and reporting of performance and progress;
- Pricing and incentives to influence mode choice and travel demand;
- Adoption of public policies that imbed transportation demand management (and predictability) into the land development process; and
- Broad and effective public outreach and promotion programs that not only improve the public's awareness of alternative modes, but actively assist them in their day-to-day travel planning and choices.

The study cites many of that standard parameters for success, including a local champion, diversified alternate mode options, better decision-making information for trip planning, parking management, education and outreach. However, this study is more focused upon daily commuters than single trip users.

The full report is available here:

<https://smartgrowthamerica.org/program/innovative-state-transportation/past-projects/michigan-2013/>

### *FHWA Active Travel Demand Management Program Brief*

FHWA has developed the concept of an active travel demand management (ATDM) toolbox, which consists of a series of strategies related to active demand management, active traffic management, and active parking management:

Active Demand Management	Active Traffic Management	Active Parking Management
Dynamic Ridesharing	Dynamic Lane Use Control	Dynamically Priced Parking
On-Demand Transit	Dynamic Speed Limits	Dynamic Parking Reservation
Dynamic Pricing	Queue Warning	Dynamic Way-Finding
Predictive Traveler Information	Adaptive Ramp Metering	Dynamic Parking Capacity

Source: FHWA Active Transportation and Demand Management (ATDM)

Active demand management aims to change the total number of vehicles on the road during peak periods, by encouraging guests to travel at off-peak times, on different routes, or via different modes. Active traffic management uses strategies to reduce traffic congestion, such as changing lane direction, warning travelers of upcoming queues, or ramp metering to restrict the number of vehicles allowed to enter a highway. Active parking management includes area-specific parking pricing or reservation strategies, in which sensors are used to provide travelers with information on their parking locations and options, occupancy, and routes, to minimize the time spent searching for available parking. This activity is one of the major contributors to congestion in urban areas at sports facilities.

The ADTM Brief on the *International Influence on ATDM in the United States* focuses on the need to use dynamic signage and wayfinding to direct travelers to specific destinations and make them aware of congested routes and available alternatives.

The ADTM *Program Brief on Linking Demand Management and Traffic Management* includes analysis of traffic conditions and work zone activity to identify the worst-case scenarios, rather than typical event conditions. A range of scenarios are developed, from the worst-case scenario with severe weather and work zone impacts, to less severe scenarios with lesser adverse impacts. Historical traffic trends determine seasonal adjustment factors. The trends also provide insights into the influence of major and/or special events (sports and concerts, marathons, major street closures for public festivals and parades, for example). While the output analyses identify the worst-case conditions, most analyses focus on mitigating typical conditions, since the improvements will likely improve all scenarios. It can be difficult for operators to implement multiple plans for multiple conditions.

The FHWA document *Mitigating Traffic Congestion: The Role of Demand-Side Strategies* categorizes these strategies as either demand-side or supply-side. Demand side strategies aim to change traveler behavior. This can be achieved using travel time incentives, financial incentives, marketing, and technology implementations. The key is

to make travelers aware of these strategies, and to ensure that direct, personalized information can be provided to travelers where possible. Financial incentives can include telecommuting, transit, shared ride, or off-peak travel tax incentives for employers.

The FHWA desk reference on *Integrating Demand Management into the Transportation Planning Process* starts with creating an understanding of overall mobility patterns, to determine their influence on regional congestion during peak periods. This includes freight mobility, non-commuter trips (e.g., recreation, shopping, and school), travel outside the peak, and identification of less congested alternatives to the seemingly “best” option for traveling through a congested area. It can also include policies to encourage better sharing of information on real-time congestion, expected and unexpected road closures (e.g., due to inclement weather), and the use of custom roadway utilization strategies for highways, such as high-occupancy vehicle (HOV) or high-occupancy toll (HOT) lanes to disperse and mitigate traffic congestion. App providers such as Waze, Google Maps, and ridehail companies such as Uber and Lyft should be part of the solution.

The report can be viewed here: <https://ops.fhwa.dot.gov/publications/fhwahop12032/>



### *Park City Transportation Demand Management Final Report 2016*

This report focuses on two separate groups: residents and visitors for different programs. A peer review of Whistler, Aspen, Lake Tahoe and Boulder found that most successful TDM programs were based on private/public partnerships rather than punitive measures. Key strategies focused upon cycling programs (bike share, trails, secure parking) and parking management (regulation and pricing). Highlighted strategies included:

- Real time information
- Multimodal wayfinding
- Parking demand management
- Parking for ridehail, car and van pools
- Communication and marketing of alternative transportation options
- Charter buses for larger events
- Transit priority
- Improved cycling facilities
- Curbside management for ridehail via hangtag permits

The full report is available here:

<https://www.parkcity.org/home/showdocument?id=41938>

### *Chase Center Transportation Management Plan (TMP)*

A TMP for the Chase Center in San Francisco, CA was published in 2015 as part of the Subsequent Environmental Impact Report prepared by GSW Arena LLC. The Chase Center has a capacity of approximately 20,000, opened in 2019, and its primary tenant is the NBA's Golden State Warriors. The Arena is located in the urban neighborhood of Mission Bay, adjacent to UCSF Mission Bay Hospital in San Francisco. The TMP focused on guest safety, guest convenience, synergy & resource intelligence, and good neighbor policies. Highlighted strategies included:

- Provide bike valet services located at the entrances closest to established bikeways.
- Provide generous pedestrian queuing areas on-site to minimize neighborhood spillover.
- Establish the site's identity as a porous, accessible, and welcoming neighborhood center.
- Staff an on-site Transportation Management Control (TMC) center during events.
- Establish real time communications between TMC, local transit stations, shuttle operators, variable message signs, emergency services, and city intersection cameras. This includes the ability to adjust transit departure times and request additional trains.
- Enact special on-street parking rates during events.
- Identify arena event patrons arriving via transit and reward those patrons with promotional incentives that may include discounted food or beverage, team or venue merchandise, raffle entry, access to a "fast-track" security line or one or more other options.
- Distribute branded transit cards to encourage patrons to associate event attendance with transit usage.
- Provide the option of event ticket "bundles" that include the cost of a round trip transit fare into the cost of all ticketed events.
- Provide transit fare subsidies to event ticket holders.
- Encourage customers at point-of-ticket purchase to use sustainable modes via communications on the internet and through the ticket vendor.
- Brand transit stops/stations near the project site.
- Utilize TVs and other screens inside the Event Center building to display real time transit information and prominent comparisons between transportation choices available to fans, employees, and visitors to the Event Center Development. Emphasize transit's lower-cost, higher sustainability, and other beneficial factors as compared with private autos.
- Play recorded announcements during halftime (for games) or between opening and main acts (for concerts), and as Event Center attendees exit the building, to notify guests of non-auto travel options home, including real time transit and shuttle departure times.

- Provide information to, and coordinating displays within, hotels and local businesses in the Event Center vicinity, especially during events where first-time or infrequent visitors are anticipated.
- Encourage off-site parking partners to charge market-rate parking fees for all arena events.
- Designate priority curb areas on-site for taxis, charter buses, and ridehail vehicles. Explore partnership options with ridehail/carpool/TNC companies to offer discounts to event attendees and other visitors and/or employees.
- Provide employees with a tax-deductible transit payment program, promote transit options to employees, and provide access to a guaranteed ride home program.
- Provide employees with secure indoor bicycle parking, showers, and locker facilities.
- Identify potential tenants who may provide on-site amenities (such as fitness and exercise centers, food and beverage options, and/or automated banking resources) to encourage employees to stay on-site during the workday.
- Coordinate with the adjacent hospital to prevent event transportation conditions from interfering with emergency services. This includes communicating exact dates, times, and locations of any partial lane closures; allowing emergency vehicles through partial closure barricades; directing emergency vehicles onto local streets where event traffic is barred; and showing an alternate hospital access route on event routing plans.

The report can be viewed here:

[https://www.gsweventcenter.com/Draft\\_SEIR\\_and\\_Appendices/Vol\\_3\\_GSW\\_MB\\_DSEIR.pdf](https://www.gsweventcenter.com/Draft_SEIR_and_Appendices/Vol_3_GSW_MB_DSEIR.pdf)

### *Fiserv Forum Case Study*

The Fiserv Forum is a 17,500-seat arena in Milwaukee, WI that is home to both the NBA Milwaukee Bucks and the NCAA Marquette Golden Eagles since it opened in 2018. Johnson Controls was brought on as the technology contractor during the design and construction of the Forum to position the arena to compete with the connectivity and convenience of at-home entertainment. Johnson Controls published a case study in 2018 summarizing their approach and technologies applied. Highlighted TDM-related strategies included:

- Installing a high speed wi-fi network with coverage throughout the entire facility to accommodate smart phone usage of all kinds. This can make mapping a way home or hailing a ridehail service more convenient when cell towers can become overwhelmed by user density found in arenas.
- Integrating emergency frequencies into the building's wireless system to allow emergency personnel to remain in contact in hard-to-reach areas like stairwells.
- Digital displays and audio announcement systems are interconnected to a central command center that allows evacuation messaging to be communicated in the event of an emergency.

The report can be viewed here:

[https://www.johnsoncontrols.com/-/media/jci/insights/archive/files/case-study-pdfs/bts\\_casestudy\\_fiservforum\\_cs\\_final.pdf](https://www.johnsoncontrols.com/-/media/jci/insights/archive/files/case-study-pdfs/bts_casestudy_fiservforum_cs_final.pdf)

### *Dickies Arena Health & Safety Guidelines*

Dickies Arena is a 14,000-seat arena that opened in Fort Worth, TX in 2019. The arena hosts events of all kinds, including concerts, sports, community events and the Fort Worth Stock Show rodeo performances. In August 2020 they published their operating protocols in response to the COVID-19 Pandemic. The operating plan has various levels, ranging from Level 1 (Normal Operations) to Level 4 (Strict Social Distancing Measures), under which the arena will operate. Highlighted strategies included:

- Coordinating with the adjacent cultural district museums and memorials to maintain consistent protocols for guest clarity.
- Parking attendants direct entering vehicles to specific spaces in order to maintain social distancing while guests exit their vehicles.
- Use exterior digital signage to clearly indicate what level of protocols are in place at that time before guests enter the venue.
- Guests will enter at specific entrances based on seat location and will be encouraged to stay within certain areas of the arena based on their seat location.
- Special rooms such as nursing mothers' rooms and sensory needs rooms will only be accessible by request and sanitized between guests.
- Escalators are to be used on an every-third-step basis and elevators will be accessible for ADA use only.
- Six-foot social distancing messaging is located throughout the venue and floor marking will show proper distancing at queue areas such as concessions and restrooms.
- Ticketholders will receive event-specific messaging about the protocols and restrictions in place for their event.

The report can be viewed here:

[http://fwsymphony.org/media/3141/tdmc\\_covid19\\_publicplan\\_v5.pdf](http://fwsymphony.org/media/3141/tdmc_covid19_publicplan_v5.pdf)

### 1.3 Stantec Consulting Services for Special Event - example studies/plans

Stantec has also prepared several reports that describe a combination of travel demand management strategies. Several documents published in the past two years are publicly available.

#### *Belmont Arena Transportation Management Plan*

In 2019 Stantec prepared a comprehensive event management plan for the redevelopment of a new 19,000 seat arena for the New York Islanders adjacent to Belmont Park in Elmont, New York. This plan includes three sections described below:

- A travel demand management plan that includes strategies to reduce vehicular traffic volumes. These include use of parking permits to encourage carpools, background traffic diversions, use of custom navigation apps like Waze, transit improvements, incentives to arrive early (outside the peak hour), and off-site park and ride operations.
- An operations plan showed the movement of vehicles, pedestrians, transit shuttles, and ridehail vehicles on the site, the location of parking areas, staff allocation, and traffic management strategies at key locations. The operations plan is intended to be a visual document that can be used by stakeholders to confirm the in-field operations match the intended plan.
- A monitoring plan that provides a framework for evaluating operations in the field, sharing the results, and developing adjustment measures as needed.

The plan, Belmont Park Redevelopment Project Transportation Management Plan, can be viewed here: [www.esd.ny.gov/sites/default/files/Appendix%20J.pdf](http://www.esd.ny.gov/sites/default/files/Appendix%20J.pdf)

### *Sarasota-Manatee Barrier Islands Traffic Study*

The set of barrier islands (Coon Key, St. Armands, Lido Key, Longboat Key, and Anna Maria Island) that sit off the Florida coast between Sarasota and Bradenton have long white sand beaches that make them an ideal tourist paradise. Between Thanksgiving and Easter (The Season) there is an influx of visitors that make regular travel for residents to and from the islands via the three connecting points a major challenge. During the peak of The Season, daily traffic jams can take hours to resolve as people flock to the beaches and struggle to find adequate parking. Each Island has a distinct character but the connection between these islands becomes choked with traffic trying to find the best way on and off the islands.

For this study, we took a more strategic, multimodal approach that stems from our transit master planning and major event/tourism approach to understand the potential solutions as a package of options rather than a single solution. Our goal was not to study the problem from an 'we can build our way out of the problem' viewpoint, as had been done on many occasions in the past, but to find real solutions that can be implemented.

We reviewed the data analytics from transit, Bluetooth capture locations, traffic data, and location-based data (Streetlight) to understand when and where people were moving and what the key issues were for different locations in the study area. Changes to transit, a review of parking, creating mainland based mobility hubs with connections to island shuttles, aerial tramways, waterborne shuttles, street car, car share, autonomous shuttles, electric cart operations on street and on beaches have all been considered in the development of more than 80 mobility solutions. The goal was the delivery of an integrated mobility plan to address the special event nature of the seasonal visitors for a 20-mile area from Lido Key to Anna Maria Island.

To do this we created a multiple account evaluation process that allowed us to evaluate the 80+ options and identify those that had the greatest potential impacts for the short, medium and long range time periods. This resulted in a package of transportation/traffic solutions to mitigate the need to bring additional vehicles onto the islands, reduce congestion on the islands, address parking issues, and create more mobility choices. The transportation plan addresses congestion relief, park and ride strategies, the use of alternative transit modes such as trolleys, water taxis/ferries, aerial gondolas, low speed electric shuttles, and ITS to provide traveler-related and parking information to the population. Our key takeaway is that a collective program of strategies that perform together allow the counties, FDOT, and municipalities to complete projects within their control in order to collaboratively move towards reduced congestion and improved visitor and resident experiences.

The report can be viewed here: <http://swflroads.com/sarasotamanateebarrierislands/>

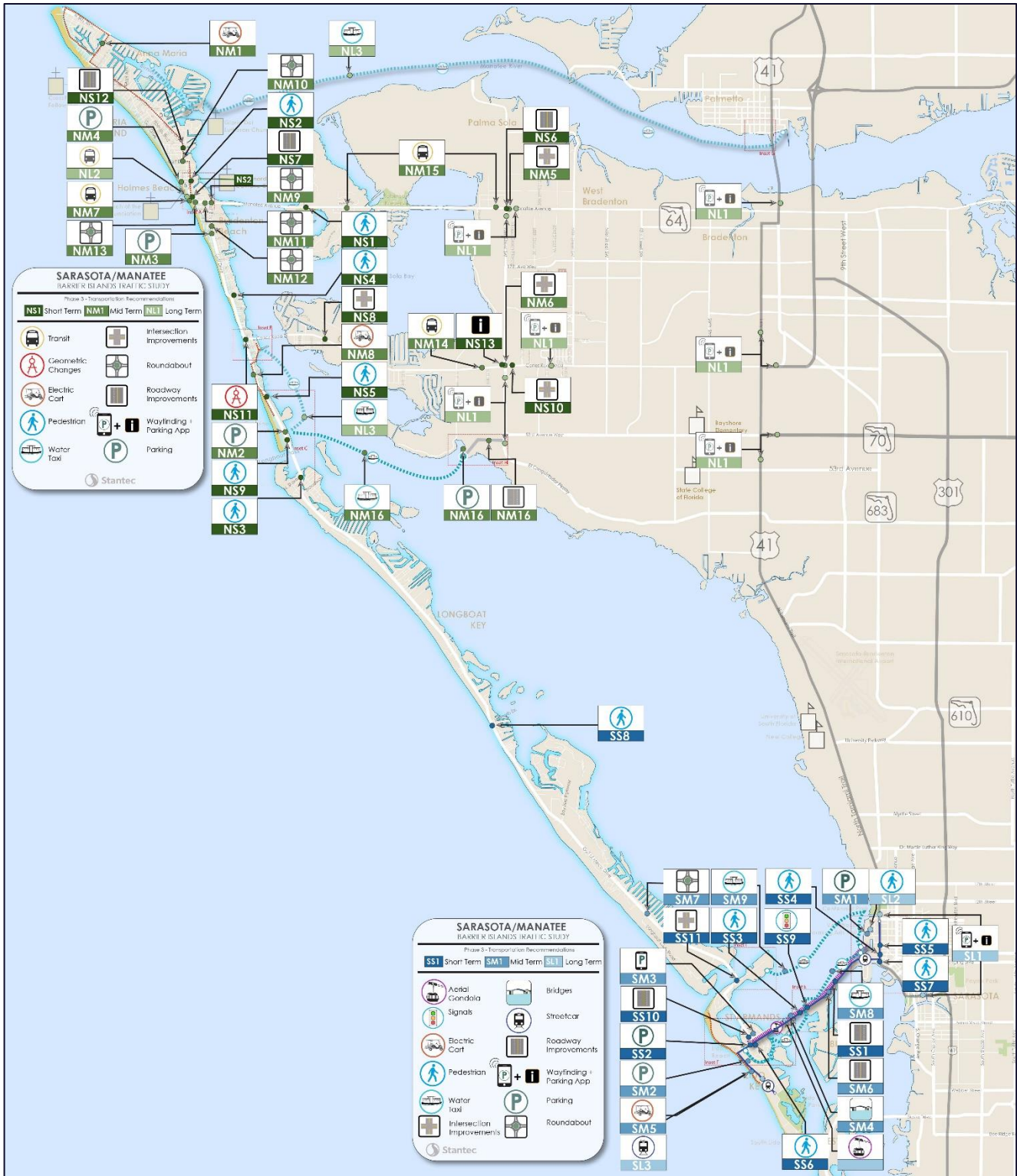


Figure 2 -Recommendations from Sarasota-Manatee Barrier Islands Traffic Study showing location and typology.



### *Lake Tahoe Multimodal Corridor Management Plan*

The Lake Tahoe Basin draws millions of visitors each year with surges in the winter and summer months. Mobility in the region is extremely challenging and travel around the 72-mile lake is predominately by two-lane roadways, public and private bus, and to a limited extent on- and off-road bikeways. Significant environmental constraints make expanding the roadway capacity impossible. With seasonal congestion beyond tolerance, policymakers needed a better understanding of the problem areas and more progressive solutions.

Stantec conducted a comprehensive investigation of zoning, land use, existing and planned infrastructure, AADTs, crash data, recreation, and transit services available from two local agencies, one regional provider, and several private companies for the study area encompassing five counties, one city, and state and federal land management agencies.

With this depth of seamless travel pattern data, Stantec revealed annual visitation estimates were off by 250%: 24 million vs. 8-10 million estimated. Basin agencies were undercounting due to VRBOs, transient oriented tax collections, and small sample sizes from intercept surveys. Transit ridership was 1.4%; bicycle and pedestrian mode share was even smaller. Most importantly, transit services were focused on the needs of winter users and ski resort employees, rather than the tremendous number of summer visitors.

Stantec created two deliverables: Linking Tahoe Transit Master Plan and the Linking Tahoe Corridor Connection Plan, together referred to as the Comprehensive Multimobility Transportation Plan. After calculating how many potential vehicles would be removed from the roadway network with each 5% incremental increase in transit ridership, the TTD Board unanimously approved the "20 in 20" goal of striving to achieve 20% active mode share in 20 years.

The Corridor Connection Plan can be viewed here:

[https://www.tahoetransportation.org/wp-content/uploads/2020/05/2017-Sept-Linking\\_Tahoe\\_CCP-Adopted.pdf](https://www.tahoetransportation.org/wp-content/uploads/2020/05/2017-Sept-Linking_Tahoe_CCP-Adopted.pdf)

The Transit Master Plan can be viewed here: [https://www.tahoetransportation.org/wp-content/uploads/2020/09/2017-June-6\\_Tahoe\\_TMP\\_adopted.pdf](https://www.tahoetransportation.org/wp-content/uploads/2020/09/2017-June-6_Tahoe_TMP_adopted.pdf)

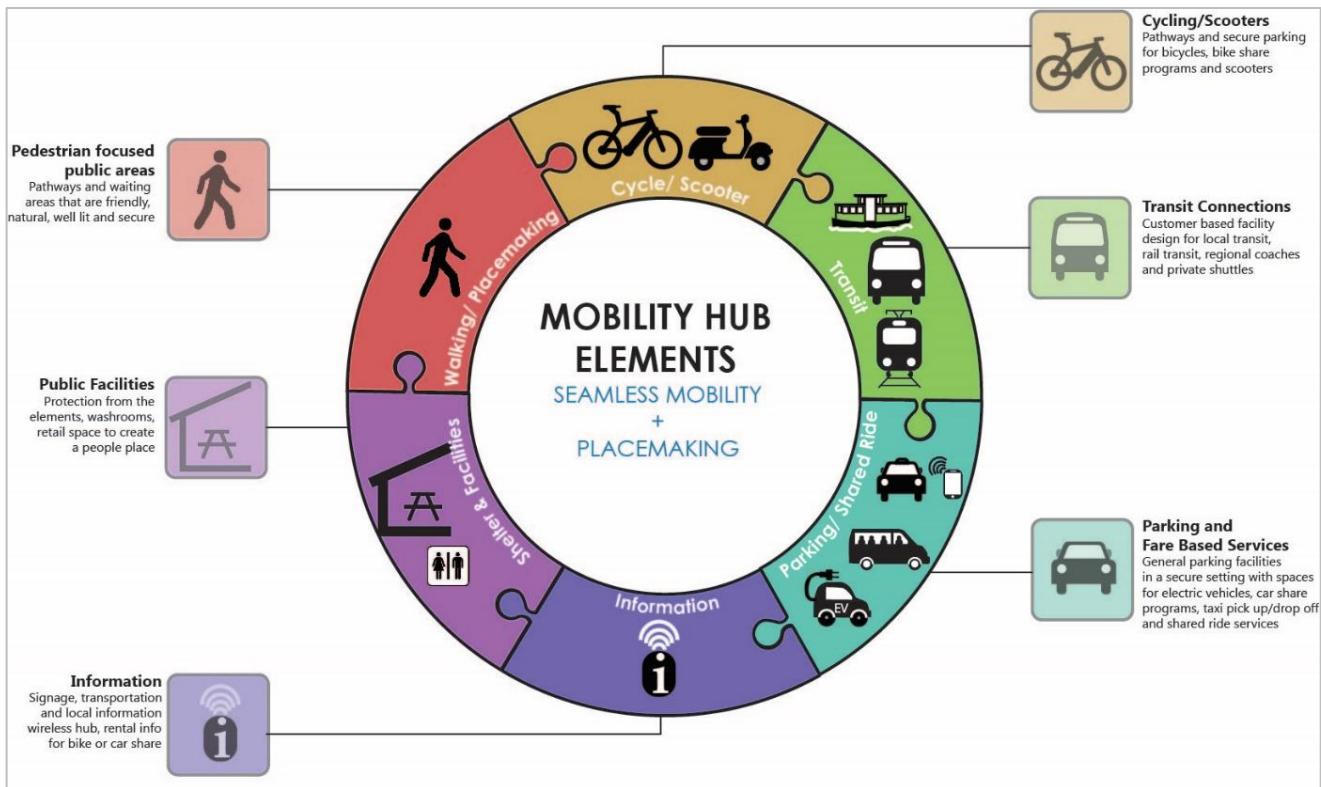


Figure 3 - Elements of a Mobility Hub

One of the foundations of the plan was the use of **mobility hubs** to intercept people at the earliest opportunity. Three different size hubs were proposed to allow regional trips to be intercepted, as people entered the basin and then within the towns themselves. Each hub was designed based on the expected park and ride projected modal transfer demand.

### Other Studies

Other studies that are not publicly available include the NFL Ingress and Egress Toolkit, which Stantec assembled over several years of observations at all facilities in the League, and the recommendations for improving operations at The Ohio State University.

Each of these documents include a variety of approaches in better understanding the travel behavior and implementing strategies that influence travel behavior change to improve the overall operations as well as improve the guest experience. The following section discusses the steps for creation of a TDM plan and specific strategies to be included in the plan.

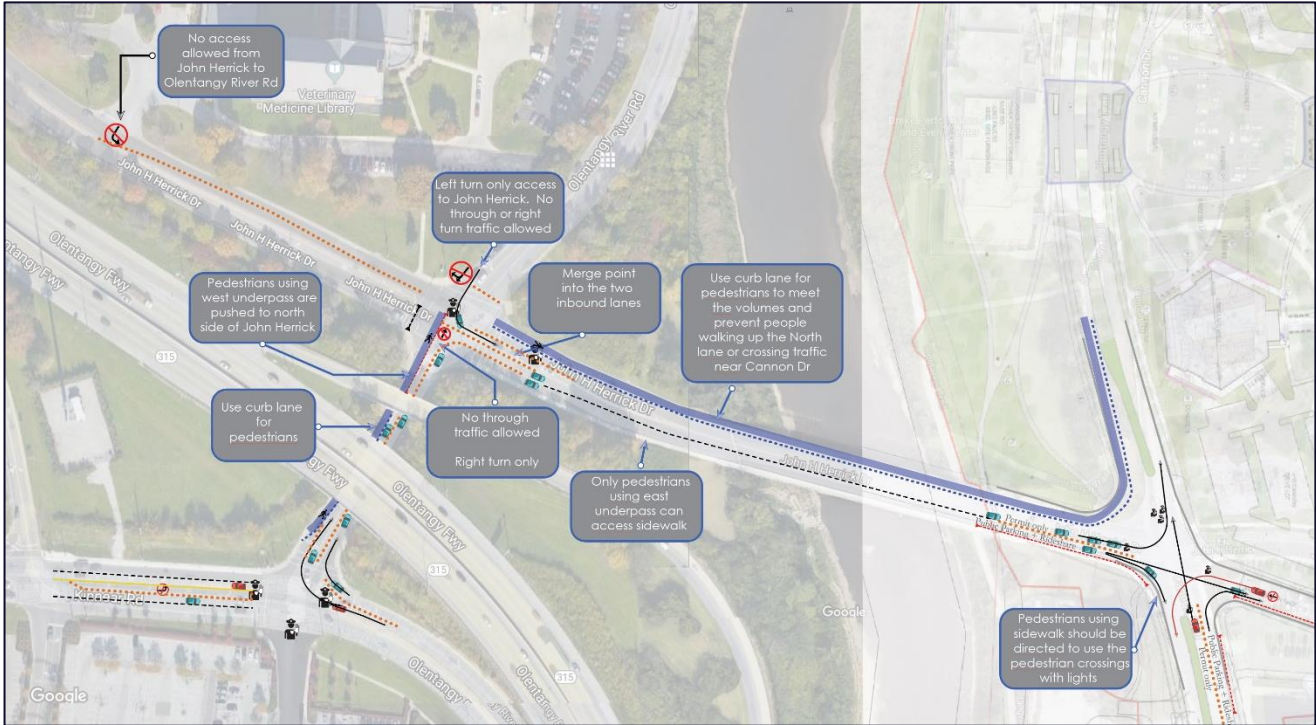


Figure 4 -Sample of The Ohio State University Egress Recommendations

## 2.0 TDM for Dome Area Traffic Management Plan

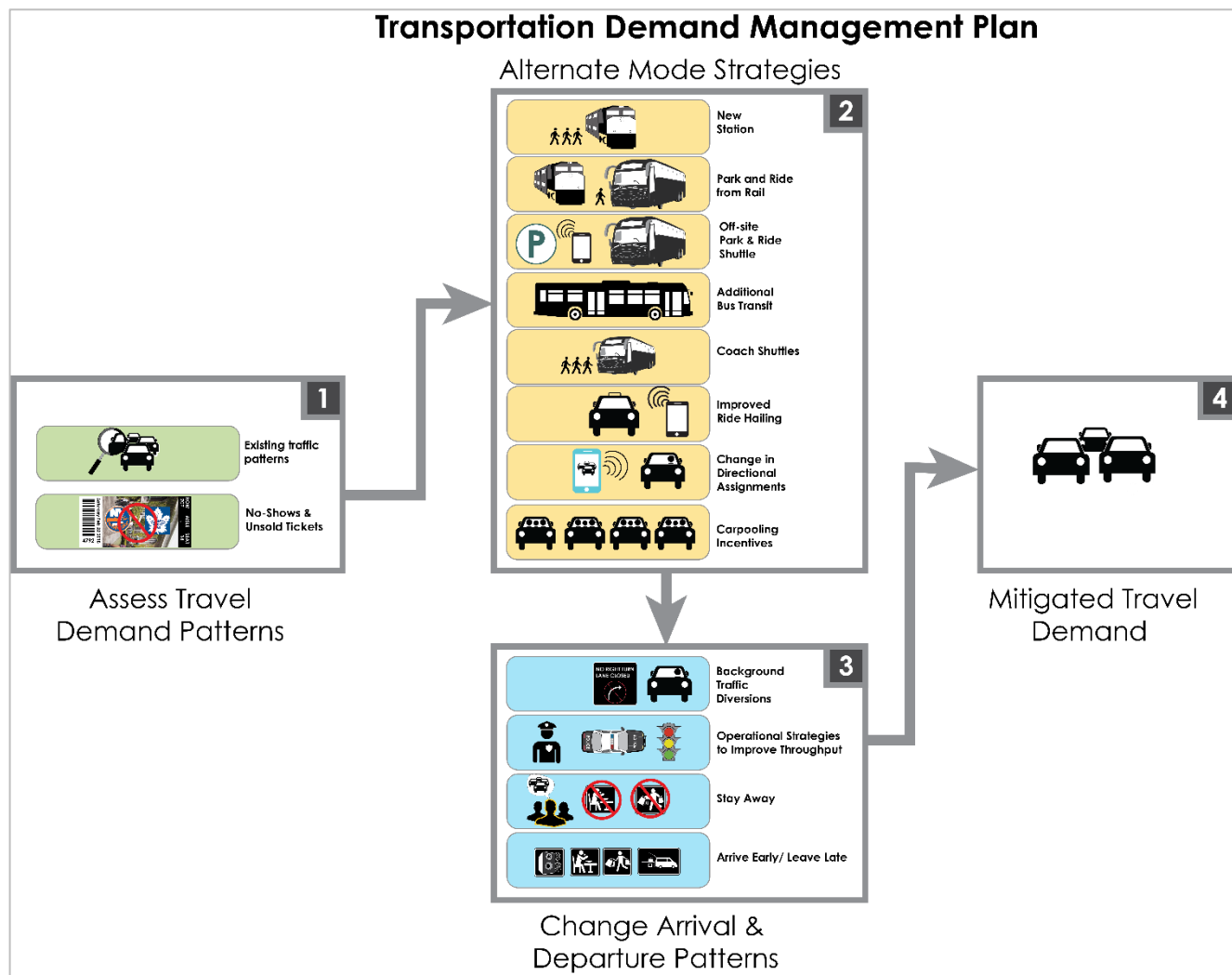


Figure 5 - Standard TDM 4-step Process

The rationale for using TDM is to reduce seasonal and event-related visitor congestion. When event traffic is combined with general background traffic on a weeknight or weekend, traffic congestion can be a significant constraint for residents and a deterrent for visitors, ultimately impacting the quality of life of locals and most likely revenue loss by visitors choosing alternative destinations or choosing to watch the event from home.

The creation of a TDM plan for The Dome is a four-step process:

### 1. Assess Travel Demand

The first step requires an understanding of the background traffic patterns that occur in a typical condition, and how much additional traffic is generated during different types of events. The changes in traffic patterns associated with events include the event-related traffic patterns, and any changes in background traffic patterns to avoid congestion

around the Dome on event day. This data can be reviewed across seasons or even years, going back to 2017, from location-based services data sources, to understand travel pattern changes over time. This type of information is especially important to establish a 2019 baseline of pre-COVID conditions. Field data, if collected, for 2020 would not reflect traditional travel behaviors hence it cannot be used.

As described above, it is important to assess travel demand at the start of a TDM framework. Data from Location Based Service vendors such as StreetLight and Airsage can also be used to gain insights into the travel patterns in a manner that is not possible from traditional traffic collection sources, by providing information on trip purpose, origin, destination, trip type (e.g., mode), trip length, trip time, trip routes, congestion areas, and traveler demographics, coupled with a much longer data aggregation or “survey” period (many vendors can access high quality data from 2018 to current time frames).

We will examine three basic categories of visitors with the data:

- **Local** - (living in the Syracuse area) are able to access local public transportation options to attend events, and may have direct, one-seat access from Centro services.
- **Regional** - (Living in the surrounding Syracuse area) who can drive into the Syracuse area with the intent to attend the event and probably stay for short-term.
- **Event Visitors** – those that need to fly, drive, or arrive via intercity bus into the area with the intent to stay for an extended period. Location-based services data can be used to understand the home locations of these visitors, for different types of events.

### 2. Create TDM / Alternate Mode Strategies

All TDM plans have a basic goal: change travel behavior through a series of measures that ask users to change their travel patterns. The goal is not to punitively force a change in the core travel patterns with a single solution (such as a new toll). The goal is to both inform and encourage several possible options that each change travel patterns by a small, but measurable amount.

Given that one lane-mile of queue stores approximately 200 vehicles, collective changes in travelers behaviors can greatly reduce congestion in environments where thousands of vehicles may descend upon an area for a single event. The cumulative goal is a larger change in overall travel patterns that reduce congestion levels on peak days and greatly reduces travel-related stress on residents, visitors and service providers. A less congested environment around the Dome means there would be less congestion for both event attendees and for background traffic.

All trips begin with the search for event and travel information. There are several ways to find information about the Dome from the facility, campus, City, or from the event organizers (for concerts and sporting events). Not all travel modes are equally communicated on these forums. This can lead most users to the drive option due to the potential confusion, uncertainty on the ideal or fastest route, parking availability, and lack of information on travel options from the origin to destination.

For the Dome, travel options include auto, ridehail, shuttle bus from an off-site facility, transit, bike and walk (for those located close to the Dome).

### 3. Encourage Travelers to Adopt These Strategies

As new strategies are implemented, it will be important to monitor the change in travel patterns to determine which strategies are successful and which require modifications or incentives. Not all strategies will have equal impact, and some will take longer to implement if they require collaboration with state and other local agencies, physical infrastructure and/or technology. The objective is to convey these strategies to travelers through a series of communication methods.

### 4. Evaluate and Continue to Mitigate Travel Demand

The final step includes evaluation of the effectiveness of different strategies. Successful strategies can be further emphasized to increase their effectiveness, up to a certain limit. Unsuccessful strategies can be discontinued or altered, depending on the reasons for their lack of effectiveness. Evaluation strategies can include traffic data analysis, speed runs, intercept surveys, and the use of location-based services or Big Data to develop a deeper understanding of historic and near real time visitor and resident travel patterns.

### 2.1 TDM Plan Creation Process

TDM should be looked at as a package of options that can be deployed areawide, or on specific roadway segments, on specific event days. Think of a deck of cards with each card being a different strategy used to change travel behavior for a specific reason. These strategies should be considered ways to enhance the travel experience by creating choices and enriching the amount of pre-travel information that is available to make travel a positive experience that is part of the overall visitation experience. Each event may have a different set of strategies that will apply but the overall program may consist of the entire deck. TDM includes other terms such as Smart Mobility, Mobility as a Service (MaaS) or First Mile/Last Mile (FM/LM). These are specific strategies within the TDM Framework.

The TDM deck is a summary of the main modal, transportation network and communication options that have been utilized over the past decade in stadiums and venue-based areas to encourage and force changes in travel to reduce the impact of the trip on the guest experience. We have identified a deck of strategies that can be divided into five suits:

1. Communications
2. Travel Behavior
3. Improve Existing Facilities and Services
4. Parking
5. New Modal Options

This next section will review a selection of the Categories and options within that “suit”.



Figure 6 - TDM Playing Cards



## 2.2 TDM Strategies for the Dome

### Communications

Providing information at decision points in the journey to allow informed decision-making is critical to allow visitors to understand their options. This can be pre-travel communications, information provided en route, wayfinding approaching venues and proper signage.



#### *Smart Mobility App*

Smart mobility providers, such as autonomous shuttle providers, e-scooter companies, bikeshare, e-bikeshare and ridehail may provide their own app. There is an opportunity to communicate travel messages via these apps. E-scooter or bikeshare companies, for example, can prohibit scooter/bike pick-ups and drop-offs in areas with high pedestrian activity.

In areas without these limitations, abandoned scooters impede pedestrian flow and/or cause safety concerns. As an enhancement, autonomous shuttle providers can be asked to provide more capacity, especially for on-demand shuttle routes, during peak event periods.



#### *Change Travel Day Messaging*

Event day messaging can inform event attendees of the recommended travel routes and can also be used to divert background traffic. Signage forms include dynamic signage (using permanent, overhead variable message signs), temporary roadside signs that are deployed on the day of the event, fold-down signs attached to light poles, or static signs that are deployed on the day of the event. A consistent theme on event signs

draws users' attention and helps them identify upcoming event day signage as they travel towards the event. Signage can also be used to identify diversion routes for background traffic, so they can avoid event-related congestion.

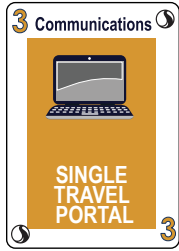
Examples



Figure 7 - Dynamic Highway Signage leading to MetLife Stadium in New Jersey



Figure 8 - Parking Messages in Kansas City approaching Arrowhead Stadium



### *Single Travel Portal*

Multiple travel options, each with their individual app/website, can make it difficult and/or challenging for visitors to plan their end-to-end travel experience. A consolidated travel portal that includes information on airport connections, bikeshare/e-scooter program, transit, special buses, trains, shuttle bus operators and parking would significantly enhance the attractiveness of choosing more sustainable travel options than the personal vehicle. A single travel portal provides visitors with an opportunity to communicate directly with providers to learn of park-and-ride lot locations, and carpool or off-peak incentives.

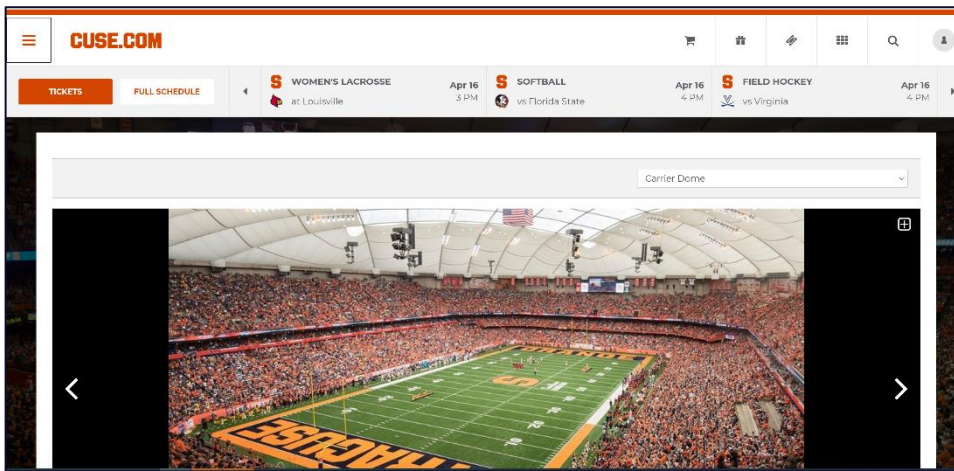


Figure 9 - Dome website

Ideally, the user enters an origin and destination and is presented with the door-to-door travel options, travel times and costs. The existing site is not intuitive to find travel information.

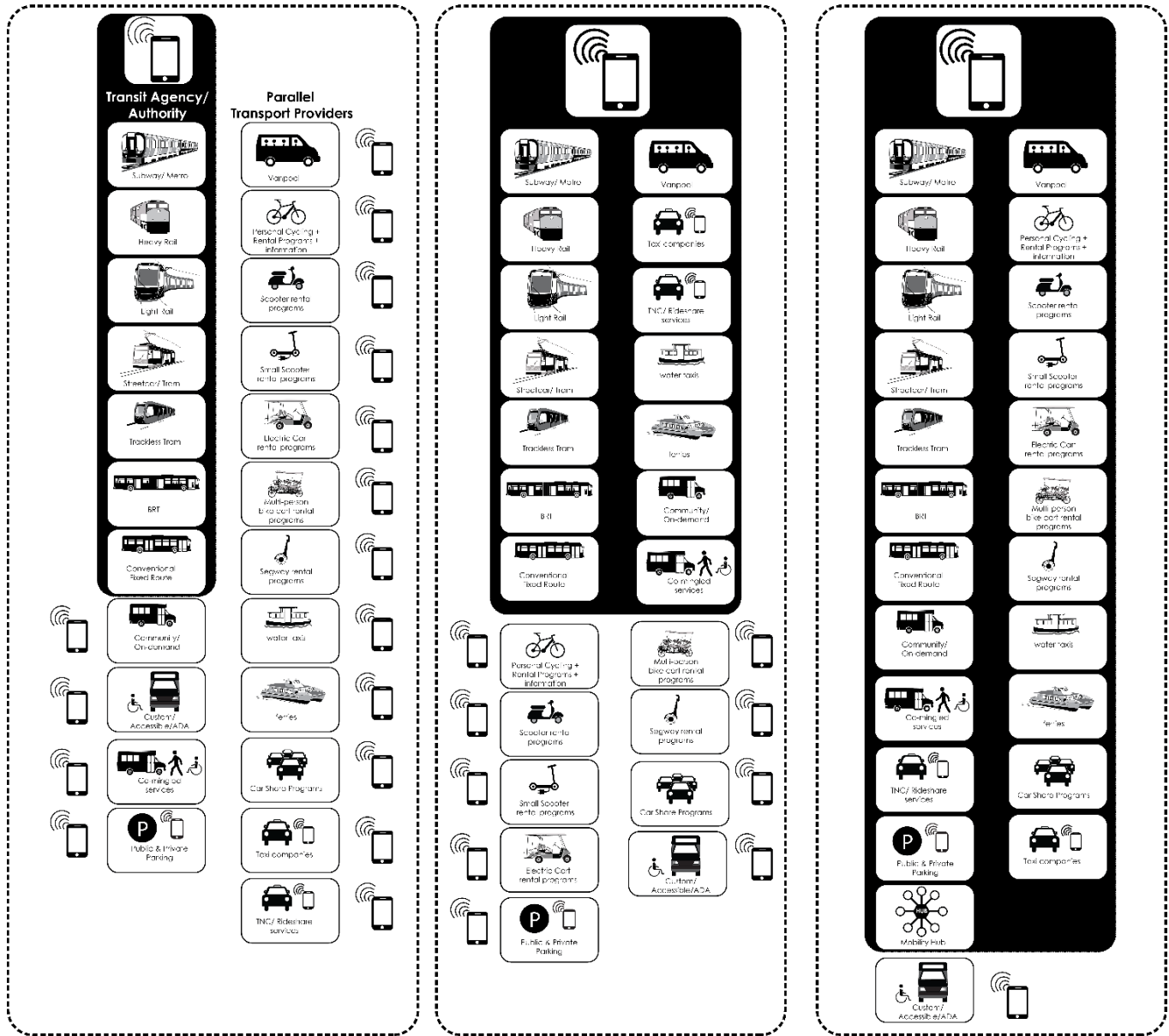
### Mobility as a Service (Maas)



#### TYPICAL SEGMENTED APPROACH

#### INTEGRATED APPROACH

#### ORGANIZATIONAL OR PORTAL APPROACH




 - indicates services covered by a single portal from a customer perspective

Figure 10 - Integration of Mobility Services Information

## Signage and Wayfinding



One of the most cost-effective improvement strategies is signage and wayfinding. Beyond just individual signs, wayfinding is a comprehensive strategy that includes the location of signs, their clarity, sequential organization, and thematic representation, relative to all the other non-event day signs on the road. An audit can be conducted by a non-

technical user to determine if he/she can understand the signage, have enough time to comprehend and respond to the directions, and can reach a desired destination. In many situations, we see gaps in the signage sequence, so that a highway exit is signed but there is no follow-up signage at the top or bottom of the ramp directing visitors which way to turn to their destination. There can be issues trying to create the appropriate signage throughout the journey due to different jurisdictional policies that may prevent the use of logos or actual names of a private facility.

## Examples



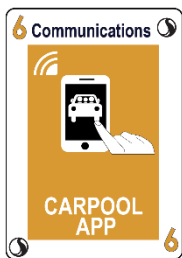
Figure 11 - Tourist signage in Ardmore, Ireland



Public Transit Information in Wellington, NZ



Figure 12 - Legible London Tourist Informational Sign, London, UK



### *Carpool / Vanpool App*

Incentives can be used to encourage friends and family to carpool such as preferential parking, reduced entry costs etc though it may take some time post COVID to rekindle the desire to use shared ride vehicles. A matchmaking service can be used to bring together other users who are interested in a shared ride to the event. This type of service is typically set up by asking users to enter their origins, destinations, and travel times, and find matching users. This can be difficult to coordinate for working commuters. However, for a single event, it is significantly easier to find matches; all that is necessary is an incentive to do so. To encourage users to sign up for this service, it can be offered on event websites, and at the point of sale. Venue/event operators can encourage the app usage through promotions, prize drawings and/or significantly increased parking costs at event venues. We understand this runs counter-intuitive to event operators. However, a partnership of the objectives for the larger community and event operators must be established to solve the congestion problem collaboratively.

There are providers that specialize in providing the platform or additional services such as RideAmigos and Via.

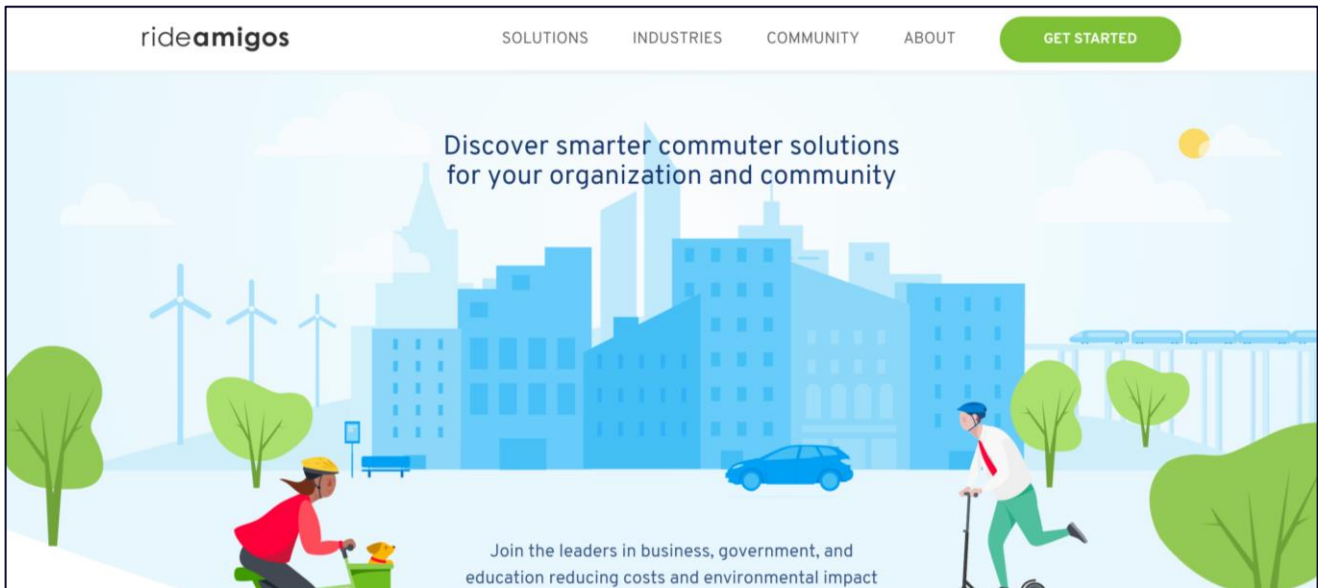


Figure 13 - Rideamigos Ridesharing Website

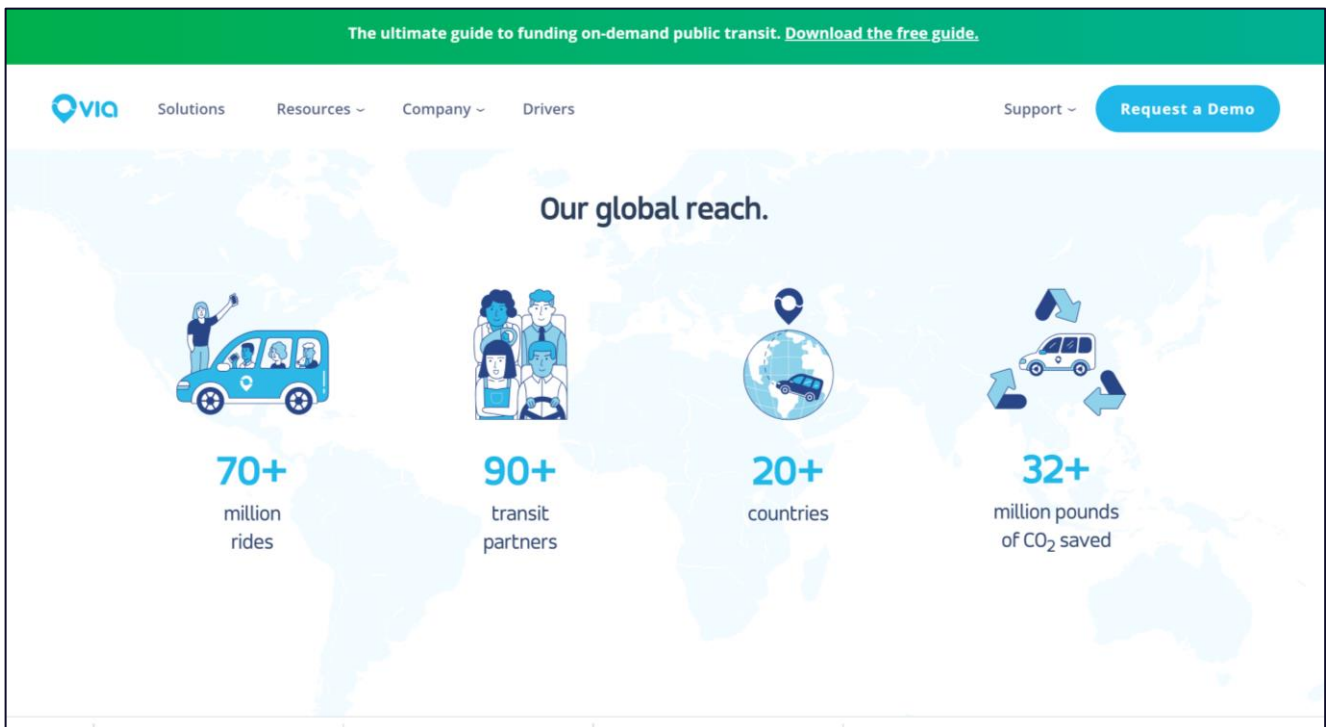
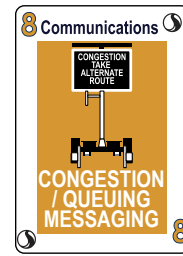


Figure 14 - VIA's Homepage offering transit solutions for on request services



*Social App Messaging*

To maximize the number of communications options, a social media strategy should be considered. Unlike other websites or apps, social media requires a relatively small commitment. The audience for an event or agency is already established, and a communications platform (e.g., Twitter or Instagram) exists. Social media messages can be used to reinforce other communication channels, and disseminate information on event patterns, congestion, road closures, incidents, weather, and/or construction patterns.



*Congestion Queuing/ Messaging*

Congestion queuing is given its own sub-category in this hierarchy because it aims to influence visitor behavior by informing travelers of the relative travel times on different routes (e.g., best route – Garden State Parkway – 15 minutes – other routes-expect delays up to 40 minutes). This type of differential messaging informs travelers of the reason(s) detours are recommended rather than simple awareness of detour routes.



*Advanced Parking Information*

The provision of information on key routes about parking and which lots are full or not full can allow visitors to make different choices about how they access the site unless they have permits. This can eliminate congestion at the lot entry points as well as reduce questions and turnbacks at the entry point.



*Pre-event Information*

Often, one of the congestion factors in the roadways passing by a venue or site is the through traffic unrelated to the event. Travelers who are unaware that there is a different travel pattern occurring. By providing pre-event information, it enables travelers to plan for a different route on the day of the event to avoid congestion.



### Travel Behavior

Traveler patterns can be influenced through incentives, information, or infrastructure. This can include on-street operational changes, new forms of information, using traffic apps to change the way people use the road network, creating priority infrastructure for transit and cycling or diverting background traffic (regional and local through traffic not related to patron trips) onto new paths.

#### Change Travel Patterns with Apps



Custom navigation apps such as Waze can be used to change user’s travel patterns. These crowd-sourced navigation apps provide current traffic conditions based on observed travel speeds from hundreds or thousands of travelers using these apps. They can also be used to identify the locations of user-reported incidents or hazards. Finally, the Waze platform allows the operator to define their own travel patterns. This can be used, for

example, to designate street closures near event venues on major event days, or to provide custom routing patterns to different parking areas.

#### EXAMPLE

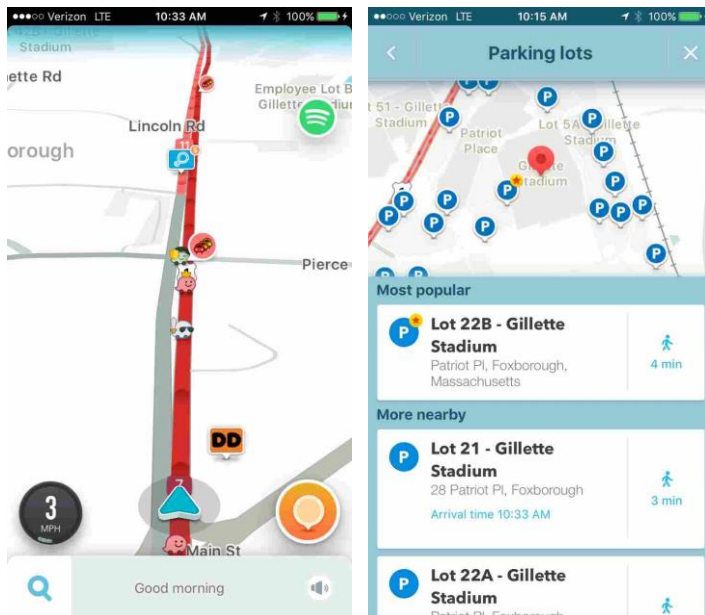


Figure 15 -Waze App information from the New England Patriots

The use of Waze and Google Maps have become more widespread for users to plan their routes. Cities and regions can work with Waze to ensure that during event days, vehicles are pushed to use different routes to spread out demand.

Dallas allows fans to put in their home zip code and parking lot and generate customized directions. Minneapolis uses a color-coded parking system to allow guests to reserve parking based on their arrival route, then gives them specific directions to that lot.

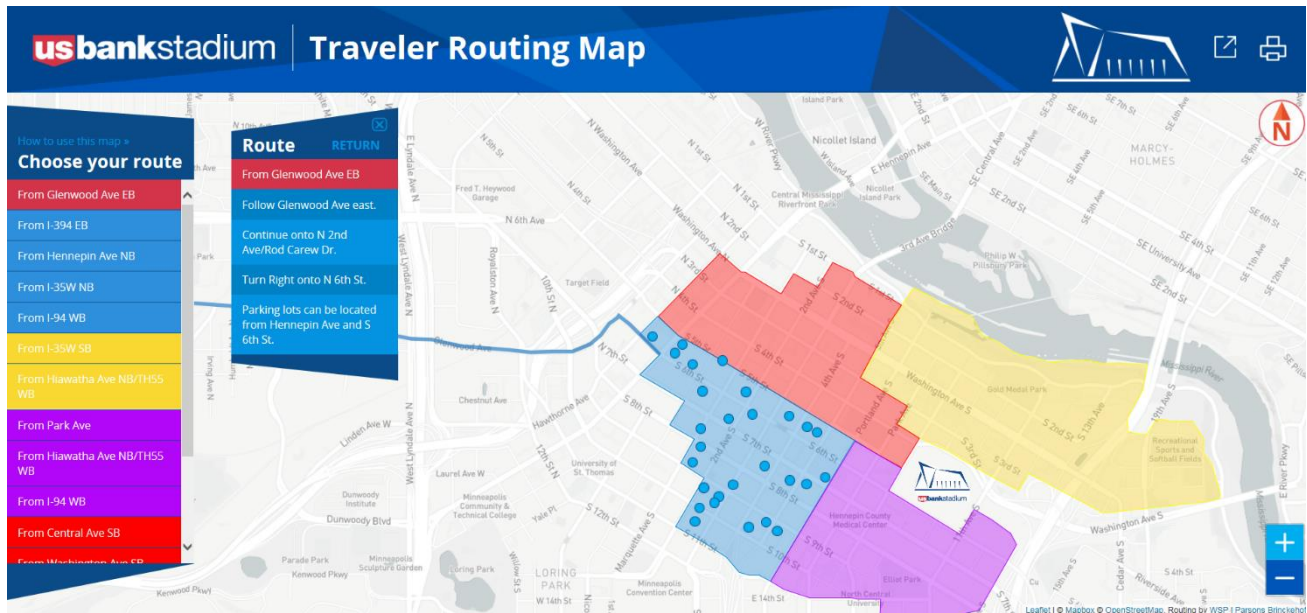


Figure 16: Minnesota Vikings Parking Tiers

### Operational Strategies



Operational strategies include signal optimization, manual traffic override, lane closures, and ramp metering. These strategies sync roadway capacity with the projected demand. An arterial with primarily one-way flow, for example, can be set to counter-flow all lanes in that direction (or most lanes, with provisions for one emergency entry lane to respond to incidents). Signal optimization strategies are dependent on the types of traffic controllers available. Modern traffic controllers can be synchronized along a corridor to improve coordination and provide additional signal timing to the peak ingress or egress movements. Automated signal control manages the flow movements, so traffic management staff can conduct other critical activities, such as “don’t block the box” operations, or pedestrian management. A traffic management center can be used to coordinate these activities with the overall event day operations plan.

### Examples

Use a combination of orange barrels, signs, and staff to create a pedestrian crossing at mid-block points. The visibility of this crossing reduces informal mid-block crossings and makes drivers more aware of the managed crossing.



Figure 17 --A temporary crosswalk at a high-volume pedestrian location in Arizona.



### Traffic Diversions

It is our experience that many travelers will continue to use the congested roadways to a major destination even when better options are available. This is particularly true when the travelers are unfamiliar with the area. A background traffic diversion strategy can identify these alternate routes and make drivers aware of them at key decision points. Diversion routes are intended to allow pass-through traffic to reach their destination faster, and the volume of diverted traffic will also improve conditions for vehicles destined for the event site.

### Example

Pittsburgh has effective counter-flow on many of the roadways surrounding the NFL stadium site. These are generally lower-speed roads, with surrounding businesses that generate some drop-off activity. Counter-flow is implemented using a network of cones and ground-mounted signs defining the start and end of the counter-flow measures.



Figure 18 --Counter-flow optimization strategies in Pittsburgh

*Arrive Early / Leave Late*



Early arrival / late departure incentives can be useful to reduce the volume of traffic arriving in the peak hour. Incentives can be monetary, such as discounts to dining, retail, or parking, or special events (pre-game parties or tailgates) for those who arrive early. Late departure incentives can include smaller post-events. Many facilities use smaller-scale concerts or organized post-event party hubs to encourage some guests to stay late.

These guests get to extend their experience, enjoy a relatively uncongested trip out from the site after the event, and, because they do not depart during the peak, they help reduce peak hour congestion as well.

*Carpool Incentives*



The average vehicle occupancy at many events has declined by nearly half a person over the past 2-3 decades, from around 3.0 persons per vehicle to 2.5. This is likely due to changes in the family structure, and friends and family meeting on-site, rather than carpooling. Incentive programs can help reverse some of this trend by reducing parking fares for higher-occupancy vehicles, and/or offering preferential parking for these groups.

Examples



Figure 19 - MetLife Tiered Parking Map

The NY Giants and NY Jets implemented a tiered parking system to simplify the traffic and parking operation. Instead of 5-6 tiers of parking, they now have 2 major tiers, and fans can find parking in their tier based on where they enter the site. For example, there is no Lot M pass, but fans that enter on the west side with a blue parking permit will be directed to one of the blue lots on that side of the Stadium.

A similar approach could be used with parking defined in rings outside the main attraction. Cost of parking could be tied to distance from the attraction and better access to parking closer to the defined

destination area could be provided for carpools or pre-paid higher daily rates.

### *Promote Traffic Apps*



One of the strategies includes using navigation apps to provide personalized directions to parking lots by location of lot and the direction the visitor is arriving from. The effectiveness of these apps is directly based on the size of the user base. A coordinated effort to encourage guests to download these apps and use them to plan their event day travel can be easily implemented by adding links to these apps on event

websites, point of sale, or via signage on the site itself. On-site signage is effective for repeat guests and for travelers who choose to use that app for egress on the same trip.

### *Transit and Bicycle Priority*



To provide incentives for alternative modes, it is important to explore opportunities to make the travel time on these modes competitive with the personal automobile. Prioritization at signals as well as dedicated lanes can be an effective strategy.

The transit vehicle or bicycle platoon is detected using in-ground sensors, cameras, or 2-way communication technology. The

signal sequence is then pre-empted to prioritize these flows as they approach the intersection. Priority can be advanced light signals, queue jump lanes and signals to allow access to the intersection prior to general traffic. Improved infrastructure to prioritize these modes like dedicated lanes for transit and bicycle significantly improves user experience and travel time.

Examples

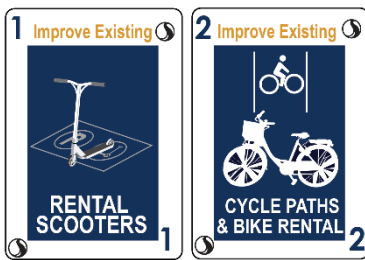


Figure 20 - Dedicated bike lanes in Victoria, BC

Dedicated Bike lanes, like the ones shown here in Victoria BC, help to encourage bicycle use even during congested periods by providing a designated or separated space for cyclists of all ages and abilities.

*Improve Existing Facilities and Services*

Make changes to existing modal options to encourage different choices. This may include making shared rental programs more widely available, adding service to existing public and private transportation services during busy weekends, key changes to problematic intersections to improve flow, managing pedestrians at key crossings, or temporarily altering traffic signal operations to reflect changes in peak travel demand. These options all exist. The goal is to make travelers more aware of them and customize existing facilities and services to benefit the major event day or seasonal peak experiences.



*Rental Scooters and Bike Programs/Infrastructure*

Gotcha LLC operated a bike share program in the City of Syracuse from July 2019 through late 2020 (the operator was acquired by another entity and the service was suspended). The City of Syracuse released an RFP for a Syracuse Shared Micromobility System in February 2021 and is currently working to reach an agreement with a preferred vendor to

operate a bike share system and possibly other modes such as scooter. An improvement to these programs is to increase awareness of these mode options and work closer with vendors to ensure adequate supplies to meet the historical and projected demand on event days. These programs also can be integrated into centralized travel websites or apps. As park-and-ride and alternate mode services are introduced and/or expanded geographically, they will help travelers move around more easily without a personal vehicle. In addition, improvements to bicycle infrastructure, such as local to regional trail connections and on-street bike lanes will help area residents travel without a car and encourage visitors to bring or rent bikes to move throughout the selected destinations safely without needing to get back into the car and drive.

Docking ports and charging portals for scooters should also be a consideration similar to that used by Swiftmile and what are typically in place at most bike share stations.

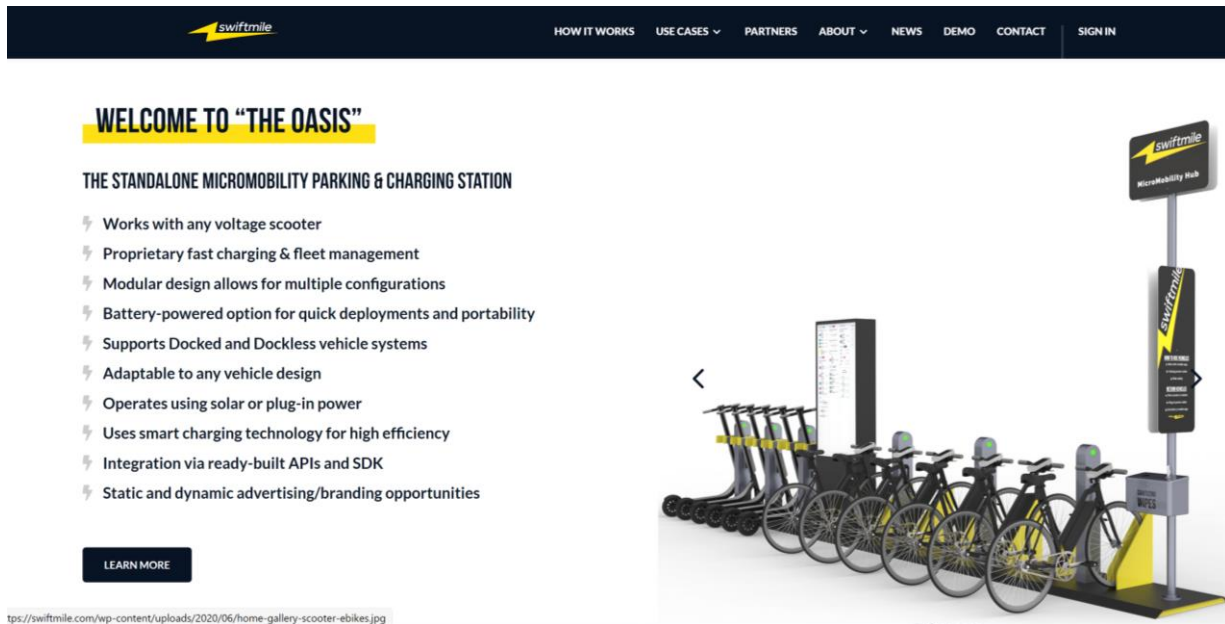


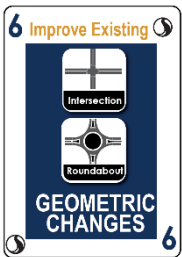
Figure 21 - Source: [www.swiftmile.com](http://www.swiftmile.com)

*Additional Transit Service*



Centro services are primarily scheduled to support commuter patterns and other local circulation needs with limited adjustments intended to serve event and tourism (seasonal) demand. In our experience, transit agencies are open to providing additional service to meet demonstrated demand, especially on weekend days when there are not as many constraints on the rolling stock. The key is to demonstrate that there is a concerted effort to make travelers – both employees and visitors – aware of the increased service. Transit utilization is correlated to service frequency and travel time, so more frequent service with predictable travel time can help increase that mode share option.

*Geometric Changes*



Minor intersection reconfigurations can be used to calm traffic flows and increase capacity. Roundabout conversions may be considered at locations with high turning volumes. As part of Stantec’s recommendations for the Sarasota-Manatee Barrier Islands Study, a major 4-legged intersection in Sarasota with multiple turn lanes will be converted to a roundabout to improve safety and decrease congestion. Turn lane reassignments include conversion of a through lane into a left or right turn lane to facilitate turning movement demand. Allowing for increased turning movement can be accomplished with signage, traffic management staff, and/or cones since the lane assignments are temporary for event day operations. Another example is physically modifying the roadway to add turn pockets at major intersections to accommodate demand. This change may require additional right-of-way at the intersection approach.





### *Pedestrian Management*

The flow of pedestrians near an event venue can significantly influence traffic patterns. Best practices include the delineation of pedestrian flow corridors, road closures to create pedestrian spaces, and pedestrian management staff to speed up crossings. Designating pedestrian flow corridors is relatively simple and cost effective: tape, pavement markings (“follow the red line to the Arena”). New pedestrian crossings may be created to match desire lines (for example, at mid-block locations between intersections). Road closures can provide an open pedestrian space, which can be programmed for other activities that support the primary guest experience (for example, a fan fest near an event facility), while lane closures can be used to “widen” the sidewalk in areas where pedestrian demand exceeds sidewalk supply. Pedestrian management staff should be trained with specific responsibilities (for example, prevent pedestrians from crossing out of phase).



Figure 22 -Carolina Panthers pedestrian management using policing



Figure 23 -New England Patriots created pedestrian pathways to guide fans



Figure 24 - Pedestrian spaces are separated visually in Queenstown, NZ by using different colored brick pavers



#### *Demand Based Traffic Signals*

Traffic signal optimization can be tied to projected demand, or it can be based on observed demand, using sensors to determine the length of queues on different approaches. As discussed above, automated traffic signals can allow staff who would otherwise operate the signal box to be assigned to other roles.



#### *Improved Lot Entry*

Most lot entries rely on a single entry point for payment or have several arrays creating a wall at the entry point. There are typically opportunities to stagger arrays further into the lots to increase the number of arrays and improve the efficiency of lot entry.



#### *Use of Change Makers*

For lots that are pay on entry, the challenge tends to be that providing correct change slows the entry flow and creates backups. By providing change makers ahead of the entry arrays, two things can be accomplished:

- Provision of change to speed up the entry flows
- Provision of information ahead of the entry to make the entry array processing speeds more efficient.



### *Ridehail Geofencing*

Without controls, ridehail usage can be disruptive to the ingress or egress because passengers are dropped off across the site, at times in intersections or the closest point where the passenger opts to leave the vehicle. Without a specified lot or location, geofencing can restrict ridehail to areas that allow for the stacking of vehicles and passengers and do not impede the entry or exit flows the venue or site.

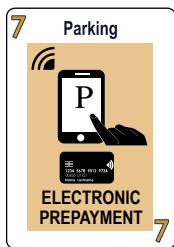


### *Parking Zones*

Parking zones work best when a directional approach is taken. By creating zones rather than specific lots, fans/visitors can be directed to the zones that are the easiest to access from a specific direction. This avoids congestion created by people driving through the site to access parking zones on the opposite side of where they are approaching from and simplifies signage and wayfinding to the site.

## Parking

Parking is identified as a special area of interest in the travel demand management deck. Even with alternate mode strategies, most patrons will choose to drive to their destination. On event day, vehicles circulating for a parking space is a significant source of congestion – particularly those who do not want to pay for a lot nearest the stadium but would prefer to park in residential areas and walk in. In our study in the Sarasota-Manatee Barrier Islands, we determined that drivers spent up to 30 minutes circulating for the elusive parking space. Visitors that are “location-agnostic” (they just want to visit a beach, not necessarily a specific beach) are more likely to circulate and re-circulate over longer distances to find parking spaces.



### *Electronic Contactless Payment*

Contactless payments offer many benefits for the operator. First, it allows for reduced interaction between parking staff and the guest. This is a reason that contactless payments have become more popular as facilities start to reopen after the COVID-19 pandemic. They also offer the possibility of a faster processing rate than cash, depending on the fare amount and the methods for making change, resulting in higher entry rates. An app can help facilitate contactless payments. A cash option is still advised for users who arrive at the paypoint without an app or other method to pay their entry fee.



### *Ridehail Priority Parking*

Ridehail pick-up and drop-off activities can put an additional demand on the limited curb space at the venue. In many situations, ridehail drivers may choose to drop off in a moving lane of traffic, rather than look for an available curbside space. In both scenarios, the ridehail activity can disrupt the normal flow of traffic and create additional complexities by dropping off visitors at locations not originally designed to accommodate them. During egress periods, when ridehail demands are more concentrated, pedestrian and vehicle queues disrupt traffic flow. An alternative is to provide designated, off-street/off site ridehail pick-up and drop-off areas. These areas – typically repurposed parking lots – should include off-street queuing space for vehicles, multiple parallel pick-up locations and serpentine queuing areas for pedestrians.



Figure 25 – Designated Ridehail Parking Location at MetLife Stadium, NJ



Figure 26 - Dedicated Ridehail lot at MetLife Stadium, NJ

They should be supported by ridehail staff and signage to direct passengers and motorists to these locations. Geofencing can also be used in ridehail apps. In a geofenced operation, a passenger requesting a ride would be directed to the closest ridehail lot and would not be able to request a pick-up until they are in the lot. The app therefore serves as

another form of communication for ridehail passengers and significantly aids in travel flow.

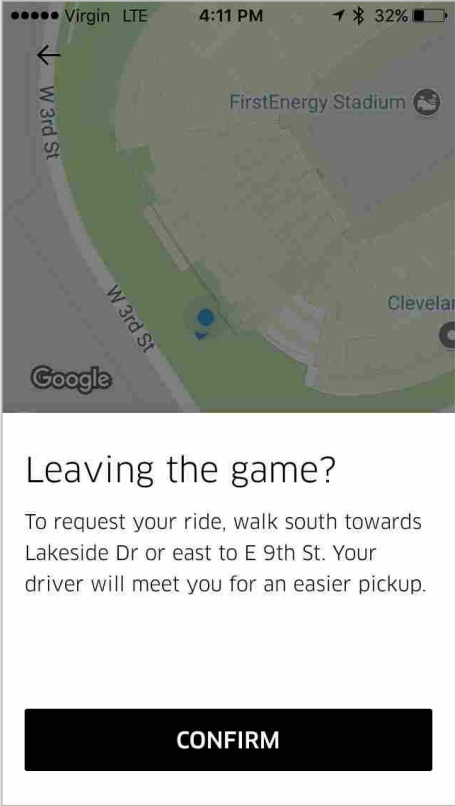


Figure 27 - Example of app with geofencing



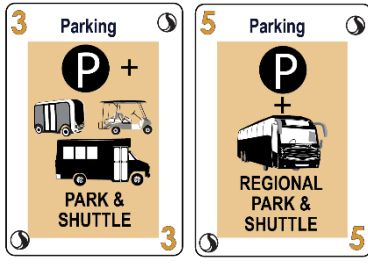
Figure 28 -Fans queuing for easily identifiable ridehail pick up are in Kansas City



### *Dynamic Parking Charges*

Parking fees influence guest behavior. A parking fee, or lack thereof, may encourage visitors to continue to drive to their destinations. There is understandable concern among members of the community to implement parking fees in areas that previously provided free parking. To address these concerns, parking fares can be implemented only in the highest-demand locations and/or in peak seasons, or in areas where alternative, free parking is available in outer lying areas with connecting shuttle service. Another option is to charge higher fares for long-term parking only and free parking for the first hour or so. Dynamic parking cost strategies adjust the parking fee based on the projected demand at specific locations during peak times. The high-demand locations would be charged higher parking fees during peak times to discourage parking at those locations. Such strategies are another deterrent to travelers from driving into high demand locations or congested areas. To be most effective, these higher fees must be communicated to travelers in advance as they plan their trip. Implementation of these strategies in larger cities nationwide suggest greater public acceptance of this approach and could be coupled with strategies that increase other transportation options.





*Shuttles*

Shuttle services can be one of the most effective tools to manage congestion. These services “extend” the parking field by providing connectivity to remote lots, including transit park-and-ride locations or local parking hubs (or improvised parking areas). The objective is to encourage people to park in these remote locations, and then take shuttles to their

destination. The benefit to the traveler is a faster trip to the destination, and less time spent looking for parking while contributing to congestion. These benefits must be clearly conveyed to travelers through communications channels described above. Parking may be full at specific locations or the messaging may inform drivers of traffic congestion and encourage usage. It is important to prioritize these shuttles to maintain the travel time to improve user experience. If a large network of shuttle buses is established, their travel time benefits will be enhanced by fewer individual automobiles and/or dedicated rights-of-way may be constructed for these services to make them more attractive and a time-saving option. In the not-too-distant future, autonomous shuttles can be used to provide first- and last-mile connectivity between nearby locations, at a lower cost and more efficiently than traditional shuttles.



*Curbside Management*

Curbside management refers to a strategy of using key curbside space in a more efficient manner between uses rather blocking it or allowing ridehail or taxis to dominate the usage. This can be done through the use of parking or stopping charges, access only via pre-paid permits with hangtags for verification so that the curbside is in continual use and not simply a parking space for a few vehicles.



*Electronic Prepayment*

Rather than required payment at the entry points, it is possible through some apps to prepay for the parking (similar to a ticket) that then becomes valid when activated by the user. This reduces the entry time at lots considerably as staff only need to see that the permit is shown as valid for entry.



*Parking Locator App*

A parking locator app or website is a means of disseminating information to travelers on their parking options. These tools can be used pre-emptively with pre-paid parking policies to allocate parking to different users. They are most effective with real-time information; however, if the app/website gives travelers an understanding of available parking in different facilities (or indicate that they are full) and provides the expected

walk times from that parking facility to specific destinations, more people are likely to

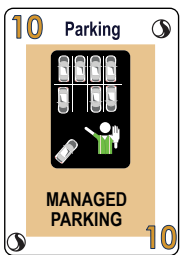
use a parking locator app. Travelers using them choose to park further away from a destination and walk, rather than spending more time looking for a limited number of parking spaces.



*Use of Hang Tags*

Parking hang tags have been in use for a long time for sports events but not universally. Hangtags can allow visual identification for specific lots or parking structures, VIPs and preferred entries as well as provide key travel information on the back of the tag. Having scannable tags can improve the entry efficiency of lots and highlight vehicles for special

access points.

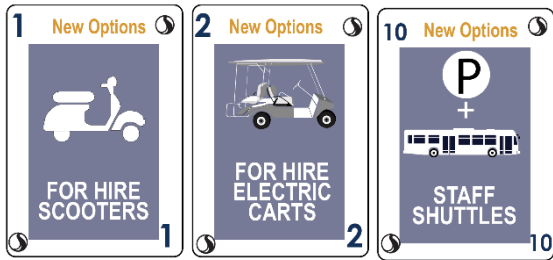


*Managed or Directed Parking*

Within parking lots, there can be improvements in the time it takes to park people as well as the safety of those walking through lots if directed parking is used. This approach uses staff to direct vehicles to rows and then specific spots rather than having people randomly drive through lots to their favorite location.

### New Modal Options

Create or encourage new modal options that do not currently exist for events, venues or areas that attract large crowds. These can include new connectivity to the Dome or improved travel within the region surrounding the Dome or from Armory Square.



### For Hire Scooters and Carts

For-hire scooters and carts can be used to provide first- and last-mile connectivity or to improve travel throughout a popular destination or within an event site. Partnerships with the private sector can be leveraged to provide these services.

In some stadium destinations, business owners might provide bikes for guests or may have for-hire electric carts. There is no obligation for riders to visit the business, but it is seen as a sign of good will, and many businesses report benefiting from the increased activity in the area.

### Examples

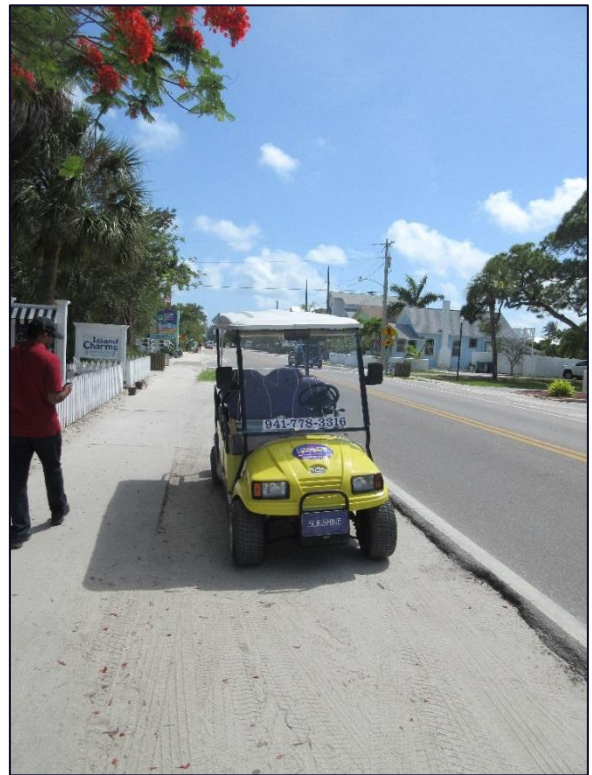


Figure 29 - Rental Bikes and electric carts on Anna Maria Island, FL

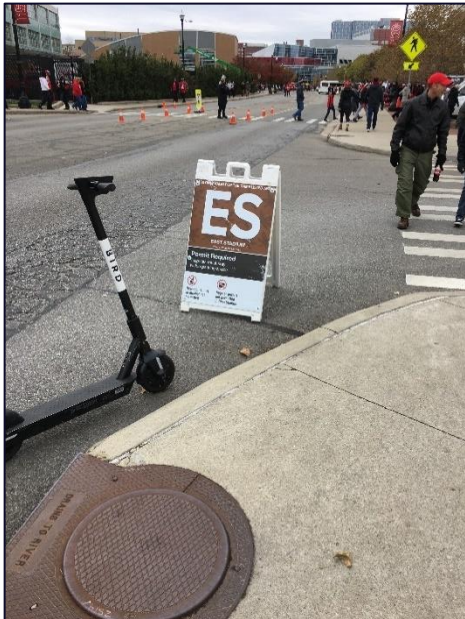
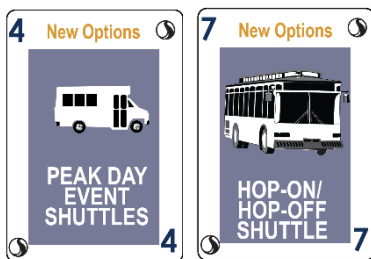


Figure 30 - scooters in use at The Ohio State



### Shuttles

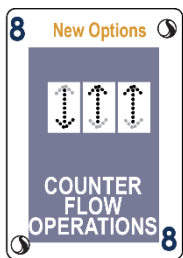
Shuttles can provide mobility for visitors who chose to travel via alternate modes, or to use a park-and-ride lot. These visitors, who no longer have their vehicle, do not have the ability to travel between destinations. Shuttles provide this missing connectivity. They connect specific event facilities and/or site-specific destinations to transit hubs. Parking shuttles maintain connectivity between other destinations and provide the option to bypass congested roads with vehicular traffic. These types of shuttles can also be used to service visitors with accessible needs or those with limited mobility. A hop-on, hop-off shuttle serves multiple destinations, and encourages visitors and guests to extend their stay or drop by destinations they might not have visited on their own.

Examples



Figure 31 -Private 'by donation' shuttle on Anna Maria Island, FL

Counter Flow Operations



Counter-flow operations include the reversal of one or more lanes for traffic flow. The intent is to match roadway capacity to actual demand. This strategy is highly recommended if there are long queues in the direction guests use to leave an event. Counter-flow the inbound lanes that are mostly empty. For a four-lane facility (two lanes per direction), counter-flow can increase capacity by 50% with one counter-flow lane, or 100% if all lanes are counter-flowed. Considerations for emergency ingress during a peak egress condition typically necessitates at least one lane for "normal" flow, although this requirement can be relaxed if there are dedicated emergency ingress routes on other roads.

### Examples

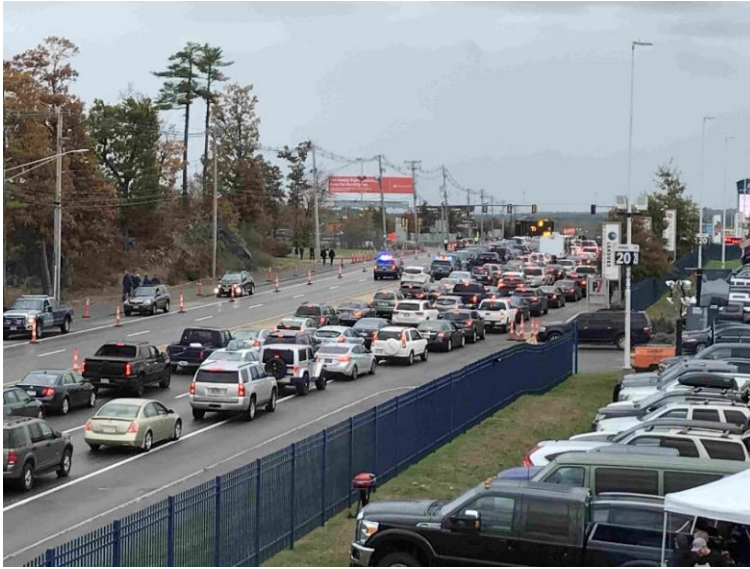


Figure 32 – Counter Flow Operations in New England for Patriot Games

A network of cones, stanchions, VMSs, static signs, and staff define the counter-flow operation on Route 1 in New England for Patriot Games. Out of six travel lanes, one is reserved for normal flow, and for easier emergency vehicle access. Signs help vehicles get into the right lanes at crossover points in the counter-flow operation, so, for example, vehicles that need to turn left to enter a lot are notified that they need to be in the counter-flow lane to make that turn downstream.



### Regional Coach Park-and-Ride

Many venues encourage the use of regional coach (longer distance bus) based park and ride services from places outside the 10-15 minute shuttle distance to reduce congestion by partnering with shopping malls or other facilities. This allows people to access the venue from longer distances without driving. The regional coaches could be operated in partnership with local transit authority to the venues like from regional shopping malls.

The New York Islanders have been doing this from the old Nassau Coliseum to their current home to reduce traffic and parking needs and will continue this approach from key rail stations and regional parking areas in Long Island for the new arena.



Figure 33 - Coaches from Regional Shopping Malls in Houston, TX



### Parking and Staff Shuttles

Staff are typically requested to park in distant parts of the parking lots or surrounding area for most stadiums and venues which may require the use of parking shuttles for staff. Kansas City Chiefs do this from a distant lot, Ohio State University has staff shuttles that then become parking shuttles, and this is already in place for Dome staffing.

Examples



Figure 34 -Staff shuttle buses that become Parking Shuttles to the Schottenstein Centre at Ohio State University



### 3.0 Conclusion

TDM seeks to reduce number of trips and vehicle miles traveled by increasing travel options, by providing incentives and information to encourage and help individuals modify their travel behavior for future events. As discussed here in this literature review, TDM strategies can range from ride-sharing services and improved transit service, to wayfinding and parking pricing. The review of best practices for TDM and traffic flow optimization for event venues show an array of TDM strategies at different locations. Combination of different travel demand management strategies tailored to the specific area affect the success of TDM. This document is intended to provide an inventory of best practices for TDM and traffic flow optimization for event venues. And the cumulative impact of a comprehensive set of TDM strategies from the best practices will be used to develop improvement strategies for Dome traffic management and operations study based on the assessment of the past travel pattern data.