

Design Guide

Parking Solutions



Parking is a valuable asset; even more so when it's being used efficiently. The right intelligence can provide benefits to both operators and drivers.

With a clear understanding on car park usage, operators benefit financially from higher utilisation rates whilst accurate guidance to spaces means drivers get to their destination more quickly, and with less frustration.

Parking solutions don't need to be complex to be useful. Clearview Intelligence's solutions utilise a mix of count equipment, our Insight® Parking application and Variable Message Signs (VMS) to help car park operators get the very best from their facilities. With the right data available, informed action can be taken to:

- Connect users with available parking spaces
- Provide effective user guidance via VMS
- Ensure efficient capacity management
- Minimise time wasted searching for spaces
- Optimise asset performance
- Reduce congestion, fuel wastage and emissions
- Deliver a better driver journey experience

Reduced congestion and quicker space-finding hold benefits for all kinds of operators, from local authorities to hospitals, leisure operators to retail environments and transport hubs to corporate car parks.

Gathering data

Understanding car park utilisation is the basis for maximising the performance of any parking asset. Whether the aim is to increase revenue, maximise usage or provide guidance, it all requires accurate and reliable occupancy information. Obtaining this valuable information can be as simple as counting the vehicles in and out of a car park to determine occupancy and visitors; this is referred to as global counts.

Global counts (in and out counts)

One of the most accurate and cost-effective methods of detecting and counting vehicles is the use of inductive loop technology at car park entrances and exits. The inductive loops are embedded in the ground and connect to a counting device (Insight Count Station/M680). These loop count sites are deployed so they are capable of distinguishing individual lanes as well as vehicles' direction of travel. This is critical to ensuring accurate data where drivers may not adhere to the car park flow.

Inductive loops identify vehicles by detecting changes in the magnetic field caused by vehicles passing overhead. This signal is then analysed by the counting device and converted into a vehicle count. The counting device communicates this vehicle movement data in real-time over the internet via a mobile data or wired ethernet connection to data analysis



software (Insight Parking). Data can be used for real-time and historical analysis or fed through to VMS and mobile phone applications to aid parking guidance.

Inductive loop count sites are a cost-effective option for covering large or small car parks as they are focused only on entrances and exits. The ability to deploy solar powered loop sites with mobile communications also removes the need to provide power and wired communications, eliminating the cost of civils for ducting work.

The global count system can be further enhanced by splitting car parks into logical or physical zones. Car park zoning aids in the analysis and management as well as providing a higher level of granularity for increased guidance.

Zone counts

Zone counts can be achieved by deploying inductive loop count sites at the entrance and exit of zones within a car park or by logically grouping clusters of parking bay sensors. As an example, a car park may have a 'staff' and 'visitor' area or in a multi-storey it could be zoned by floor. The Insight Parking application holds the logic to understand the interaction between zones and car parks and provides the ability to view data in the dashboards and reports at this level.

Providing parking space availability by zone is particularly beneficial when combined with VMS for guidance. This helps steer drivers to the areas with the most available spaces, enabling them to park quicker with minimal frustration. Zone counts also help operators know how parking provision is being used by a specific group of users (visitors, disabled, short stay, long stay, staff) and identify trends or patterns in behaviour of these groups. To get an

even more comprehensive view of this, individual parking bay sensors deliver the greatest level of flexibility and additional usage intelligence.

Individual parking bay counts

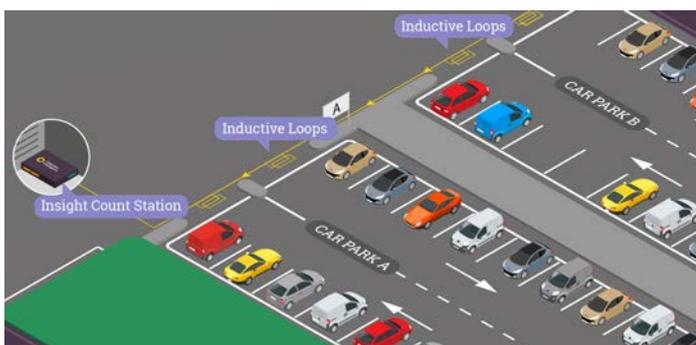
Parking bay sensors provide a high level of intelligence on occupancy and usage for each individual bay. Sensors are embedded in the centre of the parking bay and detect the presence of vehicles above them using a combination of infrared and magnetometer technology to provide the highest levels of accuracy. The sensor wirelessly sends data to an access point that is connected to the internet via a mobile data, or wired ethernet connection into the Insight Parking application.



The wireless network can be extended using battery powered repeaters providing further coverage across a car park. The parking bay sensors are available as an in-ground embedded stud fitted flush to the road surface or surface mounted.

Bay occupancy detection enables the car park to be separated into more specific zones such as disabled, parent and child, or express drop-off areas. As each bay has a sensor, the Insight Parking system can assign them to logical groups within the software to create zones as required. The Insight Parking map view displays the individual bay sensors and their current state of occupied or vacant.

The parking sensors record the vehicle arrival and departure time for each bay they are deployed in. This provides information on how long a bay has been occupied and enables the analysis of dwell times by bay, zone, site and car park through the Insight Parking application.



Key Benefits

- Modular software and hardware solution provides multiple options to meet business needs and budgets
- Scalable architecture provides low cost entry point with ability to grow or large-scale deployments from day one
- Solar based solution with mobile communications reduces infrastructure costs particularly where remote car parks require coverage.

Key Features

- Broad range of detection products to cover global/zone counts and bay level occupancy
- Mains and solar powered solutions
- Mobile and ethernet communication options
- Integrated system providing sensors, VMS and data analysis software

The application also includes the ability to set a maximum stay period on a zone and generate alerts when a vehicle has overstayed. This helps parking officers focus their time by directing them to bays or zones where there are overstayed vehicles that should be subject to enforcement, and thereby increasing revenue opportunities and helping to deter future incursions. This is a far more productive use of their time rather than just doing the rounds hoping to find an offending vehicle.

Bay alerts can also be used to identify potential abuse of parking spaces in environments that have no enforcement. Setting an alert for eight hours can be a good way to identify unwanted behaviour such as staff using visitors' spaces, sports fans using more convenient nearby retail, leisure or office parking or drivers wrongly using a private car park as a base for commuting by rail to other areas.

Technical solution: car park / zone occupancy

Clearview Intelligence provides the Insight Count Station (ICS) and the M680 inductive loop-based products for global and zonal counts. The ICS is designed to provide real-time data over ethernet and the M680 is targeted at mobile communication and solar powered solutions.

Insight Count Station

The ICS is a compact, real-time vehicle counter that utilises our latest inductive loop technology to provide accurate vehicle counts for global and zonal car parks. The combination of ICS and the Insight Parking application ensures an accurate count of vehicle movements; even when users may not adhere to the prescribed routes into and through a car park by using dual-loops, straddling algorithms and Insight Parking's virtual lane system.



The ICS is particularly suited to applications where traffic flow is frequent, and the real-time nature of data is critical to ensure information systems are always up to date. To ensure a reliable flow of data, the ICS comes as standard with Power over Ethernet (PoE) and internal battery backup in the event of mains power failure.

M680 Count and Classifier

The M680 is a traffic count and classification device based on inductive loop technology. Available in a variety of configurations and supporting several additional interface options, the M680 is a versatile platform that supports a vast range of applications including vehicle in/out counts from car parks.



The M680 is the ideal solution for car parks where ethernet or mains power is unavailable. The M680 has an integrated GPRS modem and can operate all year round by harnessing solar power. An optional switch I/O card can be used to take count data from parking barriers or to trigger ANPR cameras when a vehicle is detected.

Technical solution: bay occupancy system

M300 Parking Bay Sensors

The M300 bay occupancy system has been designed to accurately detect the presence of a vehicle in a parking space.



Unlike many occupancy systems that rely on overhead mounting, the M301 surface mounted sensors or M303

in-ground flush mounted sensors wirelessly transmit their detection data in real time. This is done via secure low power radio technology, to a nearby M310 Access Point which feeds the information to Insight Parking for analysis and display. For more complex installations with a larger number of detection locations, or spread over a large area, the M310 Access Point may be supplemented by the use of an M315 Repeater Unit.

Both the M301 surface and M303 flush mounted sensors are packaged in small hardened plastic IP68 rated enclosures. Depending on the application type, they have an operational battery life of five to 10 years.

With more than 98 percent accuracy in occupancy detection, the system yields excellent reliability using dual magnetometer and infra-red detection. The multi-hop communications ensure the integrity of the system information at all times.

Computer Vision Systems

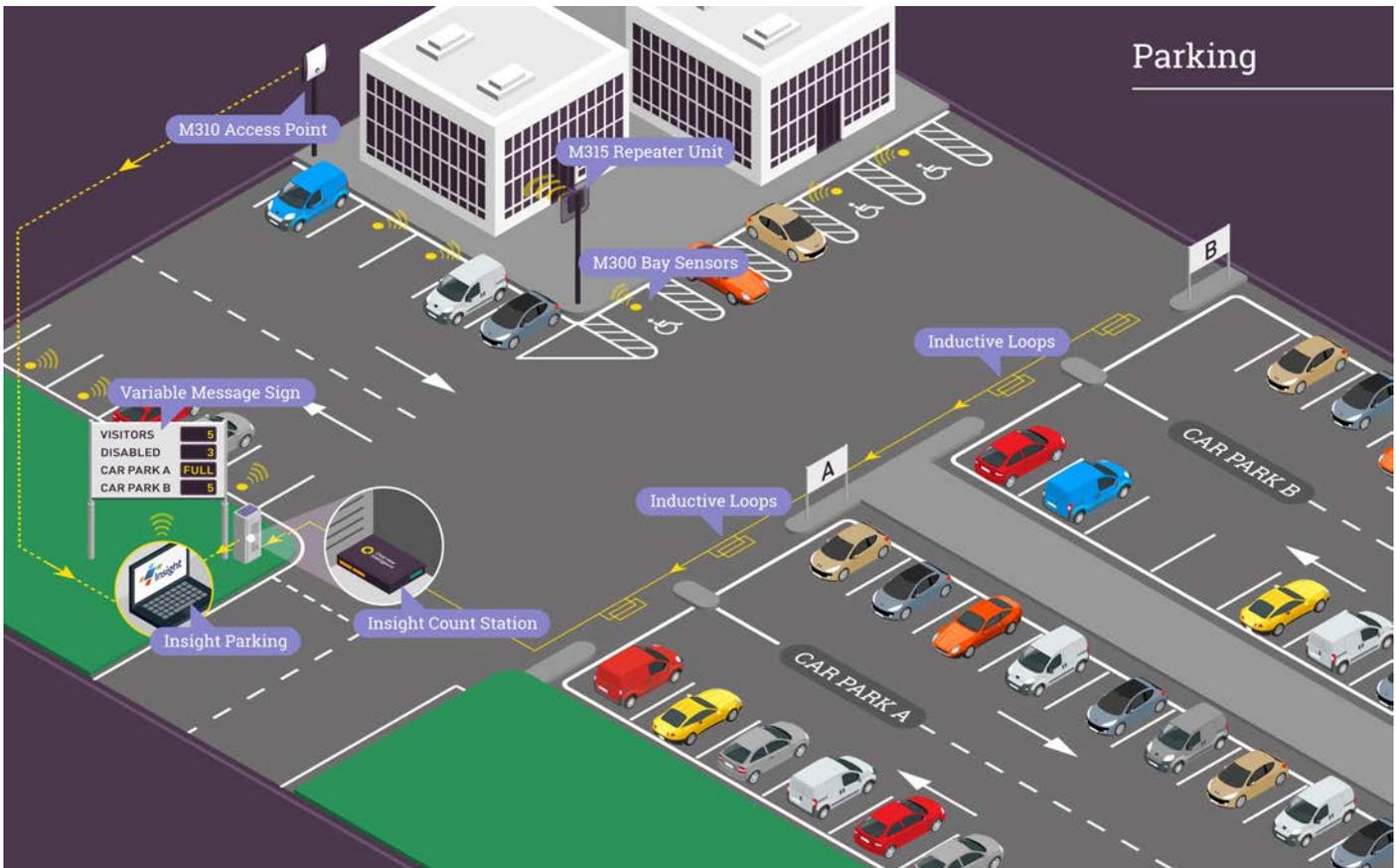
The use of computer vision systems to determine parking bay occupancy is an emerging technology that analyses a video feed. This video feed can be either from existing static video cameras or new cameras deployed where required. The video feed is sent to the Insight Parking application where it is analysed, and the occupancy data is generated.



Computer vision systems are similar to the M300 bay sensor solution in that they can offer occupancy state, arrival and departure times for each bay but currently provide a lower level of accuracy than the M300 solution. They can be a cost-effective solution for gathering additional data on bay usage for analysis when the data is not critical to the car park's operation.

	ICS	M680	M300	Computer vision
Global counts	✓	✓	✓	✓
Zonal counts	✓	✓	✓	✓
Bay occupancy	x	x	✓	✓
Mains powered	✓	✓	✓	✓
Solar powered	x	✓	x	x
Mobile communications	x	✓	✓	x
Ethernet	✓	x	✓	✓
Power over ethernet	✓	x	x	✓
Accuracy	High	High	High	Medium

Parking products in situ



Turning data into intelligence

The technical solutions covered in the previous section provide the means to gather data using different sensor technologies deployed within a car park. To turn this data into actionable intelligence Clearview developed the Insight Parking application.

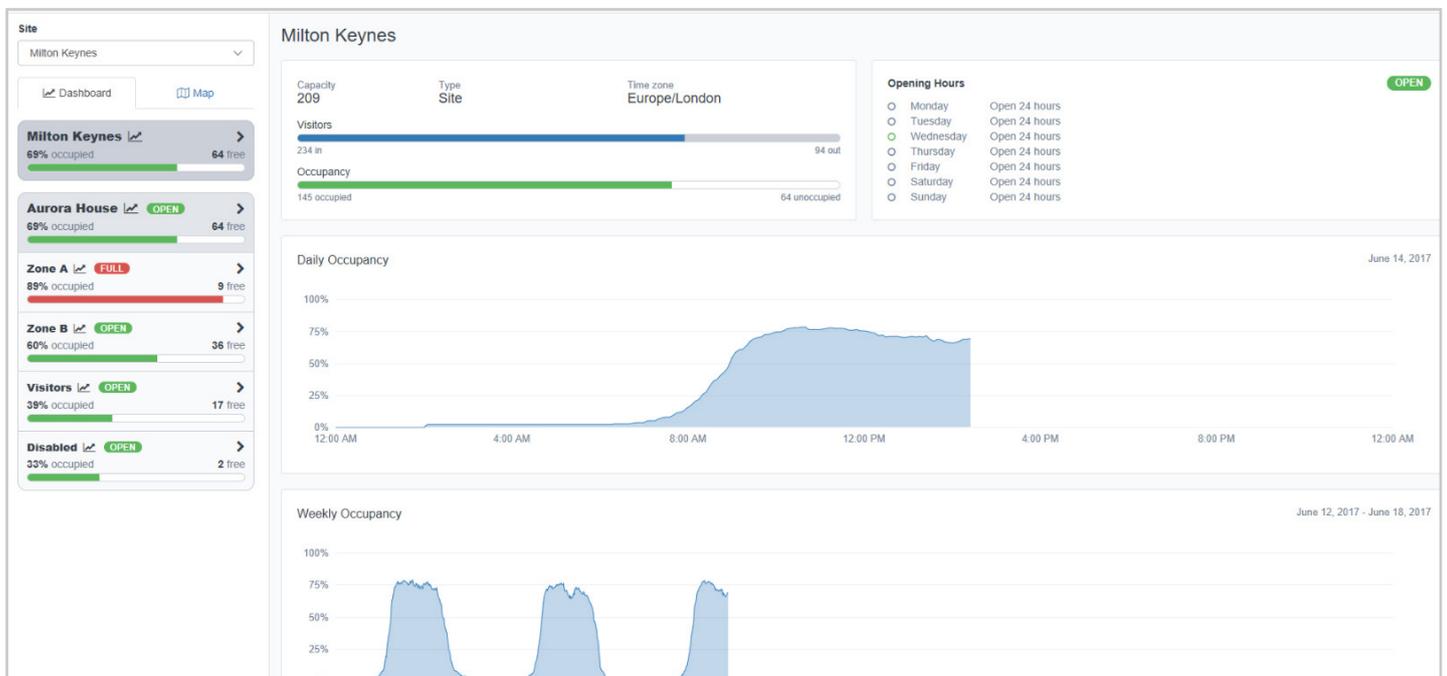
Insight Parking Application

Insight Parking is an integrated software solution designed to simplify the management, monitoring and analysis of parking assets. Combined with a range of sensors and signs, Insight Parking provides a complete solution for all parking operators and environments. A cloud-based application

designed for both mobile and desktop, Insight Parking requires only a modern day web browser and can be accessed on smartphones, laptops, tablets and PCs running Android, iOS, macOS, Linux or Windows.

Real-time occupancy dashboards

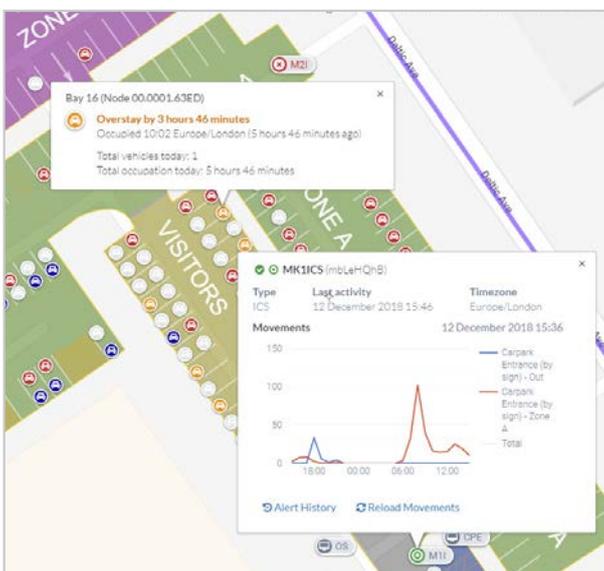
At the heart of Insight Parking are real-time occupancy dashboards providing car park space availability via status bars, occupancy and visitor graphs. All the information needed to monitor parking usage is immediately available, enabling operators to understand utilisation at a glance. In addition to real-time dashboards, the data supports hourly, daily and weekly analysis of car park occupancy.



Integrated maps

The map view in Insight Parking utilises a layer-based system to add and remove features so that only relevant information is viewed by the operator.

- Bay sensor layer: Shows the location of sensors and occupancy data for the current date using colour coded icons depicting the current state (free, occupied, overstay)
- Device layer: Shows the location of loop count sites and their fault status; selecting a loop count state will show vehicle movements at that location for the day
- Overlay: Presents a custom designed scalable image to show the layout of the site including logical zones
- VMS layer: Displays the location of Variable Message Signs and their operational state
- Traffic layer: Displays Google traffic data, useful when analysing if surrounding traffic is impacting parking assets



- Journey Time layer: Used when the optional JT module is selected and displays the route and its traffic flow status (slow, stationary, normal)

The map focuses on the site, car park or zone selected enabling users to quickly drill down to specific areas. The colours of bay sensors, devices and VMS will change to indicate if an alert has been generated providing a location based overview of the car park.

Alerts

Alerts are used to provide instant visual indications of event information and warnings to Insight Parking users (map, notification bar, history) and to subscribed users via e-mail. They come in two forms; fault alerts are used to identify issues with equipment while information alerts are used for areas such as bay overstay and journey times exceeding a threshold. Bay overstay alerts can be e-mailed directly to parking or security officers whereas fault alerts could go to facility managers or car park operators.

To ensure alert information is focussed to the operators who need the information, the Insight Parking application has an extensive permissions system enabling alerts to be received based on location, type of alert and role.

Visibility and permissions

Insight Parking includes a powerful permissions module. In addition to providing secure access can also be used to customise views and accessibility to various aspects of the system's functionality. This is based on users' roles (facilities management, parking officer, senior management) and the locations they are authorised to monitor through the use of visibility permissions.

User roles can be configured to ensure that only the information required for the user to perform their role is presented, simplifying the interface and controlling access to specific

features. Areas such as the ability to override VMS and access to reports are common options set by role.

Visibility is a key aspect when more than one location is being monitored. A parking officer covering Site A will only want visibility and alerts for Site A and does not need the parking status of Site B. The management team may want to see reporting and monitoring for all sites without receiving alerts that are intended for prompting actions by the parking officers in situ.

Insight reporting

Insight Parking includes a set of core reports designed to enable quick and easy access to vital parking management data. A simple interface means in just a few clicks, reports can be generated on screen and exported to Excel in seconds. The Excel exported reports include formatting and formulas, reducing the time spent in making data easily digestible and presentable. The inclusion of exported formulas provide an easy way to further analyse data by automatically re-calculating any changes. This can be extremely powerful when wanting to run what if scenario analysis such as changing the capacity values of car parks to see what impact expansion or loss of spaces would cause.

Reports are available for sites, car parks and zones enabling managers to see performance from the top level and drill down into the detail where required. Access to report data is controlled by the Insight permission and roles module so only users who have permission to access reports can view report data.

Reports such as occupancy and visitors provide day-to-day management information on parking assets utilising global count, zonal and individual bay data from the array of sensor technologies deployed at site. Additional reports such as average stays and overstays take advantage of bay occupancy sensors to provide a level of individual bay usage detail not available with loop-based global or zonal counting.

Key Benefits

- Event driven system ensures key decisions can be made with the latest available information
- Ease of use and roles-based system reduces time spent managing assets and people
- Cloud based solution reduces IT support overhead and provides secure access anytime
- Powerful built in reports allow managers to access intelligence and answer key questions about parking asset use swiftly and easily

Key Features

- Real-time application providing occupancy information for car parks and bays
- Powerful roles and permissions system provides a tailored interface to a user's role and restricts access where required
- Cloud based web application designed for mobile first enables parking and security staff to view their site remotely and in real-time
- Comprehensive set of web reports provide instant access to important data and the option to export to Excel for further analysis

Using intelligence to influence driver behaviour

The ability to inform drivers at key decision points on the availability of parking spaces is critical to maximising parking assets. Variable Messaging Signs (VMS) provide clear direction to all drivers on where they should navigate to for a parking space. Mobile applications can provide additional features to improve the parking experience with accurate and reliable data, key to their adoption.

Variable Messaging Signs (Parking Guidance)

The ability to feed space availability data and information to VMS provides several benefits for both the operator and customer:

- Reduce the time and congestion caused by drivers looking for spaces by providing clear direction on availability and location
- Maximise use of parking capacity by encouraging drivers to enter car parks that may look full from the roadside but in fact have spaces
- Provide a better experience for customers by reducing the stress of finding a parking space

For large or complicated car parks, multiple VMS can be deployed to immediately direct the driver to free spaces. On approach, the VMS displays the count for the car park as a whole, which empowers a driver to make an informed decision whether to enter or not. Once in the car park, additional VMS can be deployed to guide the driver to the different zones based on available spaces, thus reducing the congestion and stress caused by trying to find available parking spaces.

Clearview Intelligence delivers an integrated VMS solution providing both the sign and management interface as part of the Insight Parking application. Each sign is custom made for

the intended use with ethernet and mobile communications available as options. The majority of new deployments utilise full matrix displays. These provide a degree of flexibility to adapt to changes on site or future expansion plans by being able to change display templates rather than using fixed metalwork. A combination of both is also possible.

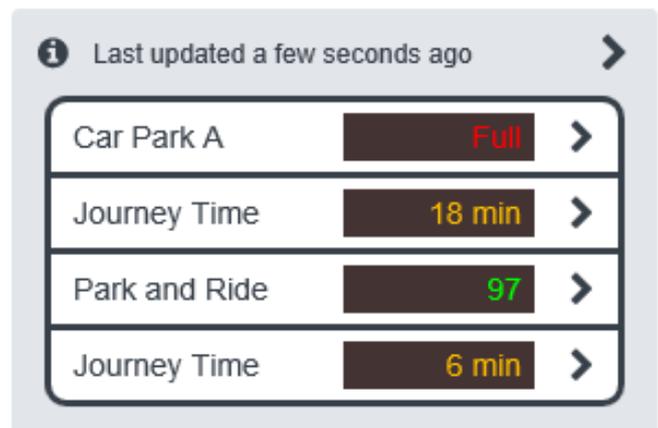
The Insight Parking VMS module provides the ability to feed static and dynamic data to VMS located at the roadside or within the car park. The sign's interface provides a live view of the display and provides confidence for the operator that what they see is being displayed. Support for traditional LED displays and modern full-matrix signs is provided. Additional configuration options are available to enable the sign to display automated messages when the car park is full or closed.

Journey Time module

The Insight data management platform comprises three applications; Insight Count and Classify, Insight Parking and Insight Journey Time. All three applications share a common set of features which enables the modules to complement each other for specific solutions.

The Insight Journey Time application provides the average speed and duration between two locations on a route. This journey time is derived from mobile phone and satellite navigation data, removing the need to install roadside infrastructure.

Using this data, it can be combined with occupancy data to show the time it would take to travel to a car park, alongside the number of spaces available on a VMS. The VMS can be positioned on the outskirts of a town to encourage drivers to maximise their use of Park and Ride facilities rather than contribute to the congestion and environmental impact of driving into the centre of town when spaces are at a premium.



The journey time module also includes an alert mechanism that can be configured to indicate an increase in journey times. This can be useful for monitoring the main routes around large car parks where congestion can cause queuing traffic to block car park exits. Providing route journey times on exit VMS enables drivers to make informed choices on alternative routes, avoiding congestion and relieving the pressure on the car parks and the local road network.

Third party systems and mobile applications

Sharing data with other systems is easily achieved using the Insight API module. The API module can either push event



driven data out or data can be retrieved on request. An online documentation system enables developers to not just view calls and responses, but also to test the API in their browser. Data is delivered in the industry standard formats of XML and JSON in a simple and clear structure for integration with an external system (website, business intelligence application, mobile phone application, etc.). The API module enables quick and cost-effective integration by providing the ability for developers to test online and use open standard data formats.

A solution for all

As an independent technology provider for parking we operate across multiple sectors and multiple parking operators. We know that access to clear intelligence around a car park's usage brings many benefits to operators, customers and business owners alike. Anyone running a parking operation can benefit from the insight and intelligence our solutions can provide.



Key Benefits

- Clear and accurate parking guidance reduces time spent looking for parking spaces
- Integrated system enables operators to manually override VMS to respond to situations
- Journey Time information can be used to influence drivers to reduce congestion and environmental impact
- Simple and intuitive API using open standards reduces the cost of integration with third party systems

Key Features

- Full-matrix VMS with mobile or ethernet communications
- Dynamic and manual operation of VMS with communications monitoring and alerts
- Optional Journey Time module integrates with VMS
- Application Program Interfaces for quick and easy integration with third party systems such as mobile applications