

# Appendix H

## Smarter Mobility



**Straitéis Iompair na Gaillimhe**  
**Galway Transport Strategy**

## **Appendix H**

### **Smarter Mobility**

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# H1 Introduction

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Galway City Council (GCC) intends to adopt a number of Smarter Mobility policies which will in turn produce a series of Smarter Mobility projects. Each of these policies and projects is in keeping with the overall objectives of the Galway Transport Strategy.

Smarter Mobility can be described as the way intelligent transport services are changing the way cities move. Intelligent Transport Solutions (ITS) use intelligent technology to increase efficiency, safety and coordination across a transport network.

GCC have progressed the adoption of Smarter Mobility and Intelligent Transport Solutions, which is demonstrated through the construction and commissioning of GCC's Urban Transport Management Centre (UTMC). The UTMC provides the hub for urban traffic control in the city together with the recently introduced Parking Guidance System (PGS), Variable Message Signs (VMS), CCTV and fault monitoring system.

Smarter Mobility policies and ITS will be used to underpin the infrastructural alterations proposed and to implement and add value to the operation of the transport network in order to maximise efficiency and ensure the optimum performance of the entire network.

Through expansion and operation of the UTMC, smarter travel policies will be implemented and projects developed. By leveraging the assets at the disposal of GCC, the UTMC can become the hub for the integration of all modes to provide efficiency of movement and provide a cost effective location to deliver mobility services.

Smarter mobility projects delivered through the UTMC can be broadly categorised in three groups: projects which provide additional capacity to the transportation network; projects which incorporate demand management; or projects which utilise intelligent systems to deliver overall efficiency and cost savings. Projects can of course fall under more than one category and deliver multiple benefits.

Additional capacity can be gained through the efficient use of the network by reducing delay on the network for all users and giving greater ease of movement to the most appropriate mode at different locations.

Demand management describes projects which in some form limit movement for particular modes and encourage the use of the appropriate mode for the purpose of the trip. Demand management measures would include instances of reducing the road capacity for private vehicles in order to provide additional capacity and reduced delay for bus services which would in turn through modal shift, increase the overall network capacity. Projects which include enforcement of policies outlined would also be considered as demand management measures.

Projects involving intelligent systems utilise current and future technologies in order to deliver services in a better manner. Over their lifetime these systems will

deliver the intended service at a lower cost and a higher level of service. Cost savings can be made through streamlining of delivery, reduced power consumption and encouraging modal shift.

## H2 Galway Transport Strategy Principles

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A key issue addressed by the Smarter Mobility component of the overall GTS is achieving the overall goals and objectives for transport within the Galway Metropolitan Area and environs. The high level principles for the strategy set out the goals to which all policies and projects identified must contribute. These seven principles are:

1. To promote and encourage sustainable transport, and in particular to make it convenient and attractive to walk, cycle or use public transport;
2. To improve accessibility and permeability to and within the city centre for pedestrians, cyclists and public transport users, while also maintaining an appropriate level of access for vehicular traffic for commercial and retail purposes;
3. To maximise the safety and security of pedestrians, cyclists and other transport users, particularly within the core city centre;
4. To manage and increase transport capacity, where necessary, for the efficient movement of people and goods into and within the city;
5. To provide opportunities to enhance the city centre Public Realm through traffic management and transport interventions;
6. To maintain and develop transport infrastructure and services to a high degree of quality and resilience;
7. To adopt a 'smarter technology' approach to all transport interventions, whereby transport infrastructure and services are future-proofed.

## H3 Smarter Mobility Policies

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In order for the GTS to succeed in implementing the above principles throughout the transport networks, Smarter Mobility must play an important role. A number of Smarter Mobility policies which meet some or all of the principles were identified, as follows:

- **SM Policy 1:** Ensure that Galway City's transport network shall be safe, usable and equitable to all road users.
- **SM Policy 2:** Ensure that Galway City's transport system is resilient and adaptable to future trends.
- **SM Policy 3:** Capitalise on investment made to date in Galway's transportation network and systems.
- **SM Policy 4:** Encourage the economic viability of Galway through ease of movement to and around the city.

- **SM Policy 5:** Maximise the efficiency of the existing transport infrastructure in Galway.
- **SM Policy 6:** Reduce the environmental impact created by transportation.
- **SM Policy 7:** Increase the capacity of Galway's transportation network.
- **SM Policy 8:** Remove unnecessary car trips to Galway City Centre.
- **SM Policy 9:** Increase the mode share of sustainable transport across the network.
- **SM Policy 10:** Focus on Galway City Centre as a destination, not a route.
- **SM Policy 11:** Improve the operational efficiency of necessary car movements.
- **SM Policy 12:** Enable users of the transportation network to make informed decisions on journey choice.
- **SM Policy 13:** Ensure Galway City Centre is an enjoyable and vibrant place to live, work and visit.
- **SM Policy 14:** Assist Galway in adopting the principles of "Mobility as a Service".

## H4 Smarter Mobility Projects

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The overall objectives of the GTS and the Smarter Mobility policies identified provide the targets which any and all future Smarter Mobility projects should aim to achieve. A list of projects which meet the criteria of multiple smarter mobility policies, which in turn meet multiple objectives of the GTS, have been identified and listed below. These are further detailed in following sections 4.1 to 4.18. The policies which each project meets are presented in Figure 1.

- **SM Project 1:** Creation of a bus network with a high level of service.
- **SM Project 2:** Restriction on Salmon Weir Bridge for private motorised traffic.
- **SM Project 3:** Removal of private cars from inner city areas.
- **SM Project 4:** Maintenance, expansion, integration and operation of GCC's Urban Traffic Management Centre (UTMC).
- **SM Project 5:** Provision of an integrated ticketing / universal method of payment across all modes.
- **SM Project 6:** Creation and operation of a smart parking system for motorised vehicles in Galway.
- **SM Project 7:** Creation of a smart street lighting system for Galway.
- **SM Project 8:** Provision of an integrated way-finding system for all modes.
- **SM Project 9:** Reviews of each traffic signal junction to ensure correct layout, configuration and operation is in place.

- **SM Project 10:** Creation of smart priority routes for pedestrians and cyclists.
- **SM Project 11:** Provision of smart parking facilities for cyclists.
- **SM Project 12:** Provision of smart coach parking in or near the city centre.
- **SM Project 13:** Provision of a "Last Mile" taxi service for public transport users.
- **SM Project 14:** Provision of a zone based, variable pricing structure for public transport.
- **SM Project 15:** Examination of demand-based variable pricing for parking.
- **SM Project 16:** Encouragement of and provision for electric vehicle usage.
- **SM Project 17:** Enforcement of red light running.
- **SM Project 18:** Verification that all proposals are future-proofed for Cooperative ITS.

Smarter Mobility Policies	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Smarter Mobility Projects	Safe, usable and sustainable transport network for all	Resilient and adaptable to future modes	Capitalise on investment	Encourage economic vitality	Efficient use of existing infrastructure	Reduce environmental impact	Increase capacity of network	Remove unnecessary car trips to City Centre	Increase share of sustainable modes	City Centre is a destination, not a route	Increase efficiency of necessary car movements	Direct users to make informed decisions	Ensure City Centre is an enjoyable and vibrant place	Adopt the principles of "Mobility as a Service"
Bus Network With a High Level of Service	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Salmon Weir Bridge PT only	✓		✓	✓		✓	✓	✓	✓	✓			✓	✓
Remove cars from inner city cordon	✓			✓				✓	✓	✓			✓	✓
Expand GCC UTMC	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
Universal method of payment across all modes	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓
Smart parking system		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Smart Street Lighting System		✓	✓			✓							✓	
Integrated way-finding system for all modes	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Preview traffic signal junctions	✓		✓	✓	✓	✓	✓				✓		✓	
Smart Priority Routes for Pedestrians and Cyclists	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	
Smart Parking facilities for Cyclists	✓	✓	✓	✓	✓	✓			✓			✓	✓	
Smart City Centro Coach Parking	✓			✓				✓	✓	✓			✓	
"Last Mile" taxi service for bus users	✓	✓		✓	✓			✓	✓	✓			✓	✓
Zone based variable pricing structure for PT	✓	✓			✓		✓	✓	✓			✓		✓
Demand based variable pricing for parking	✓	✓		✓	✓	✓	✓				✓	✓		✓
Electric Vehicle Usage	✓	✓				✓				✓		✓	✓	✓
Future proof for Co-Operative ITS	✓	✓			✓	✓					✓	✓	✓	✓

Figure 1 Smarter Mobility Projects and Policies

## H4.1 Creation of a bus network with a high level of service

As discussed in the main GTS report, Galway's future travel demands and ambitions to achieve a higher modal share for sustainable transport will require a public transport network with a high level of service (HLOS). In order to successfully implement this HLOS, both infrastructural and ITS measures will be required to ensure bus priority across the network.

The primary ITS tool to provide bus priority measures shall be GCC's Urban Transport Management Centre (GCC UTMC). GCC operate a SPOT/UTOPIA traffic management system across the junction network of the city. SPOT/UTOPIA was initially developed in Turin, Italy as a public transport priority control system and was later developed and expanded into a fully adaptive Urban Traffic Control (UTC) system. This places GCC in a strong position to implement bus priority measures at intersections without the necessity of

infrastructural works. It should be noted however that a combination of bus priority traffic control and bus priority infrastructural measures (e.g. dedicated bus lanes) will provide the highest level of service for the proposed bus services.

SPOT/UTOPIA operates as a centrally controlled system which is distributed locally. This means that while each traffic signal junction operates in communication with the central system, it has the capability to make local decisions (e.g. green time for each stage) at junction level. Junctions must operate within the central strategy and operate on a corridor by corridor basis, with the capability to alter stage times or even sequences locally to ensure optimum efficiency for the network.

GCC's UTM system has the potential to integrate traffic signal control with a bus automatic vehicle location (AVL) system and real-time information. With the integration of local bus service AVL data and timetables into the UTC system, each individual junction can detect scheduled bus services approaching. By comparing this bus service against the scheduled timetable, the individual junction's SPOT unit can identify if this service is ahead of, on time or behind time and can adjust the traffic signals accordingly, i.e. should a bus service be behind its scheduled time, the traffic signals can extend the green time on a particular stage to ensure there is the minimum amount of delay to this service, however should the bus service be on time, no additional weighting factors need to be applied to take account of the bus. This system has the benefit of giving maximum priority to bus services when required, while also ensuring the buses run to defined timetables thereby providing surety and consistency to passengers.

ITS will also be used in the absence of sufficient space for dedicated bus priority infrastructure. An example of how this can be provided is the use of bus-gating at Devon Park/Lower Salthill Road. In this instance, where bus lanes cannot be provided downstream of a junction due to spatial constraints, traffic signals can be used to 'gate' or hold back traffic thus providing downstream capacity on the network, ensuring the bus service does not encounter high levels of congestion and hence delay after passing through that junction.

ITS systems can be used to enhance the customer experience for bus passengers and act as a catalyst to encourage modal shift. Current real time passenger information (RTPI) should be expanded to cover the entire city bus network, which in combination with the integration of bus priority into the GCC UTM system can ensure more accurate and predictable journey times. Bus Éireann currently provide a wi-fi service on city routes, however the customer experience could be enhanced by the provision of wi-fi at each bus stop location also. The dissemination of information to bus passengers via the UTM system will expand customer confidence in the bus service provided and encourage a larger modal shift to public transport. These measures, combined with other related ITS solutions, will enhance and improve the public transport offering and induce the modal shift necessary to protect Galway City's transport network and ensure a network capable of servicing future demand.



## **H4.2 Restriction on Salmon Weir Bridge for private motorised traffic**

The restriction of Salmon Weir to allow public transport vehicles and cyclists only to use this crossing will ensure the benefits outlined in the main GTS report, but only if the proposed restrictions are respected by motorists. Control of the use of the bridge can be enforced by the implementation of either physical restriction (e.g. barrier controlled) or remote monitoring and enforcement. Regardless of the method, ITS can play a vital role in this enforcement.

In the case of a physical barrier being installed, there are suitable ITS solutions in barrier control which can be implemented. These include automatic number plate recognition (ANPR) programmes which can read a vehicle's number plate, and should it match an existing database of pre-approved number plates, the barrier permits the vehicle to pass through. This same solution can be implemented through a radio-frequency identification (RFID) tag contained within the vehicle which is detected by the barrier's operating system and opens the barrier automatically. These systems are restricted on the basis that public transport vehicles must be pre-approved either by providing a number plate or by being issued a tag. While this would operate effectively for city service buses like Bus Éireann and City Direct, it would not prove to be an efficient system for irregular bus services e.g. weekly private buses for students or tourist coaches. In addition, as taxis are permitted to use the Salmon Weir Bridge as part of the public transport system, this would also require each individual taxi to be pre-approved.

An alternative to a physical restriction on the bridge could be provided through closed circuit television (CCTV) monitoring. This involves the monitoring of every vehicle crossing the bridge, and where non-public transport vehicles are recorded passing through the restricted area, fines are issued to the vehicle owners through identification of vehicle registration. This type of system currently operates on the M50 at the barrier-free-tolling station.

## **H4.3 Removal of private cars from inner city areas**

ITS can play a major role in the removal of private cars along the proposed Cross-City Link. Through traffic signalling, way-finding, parking guidance, real time information and enforcement, ITS solutions can be deployed to ensure the maximum success and operability of the proposed network.

Traffic signalling strategies must be utilised to ensure the Inner City Access Network as set out in the GTS report operates in an efficient manner for all road users. Configuration and stage timing will be vital to ensure the proposed measures are successful. Primarily junctions along the Inner City Access Network must be co-ordinated to ensure maximum efficiency for traffic circumnavigating the city centre, while still permitting public transport vehicles unrestricted access to the city centre road network.

The restrictions on private vehicles entering the city centre must be supplemented with prominent and effective way-finding information for motorists. Variable Message Signs (VMS) can be utilised to provide real time information for

motorists, particularly in situations whereby restrictions are applied on a time basis.

Parking Guidance, a system whose first phase is currently being implemented by GCC, will provide a vital tool in the movement of private vehicles around Galway City. There are a large number of car parks located along or close to the proposed Inner City Access Network and associated links. Directing motorists to available parking spaces by providing real time information on available spaces will remove some unnecessary trips on the road network and help to reduce congestion within the city. This information can also result in a dispersal of trips across a longer time period, i.e. motorists stagger trip times in order to avoid saturated periods for parking.

Restrictions on private cars on the inner city road network must be enforced in order for the proposals to prove effective. ITS can provide an efficient enforcement tool. Whether through CCTV to monitor the restricted areas, ANPR to record vehicles breaking the cordon or tags to identify vehicles permitted to enter the restricted zones, ITS can provide solutions to enforce the proposals contained in the GTS and ensure the successful operation of the road network.

#### **H4.4 Maintenance, expansion, integration and operation of GCC's Urban Traffic Management Centre (UTMC)**

GCC's Urban Transport Management Centre (UTMC) has been in existence since 2011. It currently operates the following systems and sub-systems:

- Urban Traffic Control (UTC);
- Fibre Optic and Radio Communications Network;
- CCTV;
- Parking Guidance System;
- Variable Message Signage;
- Fault Monitoring System; and
- Asset Management System;

The system built by GCC has the capability to expand and integrate additional sub-systems including:

- Real Time Bus Priority System;
- Journey Time Monitoring System; and
- Environmental Monitoring System.

Each of these systems and sub-systems is integrated into a front-end interface called OMNIA.

The Urban Traffic Management Centre operates an Urban Traffic Control (UTC) system called SPOT / Utopia in which there are currently 28 traffic signal

controllers connected to the central system. The first of these was connected to the system in 2012.

These junctions operate on a fully adaptive basis, allowing the system to make decisions at the local (junction) level while maintaining operation within the central system strategies. A communications network consisting of a dedicated fibre optic network and a licenced radio frequency is in place allowing the UTM to communicate effectively with equipment on the road network. This communication allows information to travel out to traffic signal controllers, e.g. event strategies, while also allowing information to be sent back to the control room, e.g. traffic signal faults.

The UTC system is supported by a Closed Circuit Television (CCTV) system which allows monitoring of the road network from the UTM. There are currently 32 CCTV cameras erected at key locations across the road network, the majority of which are at key intersections. This CCTV system allows operators within the UTM to monitor, assess, intervene and report on the UTC system and other sub-systems as necessary.

A Parking Guidance System (PGS) has been procured by GCC and it is currently in the process of construction and configuration. This PGS shall provide real time information on the number of available parking spaces at 14 car parks in Galway City, both publicly and privately owned. Extension of the PGS to incorporate further car-parks shall be possible.

Variable Message Signs (VMS) have been erected in Galway City in recent years. These messages provide the capability of display programmed messages in any desired order. The signs have a full matrix which permit free text and symbols to be displayed. The signs require integration with the UTM in order to permit them to display automatic real time information including parking guidance, journey time, congestion conditions etc. VMS are a valuable tool to permit operators located in the UTM disseminate information to the public and can help alleviate congestion, inform mode choice, inform route choice and provide warning messages of hazards or incidents.

The fault monitoring system provides information to GCC on the current operating status of roadside equipment on the network. If and when faults occur with equipment, these are identified at the front end interface within the UTM. Operators can identify faults, prioritise repairs and manage maintenance of ITS equipment. The ability to respond quickly to potential safety issues with equipment, e.g. lamp failures at traffic signals, provides a more efficient and safer road network.

GCC's Asset Management System (AMS) is a digital database of ITS equipment owned and operated by the council. This system permits the integration of fault monitoring and maintenance, and provides operators with the necessary tools to manage and operate all ITS equipment at GCC's disposal.

Through upgrade and expansion of the UTM, Galway City Council can further development of freight management proposals, including diversion routes, restrictions on specific roads, freight route wayfinding and other potential options

such as the establishment of freight distribution hubs and associated low-emission sub-delivery vehicles, permitted to route within the core city centre area.

### **Recommended Projects**

While a significant amount of very good work has been achieved to date in the delivery of a UTMC for Galway, expansion of the coverage of the system is required in order to effectively manage transportation. As discussed, currently 28 traffic signal controllers are connected to the UTC system. There are approximately 12 relatively major traffic signal controlled junctions in Galway City which are not connected to the UTC system. Additionally there are approximately 60 pedestrian crossing signal locations throughout the City which would benefit from connection to the UTMC, the majority of which would benefit from a fault monitoring basis and others integrating into corridors for the co-ordinated control of signals.

Galway City has a number of large unsignalised roundabout junctions remaining across the road network, which currently act as a barrier to the movement of pedestrians and cyclists. It is envisaged that these roundabouts (including but not limited to Blake, Athy, Deane, Browne, Skerritt, Joyce, and Kirwan Roundabouts) shall be removed in the future and replaced with traffic signal controlled junctions. The integration of all new traffic signal controlled junctions into the Galway UTMC shall be vital for the effective management of traffic and movement within the city and environs. A potential opportunity exists for the expansion of the Galway UTMC to incorporate traffic signals within the environs of Galway City, e.g. in Baile Chláir, Bearna, Oranmore or Maigh Cuilinn. These locations all experience congestion at peak times and the inclusion of these locations into an overall strategic control system could allow for better, more efficient management of these locations in the long term.

The expansion of the sub-systems currently operating within the UTMC to include bus priority integration, journey time monitoring and environmental monitoring will provide added value to the existing systems while simultaneously enhancing the transport network for users. Should bus providers' Automatic Vehicle Location (AVL) systems be integrated into the UTC system, SPOT/Utopia can assign weighted, selective or absolute priority to specific vehicles (e.g. buses running behind schedule) without penalising other traffic. This, combined with the dissemination of information from CCTV, journey time monitors etc. to the public via multiple platforms, will increase the modal share of bus passengers and reduce journey times for all vehicles by creating a more balanced network in saturated conditions.

## **H4.5 Provision of integrated ticketing / a universal method of payment across all modes**

Across the transport network of public and private transport there are numerous potential charges and ticketing required. These include but are not limited to:

- Bus Éireann tickets;
- City Direct tickets;

- Commuter Bus tickets (e.g. Citylink);
- Iarnród Éireann tickets;
- Taxi fares;
- Public and private parking charges / pay-and-display tickets;
- Bike Share charges; and
- Electric Vehicle Charge Points.

The Galway transport network as a whole would benefit from a fully integrated ticket/universal method of payment system for all modes of transport. Importantly, this project would encourage modal shift away from the private car by providing the capability to use a single card or “mobile wallet” to pay for an entire end-to-end journey. With a system which would permit a universal method of payment, possibly similar to an expansion of the Leap Card system currently operated by the National Transport Authority, households and individuals may be encouraged to reduce car ownership levels.

The delivery of a fully integrated ticketing system for Galway would provide the added benefit of making Galway synonymous with public transport and identifying the city as a leader of ITS solutions. If such a system were to be successfully implemented in Galway, this could form a template for expanding the system to other cities in Ireland.

#### **H4.6 Creation and operation of a smart parking system for motorised vehicles in Galway**

GCC’s implementation of a Parking Guidance System, which is currently under construction, is a welcome addition to the ITS offering within Galway City. This system has the potential to expand into a world class system incorporating additional elements of smart parking. The Parking Guidance System in combination with a universal method of payment discussed in the previous section will form the foundation of an overall parking strategy. Dynamic charging, which is discussed in Section 4.H4.15, could also form part of this strategy.

A smart parking project is recommended involving the co-ordination of parking guidance, universal method of payment, and dynamic demand based charging, with a review of all parking policies including but not limited to:

- A reduction in on-street parking provision allowing road space to be utilised for other modes.
- Provision of off-road residential parking;
- Reduced parking requirements/maximum permitted levels of parking for new developments;
- Encouraging high turnover of parking in commercial developments.

The delivery of ITS solutions and parking policy revisions and enforcement would allow Galway to embrace sustainable transport policies and encourage

modal shift while simultaneously providing a smarter usage of private vehicle parking throughout the city.

## **H4.7 Creation of a smart street lighting system for Galway**

As an urban area, Galway City is largely covered by street lighting. Many of these street lights are aging, and the majority of lanterns are either SOX or SON variety (low and high pressure sodium lamps respectively).

A project to create a smart lighting system for Galway would provide benefits under the following headings:

- Direct Energy Savings;
- Maintenance Savings;
- Asset Management; and
- Road Safety.

The first step in completing a smart lighting system would be the completion of an asset inventory for the city, identifying the location, number, type, lux and energy consumption of all street lighting lanterns.

Based on criteria such as road type, usage, and remaining lifespan, the street lighting network should be quantified and assessed and recommendations on upgrading of existing facilities made. The retrofitting of SOX and SON lanterns with LED lighting could have positive benefits for the network. LED street lights offer benefits including dimming, colour render, energy efficiency and light control.

A smart lighting system could include for a communication link between the Galway UTMC and the street lighting network for the purpose of fault monitoring, asset management and variable light control.

## **H4.8 Provision of an integrated way-finding system for all modes**

Proposals to dramatically alter the transport network of Galway City present both challenges and opportunities for way-finding in Galway. Restrictions on certain modes using particular routes, alterations to directions of travel permitted on some roads and alterations to the public transport services could result in short-term confusion for regular travellers to and around Galway and longer term issues for infrequent visitors to the city.

The implementation of an integrated way-finding system for all modes across the city would alleviate confusion and form a long term solution to way-finding across the entire network, and would contribute to specific elements such as freight management, for example.

This project must involve an integrated solution for all modes and include the dissemination of way-finding information via static and dynamic means.

Static signage for motorists, public transport users, cyclists and pedestrians will form the permanent structure of way-finding in Galway. Strategic routes for all modes must be identified in a co-ordinated, coherent and logical manner and these routes clearly demonstrated to road users by mode.

Static way-finding should be supported by dynamic way-finding, applicable by mode. Dynamic way-finding can be provided by a variety of means including variable message signs, multi mobile way-finding app, provision of wi-fi connectivity at way-finding station locations and journey-time information by mode at strategic locations such as bus stops or bike stations.

#### **H4.9      Reviews of each traffic signal junction to ensure correct layout, configuration and operation is in place**

Galway City's road and junction network has developed and evolved over many years. Transport demand is relatively fluid and patterns have altered, even in recent years. Each alteration to the road network results in a shift of movement patterns across the network and as a result many junctions which were designed and configured for a particular transport pattern may no longer be optimally configured for current and future transport demands.

With the gathering of new data and the availability of new tools to analyse transport demand, a project assessing and analysing the layout and configuration of every signalised junction in the study area is recommended to ensure that the maximum benefit is being realised from current infrastructure.

This project can be completed using the Galway Regional Transport Model, developed by the National Transport Authority, to assess demand as a first step. Using an iterative process of examining and improving each junction layout to better reflect actual demand, the optimum layout and configuration of each junction can be identified in the context of the overall road network, allowing local interventions to junctions which will benefit the overall network.

Any alterations identified as being beneficial can be implemented on site, whether in the traffic signal controller or at UTM level.

#### **H4.10      Creation of smart priority routes for pedestrians and cyclists**

Investment in smart priority routes has generally been concentrated on vehicular routes with the provision of "green waves" for the tidal flow of vehicles. In order to encourage modal shift to walking and cycling, in particular in the city centre area, priority at conflict points which see high demand for multiple modes can be redistributed more heavily in favour of the sustainable modes of transport. This can create smart priority routes for pedestrians and cyclists, utilising Intelligent Transport Systems.

Priority Corridors which are capable of adapting and reacting to demands and conditions can be established where a tidal demand is evident. Examples of this could include priority corridors creating green waves for pedestrians or cyclists.



Alternatively, in areas of non-tidal movement with large numbers of pedestrians, waiting times at junction can be reduced in order to reduce pedestrian delay. Furthermore, these priority areas can be configured to be reactive to external factors including weather e.g. in rainy conditions further reductions to pedestrian waiting times could be implemented through the installation of environmental monitors and integration of these into the UTMC.

#### **H4.11 Provision of smart parking facilities for cyclists**

GCC have developed a parking guidance system for vehicles which is currently being implemented. Using the systems which have been developed to date and with the introduction of sensors on defined bicycle parking stands, data gathered on bicycle parking space occupancy can be disseminated to the public via multiple platforms e.g. over a dedicated app, over the Galway City Council website or via the dedicated parking guidance variable message signs, in a similar fashion to the current Bike Share Scheme in the City.

This project will provide real time information to cyclists on the availability of parking spaces in the city, giving cyclists confidence that bicycle parking spaces will be available at their destination prior to beginning the journey and thus encouraging more journeys to be carried out by bicycle.

#### **H4.12 Provision of smart coach parking in or near the city centre**

Galway is a popular destination for tourists, both national and international. Many tour companies currently include Galway City as a destination, however indications from the industry suggest that tourist group arrivals in Galway are currently restricted due to factors including delay as a result of congestion and a lack of dedicated, regulated coach parking spaces in the city centre. GCC, in conjunction with the NTA, have in recent times provided coach parking spaces along Merchants Road and a temporary coach parking area at Galway Harbour.

Proposals to restrict private vehicles from accessing the Cross-City Link and associated areas within the city centre, combined with a modal shift to sustainable forms of transport, will encourage coaches to access the city centre and aid in the promotion of Galway as a desirable tourist destination.

In order to facilitate a high volume of tourist coaches, and potentially commuter coaches, set-down and pick up areas in the city centre will be required, along with coach parking waiting areas which are easily accessible from the city centre. Due to the lack of available space for set-down and pick-up areas in the core of the city centre, ITS solutions can be deployed in order to maximise the efficient use of these spaces.

A major improvement for the operation of coach services accessing the city will include ensuring that any set-down and pick-up areas have a high turnover of coaches using them, i.e. coaches are not parking in these spaces longer than is necessary to load or unload passengers. ITS parking systems are capable of monitoring usage of coach set-down and pick-up areas, and informing coach operators as to the real-time availability of set-down areas. Providing an online



system which could allow coach operators to reserve set-down or pick up areas in advance for short durations would encourage the high turnover necessary. This system would assist in the enforcement on the use of coach set-down areas. The provision of longer stay coach parking outside of the city centre will be necessary in order for this solution to be adopted by coach operators and tour groups.

#### **H4.13 Provision of a "Last Mile" taxi service for public transport users**

The key element of large scale transit around Galway City is proposed as a bus network with a high level of service (HLOS). In order to provide a high frequency, direct bus network, it was not possible to provide routes in very close proximity to all residential areas. It is estimated that over 70% of Galway City residential and commercial properties will be within a ten minute walk of a bus stop served by a HLOS route. While this is an improvement on the current figures of 43% of residential properties and 54% of commercial premises, and will be attractive to many users, this distance to and from a bus stop will be viewed as a barrier to movement by some residents. When adverse conditions, for example heavy wind or rain, are present, many people will choose transport in a private vehicle over public transport if the proximity of the bus stop is not attractive.

A potential solution to improve the mode share of the proposed bus services is the provision of a 'Last Mile' taxi service. This service would involve on-demand transport, to and from bus stops within a certain range (e.g. 1 mile or 1.5 km). To make this an efficient proposition, these services could be a communal service (i.e. multiple passengers sharing the vehicle). The service would greatly supplement the proposed bus network, allowing the main bus routes to operate with high frequency on direct routes, while simultaneously increasing the accessibility to these routes for everybody.

There are a number of factors which would require co-operation between many bodies, both public and private, in order to achieve this goal. Regulation of the operation of taxis would need to be altered. Fixed fares for this type of trip would have to be agreed. Operators of the services must be consulted and agreement on the boundaries where this service would operate must be defined based on potential demand. As integrated travel is an objective of GCC, service providers would require payment options in-vehicle in the style of the Leap card (or similar adopted by GCC). As demand-responsive services emerge and the technology develops further, Galway City Council will explore the potential for integration within the city transport network.

#### **H4.14 Provision of a zone-based variable pricing structure for public transport**

The city bus services currently operational in Galway City have a fixed fare structure, irrespective of distance being travelled (i.e. the fare to travel on a city bus for only one stop is the same as the fare to travel an entire route end-to-end).

A zone-based, variable pricing structure could encourage higher usage of public transport, particularly for shorter journeys.

The proposed city bus network is based on the central concept of radial routes. Developing orbital zones around the city centre would provide a structure in which variable pricing could be implemented.

It is anticipated that a variable pricing structure (on the basis that the highest fare remains in line with current pricing) will not result in a significant additional increase in journey to and from the outer zones; however, it may provide a substantial increase in journeys undertaken within single zones or across one zone only, maximising passenger numbers and therefore resulting in a more economically sustainable public transport system.

The implementation of the zone-based variable pricing structure would require ITS based solutions, in particular for ticket sales and cash-free transactions. To accurately monitor and enforce a zone-based fare structure, tag on/off terminals should be provided at bus stop locations and/or on board buses.

#### **H4.15 Examination of demand-based variable pricing for parking**

Parking in Galway City, both publicly and privately owned, is currently charged on a fixed price structure regardless of travel or parking demand. This is currently either a per-hour charge or a fixed daily charge.

As an alternative to this, parking charges could adopt a demand-based variable pricing structure. Parking fares would be highest at peak demand periods for both the road network and parking spaces, in order to encourage higher turnover and to discourage private vehicle trips into the city centre at peak times, resulting in less unnecessary congestion.

Conversely, when parking demand is low, reduced parking charges could be implemented, which could induce usage (based on short duration occupancy) providing an economic boost to the City Centre. This would encourage a higher degree of trip planning by motorists and should result in a more even distribution of trips across the day and week, providing a more economical use of the transportation network.

Activation thresholds for varying prices would be identified by a combination of real-time usage of parking spaces, identified via GCC's parking guidance system and traffic volumes on the road network, identified via the UTC system. Information on parking charges can be disseminated via multiple platforms including GCC's VMS/PGS, a parking app, dedicated VMS located at car park entrances and a dedicated web-page with real-time information on parking availability and pricing. Over a short period of time, a profile of parking usage and charging would be developed which could allow for accurate prediction of parking availability and pricing allowing users to plan journeys based on accurate information.

#### **H4.16 Encouragement of and providing for electric vehicle usage**

Electric vehicles (EV) do not currently represent a high percentage of vehicle types in Galway, however as technology improves, particularly in relation to

range and charge times, and the cost of oil increases, it is reasonable to expect that electric vehicle usage will significantly increase in the medium term. Galway City, due to its urban nature and relatively compact size, would benefit from an increase in electric vehicle usage, particularly in relation to air quality in the city.

Galway City can encourage the usage of electric vehicles by providing infrastructure to support EVs, while also providing preferential benefits for EV drivers.

Charging points and methods remain a significant barrier to EV usage for many motorists. Providing easily accessible charge points in the city with free or reduced parking for EVs would encourage an uptake in EV usage. Galway City can place itself to the forefront in relation to electric vehicles by becoming an early adopter of new technology for EV charging. It is envisaged that inductive charging of electric vehicles will become viable in the near future and this technology has the potential to be incorporated into urban roads.

There is also a potential for use of restricted road space by EVs e.g. bus lanes or the Cross-City Link. This suggestion would require legislative change and could only be a relatively short term proposal in order to induce the demand for electric vehicles. Should the proportion of EVs increase significantly, this incentive could be reduced, as reserved road space for public transport would be required to achieve and maintain the public transport mode share anticipated.

#### **H4.17 Enforcement of red light running**

Automated systems which monitor traffic signals and detect and record incidents of red light running have been established in other cities, and are currently in use at Luas crossings in Dublin.

Using an integrated system of CCTV, the traffic signal controller, and detectors, motorists breaking a red light are recorded and identified. A background system provides the data to An Garda Síochána enabling the motorist to be located and fined.

The installation of red light monitoring has been reported to reduce the number and severity of accidents at junctions. This can have a significant effect on pedestrian and cyclist usage at junctions. Improvement to safety at junctions for vulnerable road users can increase the share of these modes in localised areas. Red light running monitors installed at locations where there is a high desire for pedestrian or cyclist movement or at locations where red light running is frequent will provide safety improvements for all users and potentially increase the participation in sustainable transport.

#### **H4.18 Verification that all proposals are future-proofed for Co-operative ITS**

Co-operative ITS (C-ITS) describes the process of vehicles having the ability to communicate with other vehicles and also with road infrastructure. Cooperative ITS will improve existing services for motorists, will provide new services and will result in significant benefits and safety for road users.

C-ITS standards and systems are being developed by a number of organisations including the European Telecommunications Standards Institute (ETSI).

In order to ensure that Galway City reaps the benefit of future developments in C-ITS, any ITS systems that are implemented by GCC and/or other stakeholders should ensure that these systems are future-proofed for C-ITS. This can be achieved by remaining informed of current and potential standards and systems and ensuring that any ITS equipment and systems procured operate with open protocols, allowing future communication with C-ITS enabled vehicles.