2025 NOCoE Transportation Technology Tournament

# Alleviating Ingress Congestion Through Smart Parking Solutions for Special Events in Las Vegas

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**List of Acronyms**

TIC: Traffic Information Center

# 1. Overview

Managing traffic and parking during special events requires seamless coordination among multiple stakeholders to ensure a smooth and safe experience for all. From regional traffic control and venue logistics to parking operations and public transit, each entity plays a vital role. Integrating smart technologies and collaborative strategies can significantly enhance efficiency, reduce delays, and improve safety for both event attendees and the broader community.

## 1.1 Problem Statement

Las Vegas frequently hosts high-profile special events that attract large crowds, including major concerts, conventions, and sporting events. Two of the most prominent venues, T-Mobile Arena and Allegiant Stadium, face significant parking limitations. T-Mobile Arena lacks a dedicated parking facility, while Allegiant Stadium has only a few small lots, insufficient for full-attendance events. As a result, these venues rely heavily on nearby casino parking garages. During events, casinos charge special event parking fees at the entrance, leading to long queues as drivers pay, ask questions, or turn around to find alternate parking.

These inefficiencies at the point of parking access cause significant ingress congestion, backing up traffic onto surrounding roadways and ultimately affecting traffic signals. While RTC-FAST technicians manage signal operations effectively, they cannot mitigate gridlock caused by bottlenecks at parking garage entrances. In many cases, drivers unfamiliar with the area or unaware of their prepaid parking arrangements worsen the issue by arriving at the wrong garage and having to reroute. This situation contributes to delays, driver frustration, and potentially unsafe behaviors. Thus, optimizing parking management is key to improving traffic flow and the overall special event experience.

## 1. 2 Study Area

The study area includes the immediate surroundings of Allegiant Stadium and T-Mobile Arena, located within the Las Vegas Strip corridor. These venues are supported by casino-operated parking garages along Tropicana Avenue, Las Vegas Boulevard, and adjacent arterials. Ingress

routes often include I-15 and local roads like Russell Road and Harmon Avenue, which feed into the Strip.


Figure 1: Friday PM peak (left) and Saturday before event start traffic flow (right) at the same time

RTC-FAST oversees signal timing and real-time traffic operations in this area. Despite proactive signal management during events, upstream congestion from inefficient parking entry processes severely limits signal effectiveness. The region's multimodal landscape includes pedestrian movements, ride-hailing zones, and occasional transit services such as the RTC Game Day Express.

## 1.3 Stakeholders

The successful coordination of special events relies on a diverse group of stakeholders working collaboratively to manage transportation and parking challenges. RTC-FAST oversees regional traffic signal operations and freeway management to optimize flow, while event organizers and venues coordinate logistics and audience experience. Casino operators provide critical infrastructure by offering their parking garages, often used by attendees. Parking enforcement and traffic control companies like PATG-LV play a key role in directing drivers and managing congestion at entry points. Public transit operators support mobility through shuttle and fixed-route services. Visitors and attendees, as end users, are directly impacted by parking availability

and ingress efficiency. Additionally, app developers and tech vendors represent potential collaborators in delivering smart parking solutions to streamline the overall experience.

# 2. Solution Statement

## 2.1 System Overview

This project introduces a combination of innovative strategies to improve the efficiency of event parking and reduce related congestion. Following the journey of a typical driver with this smart parking system will help highlight the solution's effectiveness in addressing the challenges of the study area. After the driver completes the purchase of their event ticket they will be promoted with the following choices:

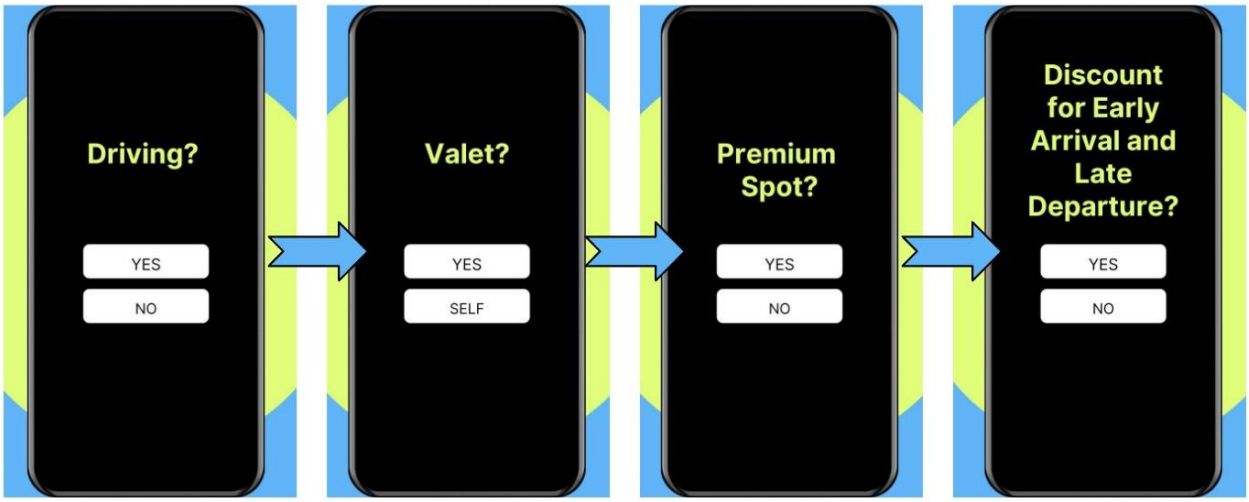


Figure 2: Driver Preference Selection

These preferences will be taken into account to plan the drivers trip and spot selection. They will receive a confirmation message with their spot assignment and their suggested departure time for the event.

The day of the event, the driver receives navigation instructions to the venue and receives updated routing information based on current traffic demand and surrounding venue demand. The driver departs and as they approach they are prompted to enter the **Prepaid Priority Lane** to the parking garage or lot. As they get closer to the entrance they drive by a **Bluetooth Reader**. The driver phone displays a prompt to confirm their arrival and the Bluetooth Reader receives this message and a light on top of the reader flashes green. If a vehicle is not meant to be in this lane then the light will flash red and the driver will be instructed to exit this lane. A **License Plate Reader** can be used as an alternate or backup device for verification.

As the confirmed driver gets closer to the entrance they see signs that say **Priority Lane 5 mph**. This speed allows the driver to smoothly and safely enter the facility. The driver easily follows their navigation to their assigned parking spot. Their spot will be marked by a spot detecting device flashing green. Once they park the light will change to a solid red light.

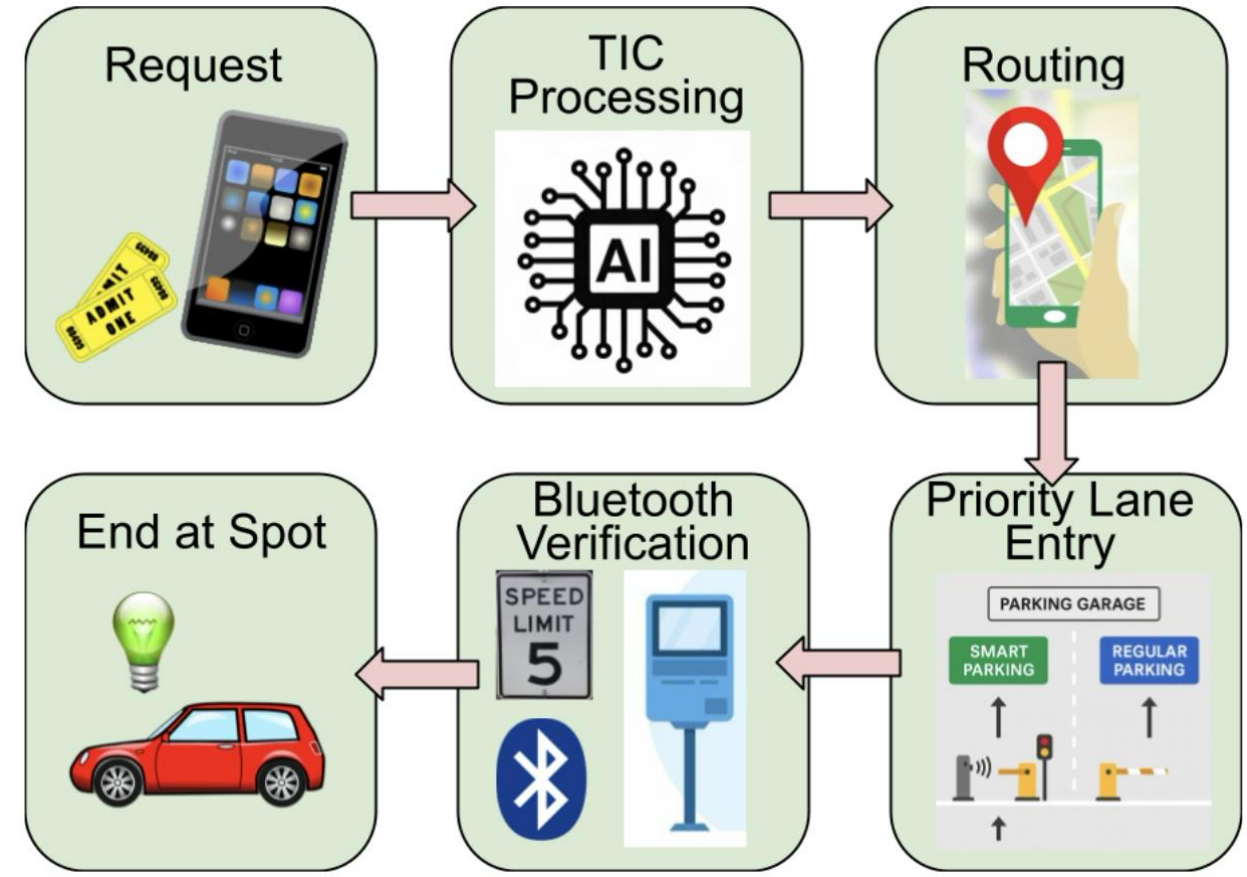


Figure 3: System Overview

## 2.2 System Architecture

The system architecture describes how the objects in this network function independently and together.

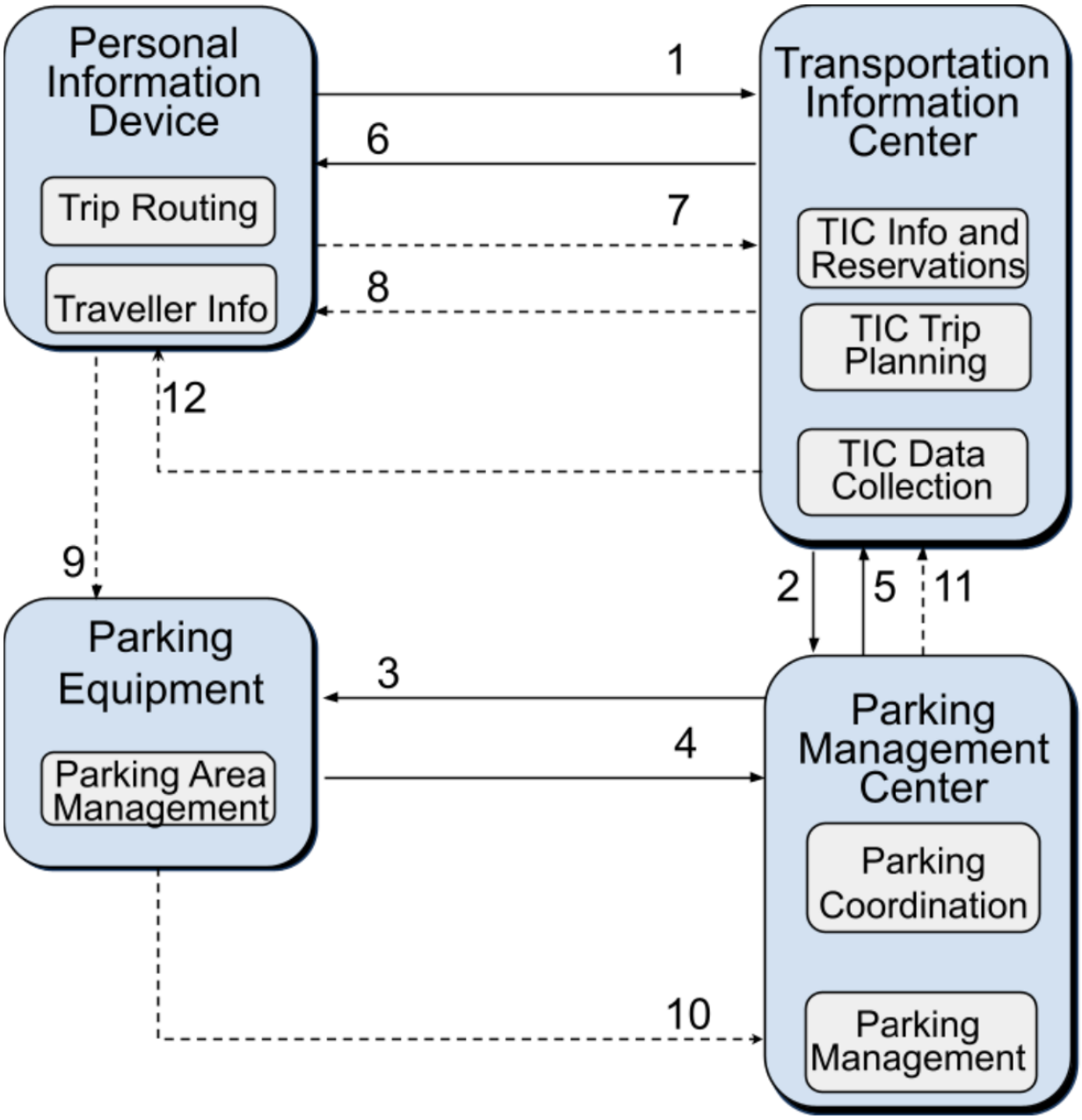


Figure 4: System Architecture

**Planning-Solid Lines**

1. Reservation and Routing Request to TIC
2. Request to Site Management for Reservation
3. Request to Site Occupancy
4. Equipment Confirmation of Request
5. Confirmation to TIC and Make Suggested Route
6. Confirm User Reservation and Route

**Departing-Dashed Lines**

7. Depart and Update real-time traffic to TIC
8. TIC to the driver with live route information
9. Bluetooth Check-in/Verification at the Site Entrance
10. Confirm User Entrance
11. Confirm and Update to TIC
12. Confirmation of completed trip from TIC

The solid-colored lines of the architecture represent the planning stage of the driver's journey. The dashed lines represent the day of the event when the driver will be driving to the facility. In the planning stage of the architecture, Line 1 shows the driver sending their parking and route preferences to the TIC. These include spot preferences and when the driver wants to arrive and depart from the facility. The TIC will begin to process this request and forward it to the Parking Management Center in Line 2. The Parking Management Center verifies that the Parking Equipment is capable of fulfilling the request in Line 3. After confirmation in Line 4, the Parking Management Center reserves a spot and a window of time for the driver. Once this is confirmed this message is sent to the TIC in Line 5. The TIC begins to finalize the routing plan by taking into account the surrounding venues and estimates the traffic demand around the time of the event. Line 6 is the confirmation back to the driver of their parking spot and suggested route.

The dashed lines show the driver’s journey on the day of the event. Line 7 shows the driver’s request at their actual time of departure. This is sent to the TIC. The TIC updates the route choice based on the current demand. Line 8 is the confirmation back from the TIC with the route. Line 9 is the communication between the driver’s phone/device and the Bluetooth equipment at the facility. This serves as a verification that this is the correct driver for this location. This Bluetooth device is located in the priority prepaid entrance lane to the parking facility. The equipment reports verification visually or audibly. When the driver reaches their designated spot, the parking equipment sends a confirmation to the Parking Management Center. Line 11 relays this information to the TIC to confirm the trip is complete. Finally, the TIC sends a message back to the driver, in Line 12, letting them know they had a successful trip.

Table 1: Physical and Functional Objects

| Physical Object | Functional Object | Description |
|---|---|---|
| Personal Information Device | Trip Routing | Personal trip plan based on traveller's preferences updated throughout the journey. |
| Personal Information Device | Traveller Information | Information of the trip such as road conditions and traffic. The Bluetooth information is here as well to be used a verification upon entry. |
| Transportation Information Center | TIC Info and Reservations | Collects parking reservation preferences and organizes them among surrounding events and parking facilities. More information is collect such as electric charging and arrival/departure needs, |
| Transportation Information Center | TIC Trip Planning | This robust section compiles all routing needs in the area to suggest ideal departure times and routes to limit congestion on arterials near venues. When vehicles are en route updates are generated from here. |
| Transportation Information Center | TIC Data Collection | Data is collected to confirm quality and to be used for future traffic studies. |
| Parking Management Center | Parking Coordination | Control Traffic around facilities in the region and communicate with supported parking facilities. Information such as availability and status and operations are shared. |

# 3. Anticipated Impacts

## 3.1 Stakeholder benefits

Each stakeholder involved in event traffic and parking operations stands to gain significant benefits from improved coordination and smart parking solutions. **RTC-FAST** can enhance regional traffic efficiency and reduce congestion through better signal timing and data-driven decision-making. **Event organizers and venues** benefit from smoother ingress, improving attendee satisfaction and event reputation. **Casino operators** see increased utilization and potential revenue from parking assets, while also reducing disruptions to regular patrons. **Parking enforcement and traffic control companies** can streamline their operations with real-time data and reduced need for manual interventions. **Public transit operators** benefit from integrated systems that balance shuttle services with traffic conditions, enhancing reliability. **Visitors and attendees** experience less stress and shorter wait times, contributing to a positive event experience. Finally, **app developers and tech vendors** gain opportunities to pilot and scale

innovative solutions, expanding their market presence and showcasing their technology in high-profile environments.

## 3.2 Safety Benefits

Implementing coordinated traffic and smart parking solutions during special events offers significant safety advantages for all stakeholders. By optimizing traffic signal timing and improving traffic flow, **RTC-FAST** can reduce the likelihood of rear-end collisions and intersection-related incidents. **Clear signage and real-time parking guidance** help minimize driver confusion and aggressive behaviors often seen during peak ingress periods. **Traffic control companies** benefit from enhanced situational awareness, allowing staff to direct vehicles more safely and efficiently. **Pedestrian safety** is improved as smoother vehicle movement reduces conflict points around event venues. **Public transit integration** reduces the volume of individual vehicles, lowering the risk of crashes and easing pressure on road infrastructure. Overall, a well-managed parking and traffic system not only enhances convenience but also creates a safer environment for drivers, pedestrians, and traffic personnel alike.

## 3.3 Potential challenges

Despite the collaborative potential, several challenges may arise in implementing coordinated traffic and parking solutions for special events. **Data sharing and system integration** between stakeholders—such as RTC-FAST, casino operators, and tech vendors—can be limited by differing platforms, priorities, or privacy concerns. **Jurisdictional and ownership boundaries** may complicate decision-making, especially when parking facilities are privately owned but used for public event access. **Real-time communication and coordination** among enforcement teams, transit operators, and event staff can break down during peak hours, leading to delays and confusion. **Visitor behavior and unpredictability**, such as last-minute arrivals or preferences for certain parking locations, can undermine even the most well-planned systems. Additionally, the **cost of deploying and maintaining smart parking infrastructure** may deter adoption by some stakeholders without a clear return on investment. Addressing these challenges will require strategic planning, stakeholder buy-in, and flexible technology solutions.

# 4. Conclusion

Efficient parking access is critical to reducing congestion during special events in Las Vegas. By focusing on the parking process, especially the last half-mile to the venue, this project will explore technology-driven solutions such as smartphone apps, LPR systems, and smart signage. These innovations can significantly reduce ingress delays, improve traffic safety, enhance attendee

satisfaction, and support RTC-FAST's broader mission of managing multimodal mobility in the region. The solution will be tailored for large-scale events such as the 2026 FIFA World Cup and can be scaled to serve ongoing venue operations.