



# North Central Texas Council of Governments Parking Technology Guide

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# Parking Technology Guide

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# Introduction and Guide Overview

This Parking Technology Introduction and Guide Overview is a companion document for the North Texas Parking Strategies Toolbox. Each Parking Management Strategy will have a section indicating technology that may be used for that strategy. This document will provide a description of those technologies which may be used for multiple parking strategies. The Parking Management Technology Matrix on the next page shows that relationship.

## How to use this document:

1. Start on <https://parkingtoolbox.nctcog.org/Grid-Navigations> and review the strategy you are interested in.
2. Once you identify the technology applicable to that strategy, you can find a detailed description in this guide.

Not all management strategies (such as zoning changes) have a directly applicable technology.

## Report Organization Method

The parking management technologies in this report are grouped into three distinct functional categories:

1. **Input Technology** – Collects or receives data to support other parking technologies or broader parking management systems. This is the only group not directly applied to management strategies. It usually supports information or enforcement/management applications.
2. **Information Technology** – Provides drivers with static or real-time information on parking availability, location, regulations, and pricing.
3. **Management and Enforcement Technology** – Ensures compliance with parking rules and regulations, manages access and timing, and helps control parking demand more effectively.

More details on these three groups are provided in the corresponding sections of this guide.

# Parking Management Technology Matrix

This matrix shows all NCTCOG Parking Toolbox management strategies and their applicable technology integration organized by the three parking technology categories.

<b>Technology Group:</b>	<b>Information Technology</b>					<b>Management and Enforcement Technology</b>		
<b>Input Technology</b>	Parking Guidance Systems	Dynamic Wayfinding and Signage	Static Signage	Parking Availability Platforms	Mobile Applications	Smart Payment (Meter) Technology	Parking Access and Revenue Control	Automated Valet
<b>Cameras</b>	*	*		*	*	*	*	
<b>Parking Space Sensors</b>	*	*		*	*			
<b>License Plate Readers</b>				*	*	*	*	*
<b>Entrance Sensors</b>	*	*		*				
<b>Parking Management Tool</b>								
Crediting Off-Site Parking		x	x	x	x			
Shared Parking	x	x	x	x	x			
Incentives for Public Parking	x	x	x	x	x			
Public-Private Development	x	x	x	x	x			
Permit and Special User Program	x	x	x	x	x	x	x	
Parking Availability Platforms	x	x	x	x	x	x		
Wayfinding, Markings and Signage	x	x	x	x	x			
Parking Management Districts	x	x	x	x	x	x	x	x
Eliminate or Reduce Parking Requirements	<b>No Technology Group</b>							
Fee-in-Lieu of Parking								
Parking Maximums								
Unbundled Parking Cost								
Curb Space Management		x	x	x	x	x		
Improve Mobility Options to Reduce Parking			x	x	x	x		
Paid Parking	x	x	x	x	x	x	x	
Valet Parking			x					x

## Input Technologies

Many technology services require foundational hardware or devices to generate data on parking activity. This data is often used to provide information to drivers, enforce parking rules, or create analysis data for operators. This usually takes the form of:

- Cameras
- Entrance Detection Sensors
- Parking Space Availability Sensors
- License Plate Recognition

These are described further in this section. Other input technologies can include payment systems and access and revenue control systems but those also serve other purposes in the process of collecting data other than just input.

## Cameras

Commonly used in parking management to monitor entire lots, specific spaces, or entry and exit points. Their primary functions include counting vehicles, tracking parking space utilization, and reading license plates to verify whether payment has been made.

### *Applicable Area*

The use of cameras is typically implemented at the facility level for off-street parking facilities such as garages and lots.

### *Integration With Other Technology*

Cameras are input technology paired with software to support both information technologies and management and/or enforcement technology.

### *Example: Grande Place – City of Vevey, Switzerland <sup>1,2</sup>*

In partnership with Parquery, the City of Vevey, Switzerland, installed two cameras to monitor a 450-space parking area at Grande Place. The system analyzes static images to provide real-time occupancy data to both city administrators and drivers. Parking officers receive information on space availability and duration of stay, which can be cross-referenced with payment records. The system also helps identify vehicles that exceed the maximum parking time limit.

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<sup>1</sup> Fossati, A. (2016, December 12). The parquery smart parking system facilitates enforcement for parking operators. Parking Network. <https://www.parking.net/parking-news/parquery-ag/smart-parking-system-facilitates-enforcement>

<sup>2</sup> Parquery: Parquery monitors over 400 parking spots with 2 standard cameras in Vevey, Switzerland. <https://parquery.com/parquery-vevey/>

## Entrance Detection Sensors

Designed to monitor traffic flow, entrance detection sensor systems count vehicles entering and exiting off-street parking facilities, such as garages and lots. The occupancy data can then be used to inform drivers about available spaces and total vehicle counts.

### *Applicable Area*

The sensors can be implemented at the facility level for off-street parking such as garages and lots.

### *Integration With Other Technology*

Entrance detection sensors are an input technology that is paired with software to support both information technologies and management or enforcement technology.

### *Example: Shops at Clearfork – Fort Worth, TX<sup>3</sup>*

The Shops at Clearfork is a mixed-use development in Fort Worth, Texas with over forty stores and sixteen dining options. It includes two public parking garages equipped with ultrasonic directional sensors that track vehicle movement at entry and exit points. This data provides parking availability within the garage to patrons via dynamic signs. Entrances to the garages also have digital displays indicating the number of available spaces on each level.

Figure 1: Shops at Clearfork, Ft. Worth, Texas  
Parking Guidance System



Source: NCTCOG

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<sup>3</sup> Q-Free. (2018). Shops At Clearfork – Texas, USA. Trondheim, Norway; Q-Free. <https://www.q-free.com/wp-content/uploads/2018/04/Shops-at-Clearfork-Reference-090418.pdf>

## Parking Space Availability Sensors

Sensors designed to detect the presence of vehicles in individual spaces enable greater accuracy of real-time data for parking availability platforms, apps, signage, and guidance systems. These technologies can help maximize utilization and optimize traffic flow by guiding drivers to available facilities and individual spaces. Additionally, they can provide occupancy and demand data. Common sensor types include:

- Overhead Sensors
- Surface Mounted Sensors
- Inground Sensors

### *Applicable Area*

The sensors can be implemented for both off-street parking (garages or lots) and on-street parking at the facility, corridor, and district or neighborhood levels to provide occupancy and demand data.

### *Integration With Other Technology*

Parking space availability sensors are an input technology that is paired with software to support both information technologies and management or enforcement technology.

### *Example: LA Metro Park and Ride Parking Sensors<sup>4</sup>*

The Los Angeles County Metropolitan Transportation Authority, in partnership with ParkHelp, is installing in-ground, cloud-connected sensors at fifty-three Metro parking facilities. These sensors will provide real-time data on occupancy and demand, alerting riders to available spaces via digital signage at lot and garage entrances. This system helps transit users find parking more quickly – either upon arrival or in advance – reducing the time spent searching for a spot.

*Figure 2: Parking Availability Sensors at Dallas-Fort Worth International Airport*



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<sup>4</sup> Descant, S. (2025a, February 25). Data, Insight Central to new L.A. Metro Parking Tech. Industry Insider California. <https://insider.govtech.com/california/news/data-insight-central-to-new-l-a-metro-parking-tech>

## License Plate Recognition

License Plate Recognition or Reader (LPR) technology provides a digital and automated recognition of a license plate through a camera and software, uniquely identifying each vehicle. This can streamline the parking process for permits, payment, enforcement, and occupancy counts. It can be used to support many information and management/enforcement technology applications.

### *Applicable Area*

LPR technology can be implemented for both off-street parking (garages or lots) and on-street parking for management at a facility, corridor, and district or neighborhood to support validation and enforcement needs.

### *Integration With Other Technology*

LPR is an input technology that is paired with software to support both management or enforcement technologies.

### *Example: City of San Marcos LPR Downtown Enforcement<sup>5</sup>*

The City of San Marcos, Texas, uses License Plate Recognition technology to enhance downtown parking enforcement. The system automates citations and permit verification with improved accuracy and efficiency. LPR captures two photos per vehicle – one of the vehicle and surroundings, and one of the license plate – along with GPS coordinates and time stamps. Enforcement officers regularly patrol timed zones, and if a vehicle exceeds the posted time limit, the system alerts the officer to issue a citation.

*Figure 3: LPR Devices Mounted on Top of Police Vehicles*



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<sup>5</sup> *License plate recognition*. License Plate Recognition | City of San Marcos, TX. (n.d.). <https://www.sanmarcostx.gov/3010/License-Plate-Recognition>

## Information Technology

Most parking management technologies are intended to inform drivers of available parking. These rely on the input technologies to provide information of space occupancy and location. Technology solutions often employed to deliver this information to drivers include:

- Parking Guidance Systems
- Dynamic Wayfinding and Signage
- Mobile Applications
- Parking Availability Platforms
- Static Signage

The information technology then shares it via on-site signs or lights, or internet-connected devices through mobile applications and websites.

## Parking Guidance Systems

The parking guidance systems use cameras, sensors, and dynamic signs to guide drivers to available parking spaces. This system can reduce traffic congestion by minimizing the time drivers spend searching for parking.

### *Applicable Area*

This system can be implemented for both off-street parking (garages or lots) and on-street parking. It's typically used at the individual facility level. See the Dynamic Wayfinding and Signage section for examples of corridor, district, or neighborhood use.

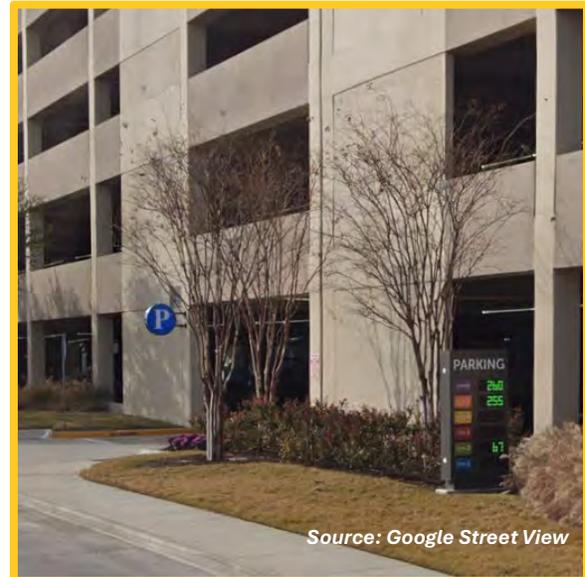
### *Integration With Other Technology*

Parking guidance systems often use cameras, parking space sensors, or entrance sensors to monitor parking occupancy. Software is then used to display real-time parking availability, through digital signage, mobile applications, or webpages.

### *Example: Legacy West – Plano, TX<sup>6</sup>*

Legacy West, a large mixed-use development in northwest Plano, Texas, experiences high parking demand. To address this, real-time parking inventory signage was installed across the site. The system aims to direct drivers to one of the over 3,200 spaces in centralized garages along the Dallas North Tollway, helping to reduce internal traffic congestion, minimize time spent searching for parking, and improve the overall visitor experience.

Figure 4: Parking Guidance System Sign in Legacy West, Plano Texas



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<sup>6</sup> Rodenhiser, K. (2020, August 31). Legacy west chooses Park Assist's L4 Smart-Sensor System. Parking Network. <https://www.parking.net/parking-news/park-assist/legacy-west-chooses-l4-smart-sensor-system>

## Dynamic Wayfinding and Signage

Dynamic wayfinding and signage provides real-time parking availability integrated into mobile apps, websites, or on-site dynamic signage. It is more commonly applied as on-site signs to guide drivers in commercial districts but can also connect to applications allowing users to check space availability before arriving.

### Applicable Areas

This technology may include both off-street parking (garages or lots) and on-street parking usually for a corridor, district, or neighborhood. For similar technology at the specific site or property level see Parking Guidance Systems.

### Integration With Other Technology

Dynamic wayfinding and signage need cameras, parking space sensors, or payment system data to monitor parking occupancy. This data can then be paired with software to display it on digital signage, mobile applications, and webpages.

### Example: Downtown Redwood City, CA<sup>7, 8</sup>

The City of Redwood City, California installed parking sensors and wayfinding signage at strategic locations for visitors to their downtown. Small circular signs mounted on poles throughout downtown guide drivers to available spaces, while five large gateway signs offer real-time parking availability. This is designed to improve the parking experience by helping visitors quickly find open spots and reduce traffic by eliminating the need to circle repeatedly while trying to find spaces.

Figure 5: Downtown Redwood City, California Parking Availability Gateway

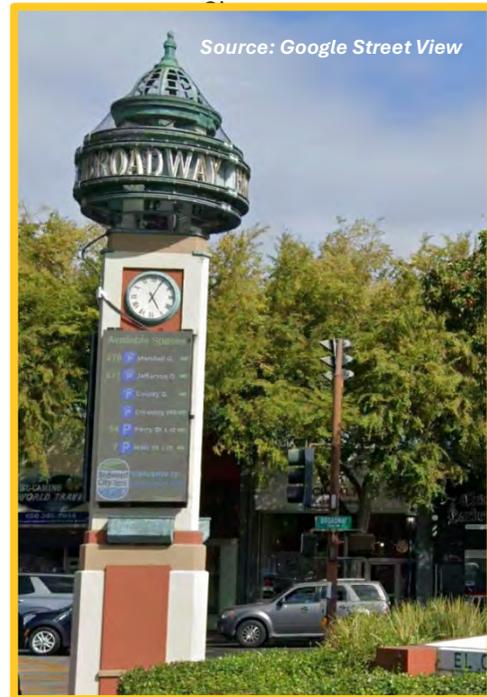


Figure 5.1: Downtown Redwood City, California Dynamic Parking Guidance Sign



<sup>7</sup> Downtown Parking Guidance System | Infrastructure projects | City of Redwood City. Redwood City California. (n.d.). <https://www.redwoodcity.org/city-hall/current-projects/infrastructure-projects>

<sup>8</sup> Downtown parking | City of redwood city. (n.d.) <https://www.redwoodcity.org/departments/community-development-and-transportation/engineering-transportation/transportation-and-parking/downtown-parking>

## Mobile Applications

Mobile applications are software for smart phones that display real-time parking space prices, manage paid spaces, and offer payment and reservation options. They allow users to handle payments before their trip begins or at the parking facilities without needing to use cash or kiosks. Apps can also ease enforcement by allowing drivers to receive notifications when their parking time limits is almost up.

### *Applicable Areas*

Mobile apps can be implemented for both off-street parking (garages or lots) and on-street parking. They can be unique apps for each facility but typically they are common platform used across a city or by many parking operators.

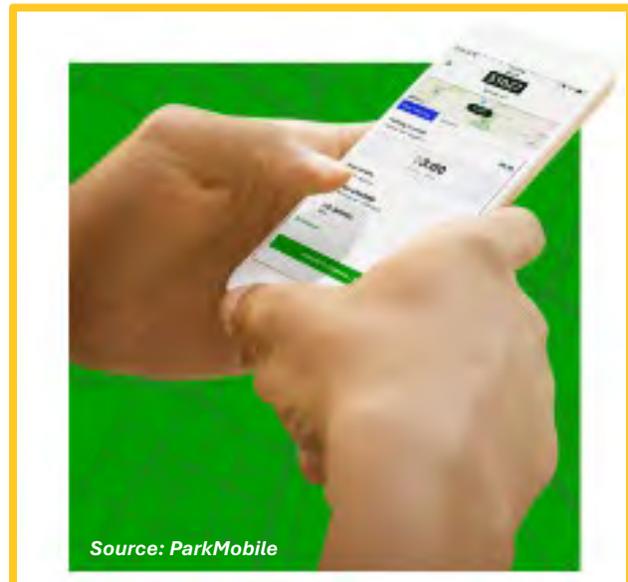
### *Integration With Other Technology*

Mobile applications need input data such as cameras, parking space sensors, and license plate readers but most often use payment data to indicate availability.

### *Example: ParkMobile FW PARK App<sup>9, 10</sup>*

ParkMobile is a provider of mobile payment widely implemented across the country, including in North Texas. One example is the City of Fort Worth which partnered with ParkMobile to launch the FW PARK App. It is the digital payment option for on-street parking. It also features a user-friendly map interface that helps drivers locate and navigate to available on- and off-street parking while also highlighting nearby retail, dining, and transit options. Users can reserve spots at gated facilities and major venues and receive notifications when their session is nearing expiration. Additionally, the app streamlines enforcement by allowing officers to verify payments digitally.

Figure 6: ParkMobile Application



<sup>9</sup> City of Fort Worth. (n.d.). FW Park app available now. – Welcome to the City of Fort Worth. <https://www.fortworthtexas.gov/departments/tpw/parking/app>

<sup>10</sup> Parkmobile. Parking Network. (n.d.). <https://www.parking.net/parking-industry/parkmobile>

## Parking Availability Platforms

Parking availability platforms deliver real-time occupancy data and wayfinding information, helping users quickly locate available spaces. Websites or mobile applications for these platforms provide information such as: location of applicable parking spaces, hours of operation, prices and restrictions, and real-time availability

### Applicable Areas

These platforms can be implemented for both off-street parking (garages or lots) and on-street parking for individual locations or entire neighborhoods.

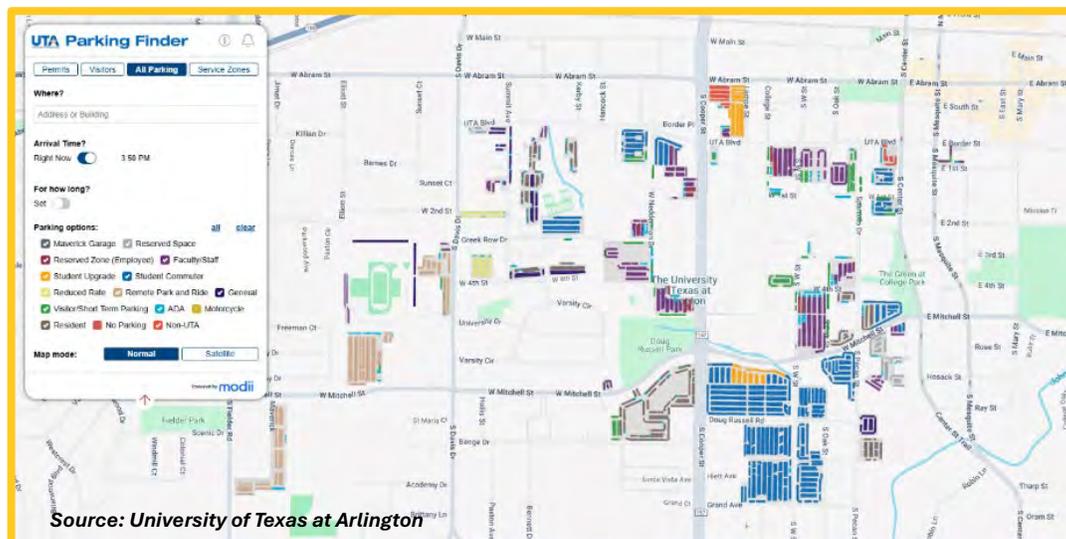
### Integration With Other Technology

Parking availability platforms use inputs from cameras, parking space sensors, entrance sensors or license plate readers show parking occupancy. This data is processed by software is then displayed through mobile applications or websites. To be most effective, it should be paired with on-site wayfinding signage to guide drivers upon arrival.

### Example: University of Texas at Arlington Parking Finder<sup>11</sup>

The University of Texas at Arlington, in partnership with Modii, launched a real-time parking finder website to help students, staff, and visitors locate available parking spaces, electric vehicle charging stations, and view lot and garage occupancy levels. At launch, 39 percent of parking areas were equipped with occupancy sensors, with plans to expand coverage to 85 percent within three years. The UTA Parking Finder is currently in its beta phase, with future enhancements anticipated.

Figure 7: University of Texas at Arlington Parking Finder



<sup>11</sup> <https://uta.modii.co/v2/finder>

## Static Signage and Paint

While it's not new technology, static signage is an important tool for creating a predictable and easy-to-understand parking experience. It helps orient drivers, guide navigation, and communicate parking rules and regulations – tailored to the specific needs and context of both on-street and off-street parking. Use of signs and curb paint is also cost effective and less vulnerable to technical problems.

### *Applicable Areas*

Static signage and paint should be implemented for all levels and types of parking: off-street and on-street, from the individual parking lot to the entire neighborhood level.

### *Integration With Other Technology*

Static signage can be integrated with websites, mobile apps, and parking guidance systems to complement real-time updates. Physical infrastructure should be consistent with digital platforms for more effective management. Static maps on websites can also be paired with physical signage.

### *Example: Downtown Parking Action Plan – Wayfinding and Parking Guidance, McKinney, TX<sup>12</sup>*

The City of McKinney's Downtown Parking Management Action Plan focuses on enhancing wayfinding and raising parking awareness to maximize the use of existing assets, improve visitor experience, and support trip planning. The Plan's strategic recommendations include:

- Raise public awareness about available parking options
- Create a unified public brand and wayfinding system
- Refresh and modernize pedestrian wayfinding signage
- Implement a digital parking guidance system
- Connect real-time parking availability data with third-party applications

The City has also developed an online map highlighting public parking locations and has introduced consistent, clearly formatted signage at lots and garages to improve visibility and user navigation.

Figure 8: Downtown McKinney Texas  
Parking Sign



Source: Google Street View

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<sup>12</sup> City of McKinney, Dixon Resources Unlimited & Wood Solutions Group, Parking Action Plan - Wayfinding and Parking Guidance 3–12 (2021). McKinney, Texas.

<https://www.mckinneytexas.org/DocumentCenter/View/26935/2021---McKinney-Parking-Action-Plan>

## Management and Enforcement Technology

The most established set of parking management technology is aimed at enforcing parking rules and managing the use of spaces. This includes technologies such as:

- Smart Payment (Meter) Technology
- Parking Access and Revenue Control Systems
- Automated Valet

These technologies go hand in hand with paid parking but may also focus on efficient use of spaces. They can be supported by input technologies like sensor and license plate recognition, but they may also be self-contained and generate their own data on use from gates, tickets, or payment systems.

## Smart Payment (Meter) Technology

Smart parking meters are internet-connected devices that offer digital payments, real-time updates on availability and meter status, and can support demand-based pricing. Many integrate with enforcement systems to flag violations, and allow users receive alerts and extend sessions via mobile apps or text. Some examples include:

- Single-Space Smart Meters
- Multi-Space Smart Meter (Kiosk/Pay Station)
- Pay by Phone

### *Applicable Areas*

Smart meters can be implemented in any parking context but are most typical for on-street parking citywide or in specific neighborhoods where paid parking is common.

### *Integration With Other Technology*

Smart meters may not need interaction with other parking management technology but there are opportunities. The incorporation of cameras and LPR with smart payment (meters) technology can offer a seamless payment experience by automatically identifying vehicles upon entry and exit, enabling automated billing without the need for physical tickets or manual interactions. Smart meters may also support wayfinding, guidance, and dynamic availability platforms.

### *Example: On-street Smart Parking Enhancements - Downtown Cleveland, OH<sup>13</sup>*

The City of Cleveland has installed new on-street parking pay stations throughout its downtown area as part of its ongoing efforts to improve the overall parking experience for residents and visitors. This initiative includes the removal of single-space coin-operated meters and their replacement with multi-space meters. The new meters allow users to manage multiple parking spaces and offer the convenience of paying with credit cards or cash.

Figure 9: West Seventh District Parking Kiosk  
Fort Worth, Texas



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<sup>13</sup> Next phase of on-street smart parking enhancements begins today in Cleveland's Central Business District | City of Cleveland Ohio. <https://www.clevelandohio.gov/news/next-phase-street-smart-parking-enhancements-begins-today-clevelands-central-business-district>

## Parking Access and Revenue Control Systems

Parking access and revenue control systems<sup>14</sup> (PARCS) combine hardware such as gates, ticket machines, and cameras with software to manage vehicle access to off-street parking. Revenue control typically includes requiring payment upon entry or exit with systems like servers, kiosks, and payment terminals coordinating transactions and gate operations.

### *Applicable Areas*

PARCS are typically implemented at the facility level for off-street parking facilities such as garages and lots.

### *Integration With Other Technology*

PARCS can be self-contained however cameras and license plate recognition technologies can be added to improve enforcement and service. Ideally these could be paired with information technologies to provide parking space availability and wayfinding to drivers.

### *Example: San Francisco Municipal Transportation Agency Parking Access Revenue and Control Systems Project<sup>15,16</sup>*

The San Francisco Municipal Transportation Agency updated PARCS at twenty-two city-owned parking facilities in 2024. These upgrades aim to make parking safer, more efficient, and more user-friendly. Facilities now feature brighter lighting, improved directional signage, audible alerts and enhanced security through surveillance cameras. Automated gate arms and updated payment machines with two-way digital intercoms also contribute to a more streamlined experience. Behind the scenes, a centralized, 24/7 command center and advanced parking management system are now connected to every machine across the network.

Figure 10: SFMTA Parking Garage Access and Revenue Control System



<sup>14</sup> Understanding Parking Access Control Systems. Electronic Lock System | Key Access Control Solution | Vanma. (2023, June 30). <https://www.lockmanage.com/blog/understanding-parking-access-control-systems/>

<sup>15</sup> Johnson, P. (2021, April 26). Safer and easier parking in every city-owned facility. SFMTA. <https://www.sfmta.com/blog/safer-and-easier-parking-every-city-owned-facility>

<sup>16</sup> Parking access revenue control systems. SFMTA. (n.d.). <https://www.sfmta.com/projects/parking-access-revenue-control-systems>

## Automated Valet

Valet parking is a very common manual parking management approach used by private off-street facilities. Advances in robotics and artificial intelligence are increasing future options for efficiently arranging the placement of cars in parking facilities.

### *Applicable Area*

Automated valet parking can be implemented at the facility level for off-street parking such as garages and lots.

### *Integration with Other Technology*

The integration of LPR technology with automated valet systems enables the validation of service usage and streamlines the payment process. Additionally, mobile applications support the efficient management of vehicle drop-off and pick-up, enhancing overall convenience for users.

### *Example: Lyon-Saint Exupéry Airport<sup>17, 18</sup>*

Lyon-Saint Exupéry Airport in France has expanded its use of automated valet parking to improve vehicle flow and enhance the passenger experience. The system is operated by seven autonomous robots and features twenty-eight dedicated cabins for vehicle drop-off and pick-up. Passengers who reserve a parking spot online can simply leave their car in a cabin, where the robot then transports it to the parking area. Upon return, the vehicle is retrieved from the same location. This innovative service offers increased safety, simplicity, and time savings, while also optimizing space by creating up to 50 percent more parking capacity within the same area.

Figure 10: HL Robotics Automated Valet Robot



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<sup>17</sup> Singh, B. K. (2019b, March 15). Stanley deploys valet parking robots at Lyon–Saint-Exupéry Airport. Airport Technology. <https://www.airport-technology.com/news/stanley-deploys-parking-robots/?cf-view>

<sup>18</sup> Chivukula, K. (2020, January 22). Lyon-Saint Exupéry Airport adds more space for Robotic Parking Service. Airport Technology. <https://www.airport-technology.com/news/lyon-airport-robotic-parking-service/?cf-view>