1.0 Introduction

The purpose of this document is to describe the requirements of toll plaza infrastructure to support toll collection at the currently planned plaza locations and requirements of facilities to support both toll collection and Mersey Gate Bridge management. However, the review starts with the feasibility of the proposed technologies and its impact on the geometric designs described in the Phase 1 Memo.

- Section 2 - Location of toll plazas
- Section 3 - Facilities
- Section 4 - Location of Facilities
- Section 5 - Local and Central facility Access
- Section 6 - Signage
- Section 7 - Ground and In-ground Equipment and Infrastructure
- Section 8 - Overhead Equipment and Infrastructure
- Section 9 - Enforcement
- Section 10 - Architectural Perspective

Each topic area (as applicable) is reviewed in relation to the three tolling configuration options:

- Conventional toll plaza with manual toll collection (MTC) and Electronic Toll Collection (ETC) lanes (referred to as “mixed use” tolling or “conventional plaza” in this document).
- Open road tolling with lay-by plaza.
- Open road tolling (free flow).
2.0 LOCATION OF TOLL PLAZAS

The section examines the location of the planned toll plazas by tolling configuration, their alignment with regard to infrastructure considerations and proposed amendments to the base design to accommodate new tolling configuration. This section follows on from Phase 1 and further describes/analyses the need for alignment and its impact on access to the central/local facilities.

2.1 MAINLINE PLAZAS

2.1.1 Mixed use tolling

The current plaza location reference design, which is for mixed use tolling, allows for a staggered design for the Ditton east and west bound mainline plazas, with each plaza located at the widest part of the two lane highway.

For mixed use tolling, this planned staggered design is adequate. Aligning the mainline plazas at a suitable location would however offer a number of benefits including:

- Reduced plaza capital costs if infrastructure is shared between the two traffic directions.
- Option of using the outside lane (lane closest to central reservation) direction as a reversible lane during peak times.
- Single facility for tolling staff vs. two administration facilities reducing the on-going costs over the life of the scheme.

2.1.2 Open road tolling with lay-by plaza

The open road tolling with lay-by plaza option would require the construction of, at a minimum, a four to six lane lay-by branching from the two lane highway, requiring land to be available to build the lay-bys to the south of the current west bound plaza and to the north of the east bound plaza. This is the most expensive tolling build and operational option.

In this scenario, the open road section infrastructure consisting of gantries housing ETC antennae and image capture cameras would be aligned with the lay-by plaza toll booths and vehicle identification capture points. It is not necessary to align the lay-by plazas in each direction although if this is preferred, land will need to be available to build on from the area presently to the north and south of the highway.

As above, aligning the two set of plazas will offer certain benefits.
2.1.3 Open road tolling

With this option, there is no requirement for toll plazas. However, the equipment required for charging vehicles will be installed on overhead gantries. There are two ways of constructing the required infrastructure to support the necessary equipment. First method is to construct a gantry traversing both highway directions and access to the gantry will only be provided from the nearside lanes from either direction. Second method is to construct a gantry for each direction of travel without any interconnectivity between the two gantries.

<table>
<thead>
<tr>
<th>Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Gantry across both direction</td>
<td>• Easy access and maintenance from the nearside of highway.</td>
<td>• Damage to one foundation base will affect opposite direction.</td>
</tr>
<tr>
<td></td>
<td>• Easier access for ducting across the gantry. No underground ducting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>required at site. Late designs can be accommodate within this design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>without impacting the ground works.</td>
<td></td>
</tr>
<tr>
<td>Separate Gantry across each direction</td>
<td>• Easier for deployment in the field.</td>
<td>• More costly than single continuous structure.</td>
</tr>
<tr>
<td></td>
<td>• Not allowance for changes in design that may require crossing across the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>highways.</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Gantry Types

2.2 Ditton On/ Off Ramps

2.2.1 Mixed use tolling

The current plaza location reference design, which is for mixed use tolling, allows for a staggered design for the Ditton on/ off ramp plazas. This design is acceptable as it stands. There are no areas of cost savings since the ramps are not adjacent to one another and are separated by embankments and main highway to the bridge (running parallel to the ramps).

2.2.2 Open road tolling with lay-by plaza

The open road tolling with lay-by plaza option would require the construction of a two to three lane lay-by and one lane for dedicated open road tolling. Review of the current reference design scheme shows that additional land needs to be made available to build the lay-bys to the south of the current west bound plaza and to the north of the east bound plaza. The number of lanes required for the lay-by will depend solely on the need for attended lanes.

Due to additional land consumption for use in lay-by tolling and no net cost savings of sharing of facilities between plazas, the most feasible solution for this site would be to leave the toll plaza in mixed use tolling with a future deployment for a dedicated ETC lane without any barriers.
2.2.3 Open road tolling

Overhead gantries will be required for fixing the equipment required for charging the tolls. The most suitable proposal for this site is to have to separate gantries with underground ducting between the sites with a shared roadside cabinet.

No alignment of gantries is possible due to the location of the ramps with the embankment separating the two.

2.3 WIDNES LOOP PLAZAS

2.3.1 Mixed use tolling

The current plaza location reference design, which is for mixed use tolling, allows for a staggered design for the Widnes Loop Toll north and south bound plazas.

For mixed use tolling, this planned staggered design should be aligned providing a number of benefits including:

- Single facility for tolling staff vs. two administration facilities reducing the on-going costs over the life of the scheme
- Option of using the outside lane (dependent on alignment) in each direction as a reversible lane during peak times.

2.3.2 Open road tolling with lay-by plaza

This would be the same as the Ditton on/off ramps.

Due to additional land consumption for use in lay-by tolling and no net cost savings of sharing of facilities between plazas, the most feasible solution for this site would be to leave the toll plaza in mixed use tolling with a future deployment for a dedicated ETC lane without any barriers.

2.3.3 Open road tolling

Overhead gantries will be required for fixing the equipment required for charging the tolls. The most suitable proposal for this site is to have to one continuous gantry with shared underground ducting and roadside cabinet between the sites. The alignment of the gantries at this site could possibly introduce some cost savings.

2.4 SILVER JUBILEE PLAZAS

2.4.1 Mixed use tolling

The current plaza location base design, which is for mixed use tolling, allows for a staggered design for the Silver Jubilee north and south bound plazas.

For mixed use tolling, this planned staggered design is acceptable since there is a grade separation between the two traffic directions.

If the grade separation can be avoided and facility sharing between the plazas in both directions can be introduced then it is beneficial to investigate moving of one or both of the plazas for horizontal alignment. The primary benefit from the alignment would be facility sharing and ease of access to sites from either the Widnes or Runcorn without having to cross the Silver Jubilee Bridge.

2.4.2 Open road tolling with lay-by plaza

This would be the same as the Ditton on/off ramps.

It is not feasible to construct lay-by plazas or toll lanes at the SJ plaza site due to the elevated nature of the site and the limited space available around the current plaza site. It is best to keep these plazas similar to the Ditton on/off ramp and start with mixed use tolling with a future deployment for a dedicated ETC lane without any barriers.
2.4.3 Open road tolling

Similar to the other plaza locations, overhead gantries will be required for fixing the equipment required for charging the tolls. The most suitable proposal for this site is to have one continuous gantry and a roadside cabinet for each travelling direction.

If the grade separation between the travelling directions can be addressed then there is a possibility of aligning the gantries. The alignment of the gantries at this site could possibly introduce some cost savings.
3.0 FACILITIES

The sizing of all types of facilities (administration or customer service centres, personal, and maintenance) will depend mainly on the number of staff simultaneously required onsite. Other factors affecting the design of the facilities include servicing a visitor centre, number of visitors, maintenance capabilities, equipment storage and vehicle storage. The types of facilities required at each plaza will depend on the requirements of the operation. The purpose of the table below is to help establish the functional requirements at each toll plaza and the central facility to cover the minimum level of operations required for the Mersey Gateway toll system.

<table>
<thead>
<tr>
<th>Location</th>
<th>Administration¹</th>
<th>Customer Service</th>
<th>Personal Amenities²</th>
<th>Security</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Facility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ditton Main Plaza WB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ditton Main Plaza EB</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widnes Loop Toll NB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widnes Loop Toll SB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ditton Off Ramp WB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ditton On Ramp EB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver Jubilee SB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver Jubilee NB</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Functional Needs at Each Toll Plaza Location

3.1 ADMINISTRATION FACILITIES

There are two types of administration facilities required for the toll system, especially when it has attended toll collection at the toll plazas. The two types are local plaza administration facility and central administration facility. The local administration facility is primarily required for toll staff shift deposits and reconciliation, local monitoring of the plazas and housing of local IT and computer equipment. The central administration facility is generally used for the oversight and management of the toll operations, financial management of the toll operation, daily operations of the toll collection at the toll plazas and housing all the central and local computer systems for the toll operations. The central administration facility, also known as the toll operation central facility or central facility is the intelligence centre of any toll operations.

¹ Administration at the toll plazas include all the end of shift deposits performed by the toll plaza staff. This will not be needed if it is an ORT operation.
² Personal amenities will not be needed if it is an ORT operation.
Local administration facility should provide sufficient space for:
- Server and systems room,
- cash counting and vault room, and
- Workspace for duty supervisor

Central administration facility should allocate separate spaces for:
- staff offices,
- meeting room,
- cash counting and vault room,
- control and monitoring room,
- material and equipment storage rooms,
- servers and systems room,
- UPS room,
- generator room,
- restrooms,
- changing facilities,
- kitchen,
- cafeteria/ mess room, and
- secluded or quiet area.

In addition to the above, consideration should be made for space to accommodate a visitor/information centre open to the public for general information about the area and toll operations.

Entrance to the spaces identified above should have open or restricted access depending on the staff and all movements to the restricted areas should be monitored or supervised. The entrance to the building should also be access controlled to monitor movements and this can be done using proximity cards or by security personnel.

The space requirements for the administration facility will wholly depend on the number of staff at the plaza and administration required to monitor and manage them. Initial staff estimates are provided in Section 3.6.

### 3.2 CUSTOMER SERVICE FACILITIES

A customer service facility would only be required if the toll operator introduced non-cash tolls such as ETC. The customer service facilities would be required to set up accounts, recharge accounts, reconcile account issues, close accounts and process account statements and payments related to the accounts.

To determine if a small or large customer service facility is required depends on two primary items such as the market penetration of the tags and number of cash paying customers to recharge
Customer service facilities should at a minimum include a customer service stations (similar to a bank teller), management and administration offices, private meeting rooms for discussions with customers, waiting area for the customers, vault for deposits, security, restrooms and kitchen facilities. Depending on the remote location of the facility, consideration should be given to providing an ATM and food vending machine. The design of the customer service area should consider a physical separation between customer service staff dealing with monetary funds and the customers to provide added security to the customer service staff. Those customers requiring further discussions with the customer service staff can be directed to the meeting rooms which should be outside the secure partitioned areas.

It is customary to collocate the customer service facilities with the general administration facilities of the toll operations. This helps minimise the duplication of services and facilities. However, entrance to the administration facility should be kept separate to that required for the areas accessible by the public. Initial staff estimates are provided in Section 3.6.

### 3.3 PERSONAL AMENITIES

Personal amenities comprise of restrooms, showers, changing rooms, lockers and kitchens to cater for attended toll plaza operation. At a minimum, restrooms, lockers and kitchens should be provided to the toll plaza staff. Depending on the operational set up for Mersey Gateway, the minimum requirements can be provided at each of the toll plazas and a complete package of personal services provided at the toll operations central facility.

Personal amenities identified above are for use by the toll operations staff and are not intended for use by the public. Consideration should be given to building public amenities such as restrooms at the toll operations central facility if customer services are provided at that site.

### 3.4 SECURITY FACILITIES

Security services should be provided at locations where there is a large exchange of cash transactions. Security services can be employed through the toll operator or contracted out to an external agency. Security is especially important for those sites that are remote and do not have a high volume of traffic especially in the evenings and night.

The above would be in addition to CCTV surveillance and any other measure taken by the toll operator to provide secure environment to their staff. Initial staff estimates are provided in Section 3.6.

### 3.5 MAINTENANCE FACILITIES

The maintenance facilities could be integrated to the administration building or next to it. The building would need to have enough space to support the maintenance activities: storage of equipment and material, covered parking for maintenance buildings (Emergency vehicle warehouse) including storage space for repairing vehicles and the repair equipment, personal amenities (restrooms, shower, changing rooms, lockers, quiet room mess – these could be shared with the administrative staff, depending on location). There would be a need for supporting activities (energy, telecommunication, water and gas storage, meeting rooms etc to be also provided if deemed required.

Initial staff estimates are provided in Section 3.6.
3.6 STAFFING NEEDS PER STAFF CATEGORY

Assumptions:

- Standard 40 hours week for all employees
- Management work hours are 9am to 5pm and 5 days a week
- Customer service work are 9am to 5pm and 7 days a week
- Customer service staff to process all violations and penalty notifications and customer queries
- Customer service and toll operations based on 10% ETC market penetration
- Shift work and 24/7 operation for bridge monitoring and maintenance; toll collection, supervision and maintenance and IT staff
- Contracted services for security, cleaning and possibly building maintenance
<table>
<thead>
<tr>
<th>Staff Type</th>
<th>Subcategory / Description</th>
<th>9 a.m. - 5 p.m. 5 days / week</th>
<th>9 a.m. - 5 p.m. 7 days / week</th>
<th>24 hrs/7 days (Assuming 3 shifts / day)</th>
<th>Possible Positions</th>
<th>Staff Requirements Estimates based on hours per week &amp; 40 hr/person/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>Directors / Managers</td>
<td>x</td>
<td></td>
<td></td>
<td>General Manager, Financial Manager, Facilities Manager</td>
<td>3 (no sick/holiday coverage)</td>
</tr>
<tr>
<td></td>
<td>Line Managers</td>
<td>(x)</td>
<td></td>
<td></td>
<td>Toll Operations Manager, Bridge Operations Manager, Maintenance Manager</td>
<td>3 (no sick/holiday coverage)</td>
</tr>
<tr>
<td></td>
<td>Supervisors</td>
<td></td>
<td>x</td>
<td>Toll Staff Supervisor x 3 shifts</td>
<td></td>
<td>5 + 1</td>
</tr>
<tr>
<td>Administration</td>
<td>Customer Service</td>
<td>x</td>
<td></td>
<td></td>
<td>2 Customer Service x 1 shift</td>
<td>3+1</td>
</tr>
<tr>
<td></td>
<td>IT support for administration</td>
<td></td>
<td>x</td>
<td></td>
<td>IT Manager [IT support (outsourcing is possible)]</td>
<td>1 Manager (assume 9 to 5 w/no sick/holiday coverage) &amp; 5 IT Support (24/7)</td>
</tr>
<tr>
<td></td>
<td>Toll attendance personnel (attended lanes only)</td>
<td></td>
<td></td>
<td></td>
<td>Toll Collection x 3 shifts (Depends on the number of MTC lanes open per location) – Assume 4 lanes at mainline, 2 lanes at ramps, 2 lanes at loops, 2 lanes at SJ Bridge</td>
<td>17 + 1</td>
</tr>
<tr>
<td></td>
<td>Bridge Control Room Operators</td>
<td></td>
<td></td>
<td></td>
<td>Bridge Monitoring x 3 shifts</td>
<td>9 + 1</td>
</tr>
<tr>
<td></td>
<td>Pickup and drop off service to satellite plaza locations</td>
<td></td>
<td></td>
<td></td>
<td>Transport Service Drivers</td>
<td>Contract = 5 required</td>
</tr>
<tr>
<td>Building Maintenance</td>
<td>All building and facilities - Amenities, common rooms, offices cleaning, minor repairs,</td>
<td></td>
<td></td>
<td></td>
<td>Cleaning and maintenance of building (contract work possible)</td>
<td>Contract = 2 +1 required</td>
</tr>
<tr>
<td>Bridge Emergency and Maintenance</td>
<td>Bridge emergency attendance and breakdown recovery</td>
<td></td>
<td></td>
<td></td>
<td>Maintenance vehicle driver &amp; Bridge Maintenance Workers</td>
<td>for 24/7 coverage = 5 (on call possible for fewer staff)</td>
</tr>
<tr>
<td></td>
<td>Bridge maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toll Emergency and Maintenance</td>
<td>Toll Plaza Emergency attendance</td>
<td></td>
<td></td>
<td></td>
<td>Emergency vehicle driver &amp; Toll Maintenance Workers</td>
<td>for 24/7 coverage = 5 (on call possible for fewer staff)</td>
</tr>
<tr>
<td></td>
<td>HGV escort</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recovery at plazas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Staff Requirements
### 3.7 FACILITY SPACE REQUIREMENTS

Typical space requirements have been listed below from experience at other central facilities used for toll operations and bridge monitoring and management.

**Local Facility:**

<table>
<thead>
<tr>
<th>Room</th>
<th>Minimum Floor Space Allocation (sq. m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server and systems Room</td>
<td>25</td>
</tr>
<tr>
<td>Cash Counting And Vault Room</td>
<td>15</td>
</tr>
<tr>
<td>Workspace for duty supervisor</td>
<td>8</td>
</tr>
<tr>
<td>Restrooms (minimum of 2)</td>
<td>10 x 2 = 20</td>
</tr>
<tr>
<td>Kitchen</td>
<td>10</td>
</tr>
<tr>
<td>UPS room</td>
<td>10</td>
</tr>
<tr>
<td>Generator room(^3)</td>
<td>20</td>
</tr>
</tbody>
</table>

**Central Facility:**

<table>
<thead>
<tr>
<th>Room</th>
<th>Minimum Floor Space Allocation (sq. m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff Offices</td>
<td>13.9 sq m per manager; 11.6 sq m per supervisor and IT staff; total for 167 for managers and 116 for supervisors and IT staff</td>
</tr>
<tr>
<td>Customer service staff station</td>
<td>8 sq m per station; total 24</td>
</tr>
<tr>
<td>Entrance and reception</td>
<td>45</td>
</tr>
<tr>
<td>Meeting Room (minimum of 3)</td>
<td>30 x 3 = 90</td>
</tr>
<tr>
<td>Cash Counting And Vault Room</td>
<td>100</td>
</tr>
<tr>
<td>Control And Monitoring Room</td>
<td>80</td>
</tr>
<tr>
<td>Material And Equipment Storage Rooms</td>
<td>See maintenance below</td>
</tr>
<tr>
<td>Servers, Systems and Communications Room</td>
<td>100</td>
</tr>
<tr>
<td>UPS Room</td>
<td>50</td>
</tr>
<tr>
<td>Generator Room</td>
<td>75</td>
</tr>
<tr>
<td>Restrooms (public and staff)</td>
<td>100</td>
</tr>
<tr>
<td>Changing Facilities (minimum of 2)</td>
<td>20 x 2 = 40</td>
</tr>
<tr>
<td>Kitchen</td>
<td>30</td>
</tr>
</tbody>
</table>

\(^3\) This need will depend on operations practice.
<table>
<thead>
<tr>
<th>Central Facility:</th>
<th>Minimum Floor Space Allocation (sq. m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cafeteria/ Mess Room</td>
<td>30</td>
</tr>
<tr>
<td>Secluded or Quiet Area</td>
<td>25</td>
</tr>
<tr>
<td>Copier/Supply Room</td>
<td>10</td>
</tr>
<tr>
<td>Janitorial Storage</td>
<td>5</td>
</tr>
<tr>
<td>Maintenance&lt;sup&gt;4&lt;/sup&gt;</td>
<td>200</td>
</tr>
<tr>
<td>Loading Area</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 4 Facilities Space Requirements

<sup>4</sup> It depends on the services provided by the local employees and the services that are contracted to third-party.
4.0 LOCATION OF FACILITIES

As described in the previous section, the locations of the toll facilities will largely depend on the needs at each site. This section identifies possible locations of the toll operations central facility and required local facilities to support the toll operations.

Operationally, it is unclear whether it would be acceptable to have either:

- one central facility and no supporting local facility at each toll plaza; or
- one central facility and a supporting local facility at each toll plaza; or
- one central facility and collocation of supporting local facilities depending on the geometrics of the site.

For the benefit of this review, we have considered the provision of one central facility and collocation of supporting local facilities where possible. Collocation of local plaza facilities seems possible at:

- the Widnes Loop plazas due to the land availability and minor vertical grade separation;
- the Silver Jubilee ramp plazas due to space constraints and is reasonable to have a shared facility between the two plazas; and
- the Ditton mainline plazas due to proximity to the recommended central facility (collocated local facilities within central facility)

Ditton ramp plazas do not lend itself to sharing of a local facility due to the geographic location and geometry of the roadway. These two locations will require a local facility for each plaza.

See Figure 1 for proposed locations.
4.1 TOLL OPERATIONS CENTRAL FACILITY

Toll operations central facility, also called as central facility are required for managing the various toll processes and operations for the Mersey Gateway including as described above administration and customer service, personal amenities, and maintenance. These facilities can also be utilised for the monitoring, management and maintenance of the Mersey Gateway Bridge. The factors listed below should be considered further to determine the most suitable location for the central facility:

- Land availability
- Operational requirements
- Accessibility from both sides of the Mersey Gateway and Silver Jubilee Bridges
- Staffing requirements and shift patterns
- Internal building space
- Security of location
- Ease of access to the buildings
- Availability of existing buildings that can be refurbished/expanded to house desired central facility
- Cost/benefits analysis

Initially, three locations can be considered for the central facility including north side of Ditton mainline plaza, south side of Ditton mainline plaza and east side of the Silver Jubilee plaza. It is understood that the land adjacent to the Ditton mainline plaza, currently a golf course, is available for use. See table and figure below summarising the advantages and disadvantages for each location and identifying the proposed locations respectively.
<table>
<thead>
<tr>
<th>Central Facility Location</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>North side of Ditton Mainline</td>
<td>• New building – can design and size for specific operational needs.</td>
<td>• Furthest distance from all the plazas if this was to be used as the reconciliation centre point for all toll locations.</td>
</tr>
<tr>
<td></td>
<td>• Larger land space</td>
<td>• Cannot be accessed westbound without payment of tolls.</td>
</tr>
<tr>
<td></td>
<td>• Expansion space available for future uses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• New building can be accommodated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Can be accessed from the eastbound slip road from A562 Speke Road without toll charges.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• May be more convenient to access than east side of the Silver Jubilee plaza location.</td>
<td></td>
</tr>
<tr>
<td>South side of Ditton Mainline</td>
<td>• Same as north side mainline.</td>
<td>• Same as north side mainline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less land space available than the north side of Ditton Mainline.</td>
</tr>
<tr>
<td>East side of Silver Jubilee Plaza</td>
<td>• Use of existing building so may reduce capital costs.</td>
<td>• May not be cost effective if external structural changes are required to meet operational needs.</td>
</tr>
<tr>
<td></td>
<td>• Conversion of existing building for use as central facility.</td>
<td>• May not be convenient for travelling public on Mersey Gateway and A562 Speke Road.</td>
</tr>
</tbody>
</table>

Table 5: Central facility Location
Due to the land space available on the north side of the mainline, accessibility from A562 and the future possibility for expansion and above review, we recommend that the central facility be located on the north side of the Ditton mainline plaza.

Alternatively, if other operational arrangements can be considered for local administration and remote customer service locations, due consideration should be made to downsize the central facility on the north side of Ditton mainline plaza and construct a limited customers service facility at the south side of Mersey Gateway and local facilities as identified in Figure 1.
4.2 PARKING FACILITIES

4.2.1 Parking for toll collection/operations staff

Based on the discussion above, if the local facilities of the mainline plaza are collocated with the central facility then parking for the toll staff at the mainline should be integrated with the parking for the central facility. Assuming that there will be some car sharing and two lanes in each direction dedicated to ETC operation, at least six parking spaces are needed to service the staff in each mainline direction. For ease of accessibility, these parking spaces should be designed to be as close to the mainline plaza as possible.

At the ramp, loop and Silver Jubilee Bridge plazas, assuming that there will be car sharing and one lane in dedicated ETC operation, at least three parking spaces for the toll staff are required at each of the non-mainline sites to service each direction.

The parking requirements for the central facility will depend on accepted operational structure for the toll operations. Based on the estimated staff numbers for the central facility, a minimum of twenty-five parking spaces will be required for the central facility. This takes into account that some are daytime employees and others are shift or contract employees. It should be noted that parking spaces for the public has not been accounted for.

The minimum size of each parking bay should be 6 metres long and 2.4 metres wide. A height restriction can be applied if required.

4.2.2 Parking for Maintenance

Depending on the toll configuration, there may be a need to park vehicles at the plaza or tolling point to conduct inspection of equipment and infrastructure. At a minimum, the maintenance crew should be given accessibility to the toll location or toll plaza from an adjacent site where they can park their vehicle and safely walk over to the site.

In the event that there is no conventional toll plaza but ORT with gantries, there may be challenges to inspect and/or maintain the infrastructure and equipment due to the highway speeds of the vehicles. See Section 5.2.1.1 for vehicular access for parking requirements for ORT locations.

Maintenance will be provided at the central facility so there will be a need to park vehicles in the central facility parking. Provision should be made to separate the parking area required for maintenance vehicles from the staffing parking requirements. The minimum size of each parking bay should be 7.5 metres long and 3.5 metres wide. A height restriction can be applied if required.

4.2.3 Parking for Enforcement vehicles

At the tolling locations, there may be a need for a parking space for an enforcement vehicle especially if there are no hard shoulders for the vehicle to safely park within the toll plaza area. To address this need, it best to allow for an emergency lay-by area or wider hard shoulder in the approach area of the toll plaza. Any parking space dedicated to enforcement vehicles should be clearly identified as emergency use only. Also see Phase 1 for details on emergency lay-by areas.

4.2.4 Lay-by areas for Heavy Goods Vehicles and Oversized Vehicles

If there are no lay-by areas well in advance of the plaza approach or if drivers realise too late that their vehicles will not be able to negotiate the plaza, then the design should make sure that the width at the end of the approach zone should be adequate to enable the turning movement of the heavy goods vehicles via an opening provided in the centre reserve area of the carriage way.
Whilst there are lay-by design size guidelines in the Design Manual for Roads and Bridges (DMRB), these are not specific to HGVs. Any design guidelines must also address HGV vehicle sizes. Under European Union legislation, which the UK complies with, large goods vehicles are classified in ‘C’ and ‘E’ categories. Addressed in these categories are rigid goods vehicles of between 8 – 14 metres in length and articulated goods vehicles of between 14 and 16.5 metres in length (both in addition to other load dimension attributes). In the UK, Abnormal Indivisible Load restrictions concerning vehicle length, apply for vehicles over 18.75 metres in length.

Based on the above, lay-by areas should be designed to accommodate at least two HGVs of maximum 14 metres in length each. It is desirable to have a lay-by close to each approach of the highway leading to the Mersey Gateway and Silver Jubilee Bridges. However, Local Highway Authority and Highways Agency standards should be taken into account before final determination of locations of lay-bys. Possible locations of lay-bys for each approach to the highway from the Ditton and Widnes areas of the north side of the Bridges and Runcorn on the south side of the Bridges are summarised in the table below. See further design details in Phase 1 document. See Section 6.1.2 regarding placement of signs for lay-by areas.

<table>
<thead>
<tr>
<th>Plaza Location</th>
<th>Suggested location of Lay-by</th>
<th>Considerations for minimising cost.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditton Main Plaza EB</td>
<td>In advance of approach to plazas – along the highway EB. Alternatively, direct traffic off the slip road to the local network.</td>
<td>Possibly use lay-by areas suggested for the Ditton On Ramp EB.</td>
</tr>
<tr>
<td>Ditton On Ramp EB</td>
<td>On the local network. In advance of ramp turn off.</td>
<td>Lay-by area common for both directions of traffic heading towards Ditton On Ramp EB.</td>
</tr>
<tr>
<td>Widnes Loop Toll SB</td>
<td>On the local network. In advance of the ramp leading to the loop toll location.</td>
<td>Lay-by area common for both directions of traffic heading towards Widnes Loop Toll SB</td>
</tr>
<tr>
<td>Silver Jubilee SB</td>
<td>On the local network. In advance of the ramp to the leading to the SJ SB toll location.</td>
<td>Consideration should be made to find a common space to share for both roads leading to the ramp.</td>
</tr>
<tr>
<td></td>
<td>Two separate roads leading to the ramp.</td>
<td></td>
</tr>
</tbody>
</table>

**All Plazas below should have a lay-by area on the South side of the Mersey Gateway**

<table>
<thead>
<tr>
<th>Plaza Location</th>
<th>Suggested location of Lay-by</th>
<th>Considerations for minimising cost.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditton Main Plaza WB</td>
<td>On A533 NB &amp; SB Central Expressway and A533 EB &amp; WB Bridgewater Expressway.</td>
<td>Given that the Mersey Gateway South Junction and Silver Jubilee South Junctions exist and can be used to turn around on the highway. It is recommended that the A533 NB &amp; SB Central Expressway lay-bys are consolidated to one location and A533 EB &amp; WB Bridgewater Expressway lay-bys are consolidated to one location.</td>
</tr>
<tr>
<td>Ditton Off Ramp WB</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Widnes Loop Toll NB</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Silver Jubilee NB</td>
<td>On the A557 or A533. There should be one in each direction.</td>
<td>It is possible to use the same as above.</td>
</tr>
</tbody>
</table>
Table 6: Lay-by Areas

The above lay-by areas are not intended to cover extreme needs when there is a bridge closure or extended delays in travel using the Mersey Gateway.

Figure 2 indicates the proposed location of lay-bys north and south of the Mersey Gateway crossing.

Figure 3 – Proposed location of lay-by areas for heavy goods vehicles and oversize vehicles
5.0 LOCAL AND CENTRAL FACILITY ACCESS

This section will evaluate the access requirements for the proposed local and central facility and propose suitable options based on best operational practices for vehicle and pedestrian accesses.

This section also identifies any differing practices in operation between each tolling configuration from each plaza locations. Where conventional toll plaza is provided, there are some common themes to be reviewed such as:

- Ability for staff to safely access between toll booths;
- Ability for staff to access local facilities and central facility for personal amenities;
- Ability to provide customer assistance due to equipment failure or toll payment complications;
- Ability for staff to refrain from crossing more than one live lane so a safe stopping/refuge area should be provided at each island; and
- Ability to access the local facility without undue driving.

5.1 LOCAL FACILITY

Local facility is provided only if a conventional toll plaza is required at each of the toll sites.

5.1.1 Vehicular Access

Vehicular access is only required for staff to access non-mainline sites to start their work shifts or to provide transportation between local facilities and central facility.

5.1.2 Pedestrian Access

5.1.2.1 Mainline Plazas

The local facility is not provided at the mainline plaza due to the collocation with the central facility.

The use of foot crossings to access each lane from the local facility will depend on the width of the plaza, speed of vehicles and number of toll lanes. If the plaza is less than four toll lanes then it is likely that foot crossing will be operationally acceptable. If the plaza is greater than four lanes then there may be a requirement to have access to the lanes via an overhead walkway.

5.1.2.2 Ramp and Loop Plazas

Local facilities are provided at these plazas as described in the previous sections. The use of foot crossings to access each lane is acceptable if the plaza is not greater than four lanes.

If local facilities cannot be provided due to cost or land constraints, alternative option such as collection and transport of the toll staff from their respective toll booths to the central facility, either at the end of their shift or during extended break periods, should be entertained.
5.2 CENTRAL FACILITY

5.2.1 Mainline Locations

5.2.1.1 Vehicular Access

The proposed central facility is accessible from Liverpool without paying toll. However, access from Runcorn requires the vehicles to pay a toll before reaching the north side of the Ditton mainline plaza.

If a conventional plaza tolling configuration is applied at the mainline plazas, a higher level of vehicular access would be required for the toll staff to access the mainline plazas. Due to the collocation of the mainline local facilities with the central facility as described above, the need for vehicular access at the mainline toll plazas is minimised.

If ORT tolling configuration is applied at the mainline plazas, limited pedestrian access is required to the central facility from the mainline locations. Access would be primarily required for maintenance of equipment and/or inspection and maintenance of infrastructure. This access could be provided by driving to the site, parking on the shoulder and using local traffic management as per Highways Agency requirements. It is advantageous for the staff to drive to the mainline locations, park on the hard shoulder of the slip roads and walk to the gantry base/roadside equipment. This method could be used for both east and westbound gantry locations. Using the slip roads for maintenance access at the mainline tolling locations prevents the maintenance vehicles from having to cross the bridge to access the site in the opposite traffic direction.

If the slip road hard shoulders cannot be used for the maintenance access then the mainline highway hard shoulder should be used with a point along the central reserve to allow the maintenance vehicles to turn around at Ditton on/off Ramps

5.2.1.2 Pedestrian Access

Based on the idea of shared local facilities at the mainline plazas, it is envisioned that the central facility can provide the required facilities to support toll operation at the mainline plazas.

Pedestrian access to the central facility should be restricted to the toll operations staff. For those wishing to access the central facility and staff parking on foot from the mainline toll plazas, access would be through the use of an overhead walkway. Whilst an underground tunnel access is preferable, primarily for safe access and to lessen the amount of intrusive above-ground infrastructure, it is understood that the current land status is that of a brownfield site, which does not permit such underground structures to be excavated and constructed. Consequently, an overhead walkway would be the most feasible alternative.

To keep the infrastructure costs for the overhead pedestrian walkway to a minimum, it would be critical to have an aligned design for the mainline plazas. Ideally, the base of the overhead walkway should be designed to coincide with the foot path from the central facility.

Where there is an ORT with lay-by tolling configuration, there is an option to provide foot crossings at the lay-by plazas especially if it has less than four toll lanes. However, there is still a need for overhead walkway to cross over the eastbound and westbound ORT lanes at the mainline. The use of foot crossings to access each lane of the lay-by plazas will depend on the width of the plaza, speed of vehicles and number of toll lanes. If the plaza is less than four toll lanes then it is likely that foot crossing will be operationally acceptable. If the plaza is greater than four lanes then there may be a requirement to have access to the lanes via the overhead walkway.

With the ORT tolling configuration, there is no requirement for pedestrian access from the central facility to the mainline locations.

With the exception of the mainline plazas, there will be no pedestrian access from any other toll plazas to the central facility.
5.2.2 Ramp locations

Due to the location of the central facility, there are some potential risks of heavy traffic near the Ditton on and off ramps. There is some probability of this occurring at the commencement of the toll operations especially if the ETC penetration increases. A design review of the queue lengths, use of signalised junctions and turning space is required to assess the impact of the traffic around the Ditton on ramp due to the central facility.

5.2.2.1 Vehicular Access

Vehicular access to the central facility located at the north side of mainline site (See Figure 2 for possible turning movements):

- Vehicles who want to undertake Movement A will need to be informed of directions to the central facility in advance of undertaking Movement A.

- Vehicles who are undertaking Movement B will need to be informed of directions to the central facility in advance of the penultimate left turn before the Ditton east bound on ramp.

- Vehicles who want to undertake Movement C will need to be informed in advance of this right turn onto the Ditton east bound on ramp.

- Vehicles who want to undertake Movement D will need to be informed similar to Movement C.

- Vehicles who exit at the Ditton west bound off ramp will need to be informed in advance of the right or left turn made at the end of movement E.

![Figure 4 – Local Movements for Access to Central facility](image-url)
5.2.3 Widnes Loop Plazas

Vehicles north bound:
With the central facility located at the north side of the Mersey Gateway Bridge, vehicles heading north on the Bridge will be directed to follow westbound signage on the highway upon exiting the Mersey Gateway Bridge to access the central facility.

Vehicles south bound:
Vehicles heading south should be informed before entry to the Mersey Gateway Bridge or on local routes such as A562 Ashley Way.

5.2.4 Silver Jubilee Plaza

Vehicles north bound:
With the central facility located at the mainline plaza, vehicles travelling north bound on the Silver Jubilee Bridge will require signage nearer to the toll plaza with directions to the central facility.

Vehicles south bound:
Vehicles on approach to the bridge to head south will need to be informed in advance of the SJB ramp area that facilities are available at the mainline plaza.
6.0 SIGNAGE

6.1 PLACEMENT AND FREQUENCY

The placement of signs will generally depend on the function of the sign, and the information it conveys. It also refers to type of installation required (overhead, surface or pavement signs).

- The frequency of signing will address two concerns: either to ensure that drivers see at least once a particular information panel (toll schedule) regardless of all the possible combinations available or to ensure that drivers are efficiently guided along their journey on the tolled zone (speed limitation, lane types, exit options...). The frequency of signage will depend on the configuration of the road (visibility, speed limit, curvature...), and will depend on the type of sign to be displayed,

- Typically speed limitation, and approach warning signs will have a high frequency, spread of a long distance;

- Information signs will have a lower frequency;

- Safety signs will have a high frequency but on a small zone (toll plazas); while

- Regulatory signs will have a medium frequency depending on the content and users’ awareness, traffic specificities and local traffic concerns.

6.1.1 Highway sign

The highway signs are informational signs located either on the highway, or at the far end of the approach zone. These advanced signs could be overhead or ground mounted on the left side of the highway, and would provide information to drivers on:

- distance before end of highway;

- existence of toll plazas ahead;

- tolled bridge and related warnings (vehicle restrictions, payment methods, toll schedules, exits before entering the no-return zone);

- lowering of speed limitations (surface sign);

- lay-bys

These signs should follow the standards for Highways Agency sign requirements (colour, symbols, placement) and for the part of the network under the responsibility of the Local Highway Authority, the sign placement should be coordinated with them.

6.1.2 Approach zone signs

Approach zone signs are generally placed at surface, on both sides of the highway.

Speed restriction signs placement will depend on the traffic density (heavily travelled tolled highways should display early warnings). Speed restriction signs would need to be installed at a minimum distance of 300m depending on the tolling configuration. The speeds at the Mersey Gateway and Silver Jubilee Bridges are understood to be 100kph and the ramp and loops speeds are 70kph. The placement of signs for speed limitations should take into account stopping sight distance and to accommodate a full vehicle stop at the toll plaza for attended toll collection.
Toll Schedule should be displayed at the beginning of each approach zone (where the taper begins) of the toll plaza. Toll schedules should also be displayed at least one junction in advance of the Bridge crossings and one junction in advance of the toll plazas.

6.1.3 Facilities

Sign providing information on facilities (location, direction, safety exits, and security points) should be installed at the entrance of all facilities, and on all (pedestrian or vehicle) road/path intersections.

Signs indicating the directions and exits in order to reach customer service facilities should be indicated on surface signs – advance of the exit (standard highway sign policy), at the exit, and at necessary frequency to reach the facility.

6.1.4 At plaza

Signs can be implemented overhead to provide short but important messages. These messages can include “STOP-Pay Toll”, “Toll Violation Enforcement in Operations” and tolling specific messages such as Lane Open, Lane Closed, Payment Type accepted, etc on a VMS above each toll lane (not applicable to ORT).

At the booth level where driver stop and pay, signs should be installed to display toll rate schedule, speed limits and regulatory messages. Information on special events in the area, safety tips and direction to popular attraction would be displayed at the tollbooth.

When leaving the plaza, directional signs indicating distance to close towns/cities and highways should be installed overhead. This is especially critical where the road splits into two ramps, e.g. SJB northbound.
6.2 TYPES

6.2.1 Toll payment sign

6.2.1.1 Payment acceptance

- Should display all payment acceptance types (e.g. cash), and be related to relevant lanes.

6.2.1.2 Toll charges

- Should display payment rates by vehicle type

6.2.2 Speed signs

- On approach - Restrictions - Should display maximum speed limit warnings. Subsequent signs should progressively indicate decreasing speed limit to allow for a safe arrival of the vehicles at the Toll Plaza facility.

- On departure – signs should display maximum speed limit warnings, by lane, as vehicles exit plaza lanes and merge with other traffic.

6.2.3 Emergency exits

- Should indicate the nearest emergency exits, emergency staff and alert systems.

- Should be clearly indicated with a different colour, symbol and shape, and universally recognisable.

- Should be displayed at regular intervals around the toll plaza, facilities etc.

6.2.4 Direction

- Should indicate the direction and distance of all main attractions (cities, points of interest) located on that route, as well as nearest exits, local direction and local points of interest. These signs need to be put either before entering the tolled area, or when exiting the tolled area (either side of the tolling point).

- Facilities, customer services, enforcement posts should also be indicated, a few hundred meters before the related exits and at the exit itself.

6.2.5 Lane use

- Signs indicating assignment of lane on approach to plaza

- Signs indicating the status of the lane on top of which it is mounted at plaza.

- There should be one sign per lane.

- Sign should indicate the payment mode (tag only, cash only, cash and tag, etc)

6.2.6 Approach warning signs

- These signs will indicate warning of, as well as distance to tolled bridge/road ahead, approach to all the slip road, exits, and bifurcation directions and should also clearly mention the point of no return (to pay the fee and cross the bridge) as well as exits directions for drivers unwilling to cross the bridge.
7.0 GROUND AND IN-GROUND EQUIPMENT AND INFRASTRUCTURE

This section reviews the ground and in-ground infrastructure required to support the tolling configurations identified in Phase 1 Memo. Irrespective of the type of technology or tolling configuration selected for design, majority of elements identified below will have an influence on the toll plaza and highway design and build and therefore should be considered during the design stage of this project.

7.1 VEHICLE PRESENCE LOOPS

In general, vehicle presence loops will have to be embedded on the newly constructed roadways for various purposes such as tolling, ATM, IDS and MIDAS.

From a tolling perspective, for the purpose of tracking vehicles, vehicle presence loops will have to be embedded in the toll lanes to track the vehicles prior to entering, while in lane and upon exiting the toll lane. In certain cases such as ORT, it may be necessary to track vehicles while they are travelling through the toll lanes with a series of loops strategically placed, not only on the roadway but (if available) also on the hard shoulders.

All of this will require numerous formations and quantities of loops embedded on the road surface and along with the loops, certain amount of ducting will be required for the wiring to be connected back to the lane controllers and/or other traffic monitoring equipment.

7.2 SAFETY LOOPS

As above, safety loops will be required, at a minimum at the exit point of toll lanes with barrier to provide accidental closure of barriers. Whilst other technologies are also available that provide alternate solutions, it is recommended that provisions be made for traditional loop based solutions.

These however would not be a requirement if the Open Road Tolling option were implemented.

7.3 WEIGH IN MOTION (WIM) SENSORS

WIM sensors are primarily used to measure the wheel and axle loads and to determine the vehicle gross weight under rolling conditions.

Most new highways, especially where bridges and limited capacity roadways are built, have included the provision of WIM to monitor HGVs and to assist in adapting precautionary processes to prevent road damage by such vehicles.

With the use of WIM, it is customary to introduced lay-bys or Emergency Refuge Areas to hold the overloaded vehicle until remedial action can be taken or provide a refuge area for the vehicles unsuitable to continue their trip.

7.4 AUTOMATIC VEHICLE CLASSIFICATION (AVC)

Automatic Vehicle Classification is used for independent validation of the transactions created by a toll attendant in a MTC lane. For conventional toll plazas, it is typical to have in-ground sensors to measure vehicle axles and presence of vehicles while ground-based infrared scanners are used to obtain height measurements. The combined in-ground and ground equipment is required to obtain the vehicle characteristics required for a valid vehicle classification in the UK.

There have been advances in the technologies that nowadays other alternatives such as overhead infrared scanners and licence plate image capture systems (VES) tied to the Driver and Vehicle Licensing Agency are available for capturing the valid classification of a vehicle.. These types of AVC systems are quite common for ORT lanes as it is difficult to utilise the typical AVC equipment described above in an open road environment.
7.5 VIOLATION ENFORCEMENT SYSTEM EQUIPMENT

See Section 9.0.

7.6 CONDUITS, CABLING AND ROADSIDE EQUIPMENT

It is understood that underground tunnels cannot be constructed at the plaza locations due to the brownfield site. This restriction does not apply to underground ducting required for electrical and communication cabling for the toll plaza and central facility. Early design and planning is necessary to complete the requirements analysis for each toll payment location (lane for MTC/ETC and overhead gantry for ORT), central facility, and traffic monitoring and traffic information management. Early design should include conduit provision for future expansion or needs. Implementation of the design should be carried out simultaneously to the construction of the roadway to avoid disrupting a newly built roadway.

There may be isolated locations which will have roadside cabinets for traffic monitoring equipment and variable message sign controllers. These cabinets will require direct links back to the Central facility or a communications node or terminal which has access to the Central facility.

7.7 FOUNDATIONS

Foundations are required for a number of elements within the toll design. These elements include ground-based roadside cabinets, toll booths, barriers (gates) at conventional plazas, overhead gantries for ORT, canopy at conventional plazas, and sign infrastructure (static or variable message sign). This is not an exhaustive list but is to provide an indication of some of the major items that would require a foundation design and construction.

For the foundations at a conventional toll plaza, information about the type of equipment to installed, allowable vibration for the equipment, and requirement for reinforcement concrete should be established before the toll islands and the concrete pavement are constructed. It is also important to identify where the reinforcement for the concrete is located and how that will impact output from the toll equipment.

For the foundations for the roadside infrastructure such as gantries or base-pads for cabinets, the Highways Agency design standards should be used.
8.0 OVERHEAD EQUIPMENT AND INFRASTRUCTURE

Identification of the following equipment and hardware will influence the toll plaza and highway build and shall be considered during the design phase.

8.1 OVERHEAD DETECTORS

As described in Section 7.4 above, there are alternative technologies that can be used for capturing vehicle classifications. This includes overhead vehicle scanners and vehicle image capturing devices. The key benefits of introducing overhead detectors are the low cost of maintenance over the life of the operation and non-intrusive methods to maintain the equipment.

Selection of overhead detectors for toll system use should have little impact on the infrastructure requirements and cost. Most overhead detectors can be installed on the underside of the canopy at a conventional plaza. Overhead detectors at the ORT locations can be integrated into the same gantries used for other areas of the toll system. If there are specific requirements by the supplier then additional gantries may be required to accommodate the overhead gantries.

8.2 PLAZA CANOPY

Whilst a canopy is not mandatory, at most conventional toll plazas a canopy is provided to shelter the personnel and equipment from inclement weather and to provide for an architecturally pleasing tolling point. A plaza canopy can be replaced by an overhead gantry to support the overhead equipment. Canopies can range from a simple petrol station cover to elaborate ones built at the M6 Toll, Tamar Bridge and Forth Road Bridge in the UK.

Key items that are to be considered when designing the canopy is the type of equipment to be installed on the canopy, required orientations of the equipment, loads of the equipment, access to conduits from the ground to the equipment on the canopy and limitations to the cable distances due to operating standards.

Some of the equipment that can be installed on the underside of the canopy includes ETC antennas, overhead laser scanners and violation enforcement cameras. Provision should also be made for lighting, lightning protection and overhead static or variable message signs.

8.2 GANTRIES

Where a canopy is not required, a gantry can be provided to support the toll equipment. In the ORT environment, a gantry will indicate the physical point at which toll is charged and provides the infrastructure to support the necessary equipment.

In addition to the gantries being used for the mounting of tolling equipment, they are also a critical requirement for the mounting of advance signage.
8.4 POSTS

The toll system has a number of equipment that is either pole mounted on the toll island or pole mounted on the side of the highway near the toll plaza.

The uses of the posts will vary depending on its use in the toll lane or toll plaza. The posts on the toll island typically are used to support the VES camera and lights, traffic signals, toll fare indicator, intercoms and alarms. When selecting the posts for such use, an early decision should be made whether to integrate the post into the toll island or surface mounted as a pedestal.

8.3 OVERHEAD WALKWAY

Given tunnelling is not an option due to the brownfield site, overhead staff walkways are proposed for the toll personal to cross over traffic at the conventional toll plazas, especially the mainline toll plazas. At the ramp and loop plazas, overhead walkway is not needed but speed restrictions and adequate safety measures should be taken to allow staff to cross the plaza.

The overhead walkway at the mainline toll plaza should consider the access across the plaza and access between the toll booths. Design should not allow staff to traverse more than two lanes at a time without the mainline plazas without These structures should support accessibility for staff to the local/ central facility and connectivity between toll booths.
9.0 ENFORCEMENT

Below are descriptions of the manual, physical obstructions and automated systems used to prevent evasion of toll payment for the use of the bridge or road.

9.1 MANUAL

In attended lanes, toll attendants capture any vehicle trying to evade payment of toll by taking down the license plate, make and model of the vehicle. Some toll attendants can be quite effective at stopping the vehicle from continuing the passage through the conventional toll plaza by raising an alarm or other operational methods agreed by the toll operator.

9.2 BARRIERS

Barriers or gates in a conventional toll plaza discourage drivers from committing toll violations. The primary reason for this is the physical obstacle preventing the vehicle from continuing its passage. Traditionally, all attended toll lanes have barriers. In recent times, with the introduction of an automated license plate capturing system, the attended toll lanes have removed the use of barriers as long as the toll operators have some assurance of recovering their lost revenue. Toll Operators sometimes take the view that it is better to take collect the tolls at payment point and reduce the risk of losing the revenue due to difficulties in pursuing the violator.

The above is also applicable for dedicated ETC lanes at conventional toll plazas. The drawback of using barriers in ETC lanes is when the vehicle is stuck in the lane due to insufficient funds, failure of OBU, etc. This would require some physical presence in the ETC lane to address the issue or use of an intercom system to assist the driver to identify the problem then providing presence in the lane if that fails.

The use of barriers has been reduced at conventional toll plazas in North America to increase the vehicle throughput. This conversely increases the safety risk of personnel at the toll plaza due to the increase in vehicle speeds at the plaza.

9.3 VIOLATION ENFORCEMENT SYSTEM

In addition to the above, some toll operators want to capture all vehicle transactions that are considered anomalies by the toll system, for example, exemptions, non-cash payments, all post paid ETC, etc. Other toll operators are content with having the barriers as described above and do not invest in violation enforcement system due to its initial capital cost and ongoing operational costs.

A Violation Enforcement System (VES) is an integrated system of cameras, infrared lights and dedicated server and application to process the captured images. The cameras are used to capture licence number plates and lighting is required to provide focused lighting for better image quality. As a start, the VES will capture any vehicle that is considered as a non-payment. Toll Operators can configure this system to capture other transactions to monitor other anomalies.

VES can be installed at all lanes at a conventional toll plaza or used at the ORT payment locations. The use of precision equipment is important in high speed ORT environments.
9.3.1 Placement of VES Infrastructure

Cameras can be mounted either overhead or alongside the toll lanes. Optimal location at the toll islands is determined by the stopping point for the toll booth and the point at which the automatic vehicle class is determined. The cameras at the conventional toll plazas are installed on a post or overhead on the underside of the canopy. Following identification of optimum distance, a camera angle must be chosen to enable a high success rate for licence plate recognition. This is dependant on the lane geometry, lane types (MTC or ETC) or by plaza.

Cameras for the ORT toll configuration need to be placed on the overhead gantries with clear view of the licence plates (front and rear).
10.0 ARCHITECTURAL PERSPECTIVE

Aesthetic amelioration is critical when a new roadway project is being undertaken that introduces tremendous disruption to the general surroundings and the immediate vicinity of the works. Whilst the environmental impacts will be assessed and steps undertaken to cause minimal impact due to the works, upon completion of the works improvement of the areas along the roadways from an aesthetic point of view is strongly recommended.

All new structures built, as part of the new roadway should tie in with the tolling locations with a common theme, providing an architecturally simple, cost effective, durable design that is effective for operational use.

10.1 LOCAL PERSPECTIVES

It is critical that any design of toll plazas or other structures such as administration or central facility buildings, signage gantries and the like should be designed to the extent possible to blend in with the local surrounding and any existing infrastructure. The local perspective of the new roadway and resulting disruptions will be less of an issue if the new development blends in with the local existing surroundings and should be taken note of during the design phase.

A recommended practice is the inclusion of local architects who know the area and can provide local knowledge and perspective. Stakeholder inclusion in the design and development stage is also important. Obtaining early assessments of designs from stakeholders can pay dividends in the acceptance of the new roadways. Therefore, a series of consultations with stakeholders should be carried out. Full consideration should be given to the views expressed by the stakeholders when developing the final strategy.

Public consultations and value management workshops to review and prioritise the findings from any previous consultations and/or the design team should be held and the final strategy/design should be presented to the stakeholders/public.

10.2 LANDSCAPING

The visual impact of the motorway and new bridge is assessed from two perspectives, from the surrounding countryside (if any), and from the road and bridge. It also should include the current landscape designs for the road. Completion of the new carriageways should not have a discernible visual impact when viewed from the surrounding area. At the new road junctions and toll plazas, the new construction will rise above the surrounding landscape. Appropriate landscape designs would help reduce the visual impact. A scheme for providing landscape planting throughout the road length should be prepared as part of the highway design.

The surrounding environment of any toll facilities should be landscaped upon completion of construction works. Tolling facilities and associated administration buildings will be frequented by the general public and will require some level of landscaping to provide for an aesthetically pleasing environment.

A landscape plan for the whole scheme should be prepared in accordance with international best practice. The plan should be commissioned as soon as the final decisions have been made on all land to be acquired and junction arrangements are completed and agreed.

10.3 DRAINAGE & WASTE DISPOSAL

In most likelihood the wide range of potential pollutants arising from road traffic will affect water resources in the area. Building interceptor traps areas close to any water streams can reduce pollution of the small streams. The construction of interceptor drains will also reduce the impact of any accidental spills on the roadway.
The spreading of winter salt will be required to ensure with road safety and having interceptor drains will also assist in the control of any damage to the environment due to the toxic nature of high concentration of the salt in rain water overflow from the roadways.

Design of drainage and incorporating in to the toll plazas and associated areas should be inherent to the design such that it is not visible to the patrons. The use natural drainage such as grass or turf to absorb run off from the highway and plazas shall be considered.

The road contractor should be required to prepare a waste disposal plan so as to cater for the safe control and handling of waste, especially contaminated materials.

10.4 NOISE REDUCTION

Noise impacts should be forecasted for each section of the new road. Regulations specify that if noise from a new road exceeds the prescribed limit levels, mitigation measures would need to be introduced. Forecasts for 2029 should be completed to see if, both day and night time, noise limits would exceed for distances of 25 metres away from the centre line of the motorway. However, this needs to be reviewed in context with if there are or will be residential areas close to the road centreline, so as to whether noise can be a problem, now or in the future.

Traditionally the use of trees and roadside noise barriers is commonly used to reduce the noise from the traffic affecting local residences. However, material used to reduce noise can have an impact on the surrounding and should be mindful.

It is recommended that noise reduction measures for roadside facilities are incorporated in the detailed design.

10.5 CANOPY DESIGN

It is critical that toll plaza canopies are designed and built aesthetically whilst maintaining the functional requirements such as minimum Highways Agency height restrictions and the need for mounting of various tolling equipment such as Lane Control Signs, DSRC readers and ANPR/ CCTV cameras.

The primary and secondary steel works along with the support columns should be covered with appropriate cladding to provide for an aesthetically pleasing toll plaza. All interior (i.e. primary and secondary steel works and connections) and external (cladding) components shall be galvanised and or rated for outdoor used. An IP rating of 65 is recommended.

10.6 OVERHEAD INFRASTRUCTURE

A range of gantries, cantilever masts and poles will be required through out the roadways to provide for mounting tolling equipment where toll plaza canopies are not utilised, advance signage, CCTV, lighting. These overhead infrastructures will be utilised for roadway management purposes as well as for assistance with tolling.

It is critical that these overhead infrastructures are designed and built aesthetically whilst maintaining the functional requirements such as minimum Highways Agency height restrictions and specifically gantries are compliant to Highways Agency standards (DMRB - Vol 2 - Sec 2 - Part 4 - BD 51 - 1998).

However, at the time of erection, new technologies such as the “Lightweight Gantry Technology” other less invasive deigns may be in operation and will need to be taken in to consideration.

10.7 TYPE OF MATERIALS

All material used for the construction of toll plaza and any associated work, as well as any tolling equipment that are installed in the outdoor environment should, at a minimum, be weather proof (standard of IP 65), easy to maintain and has life span covering the project needs. Safeguarding of equipment and material from vandals/ animals as well as bird proofing is required.
It is recommended that consideration be given that material used is, where possible, environmentally friendly and are recyclable at the end of their life cycle.

It is also recommended that consideration be given to if material can be sourced in The UK, especially locally vs. foreign imports. Local Trade Involvement can bring in high yields in terms of local perceptions as discussed above.

10.8 COLOUR & VISIBILITY

The colouring used for various areas within the roadway and tolling environment should be carefully selected with visibility being the key criteria whilst maintaining an aesthetically pleasing environment. Dramatically longer legibility distances help motorist reaction times thereby improving safety on the roads.

HA standard colouring shall be utilised for all roadway striping such as chevron pavement markings or lane striping and channelisation, impact attenuators/crash cushions. Some guidance to these can be obtained from ‘DMRB - Vol 8 - Sec 2 - Part 1 - TA 58 - 1992’.

Appropriate colouring shall be used for tolling equipment such as gate arms, tollbooths and other tolling peripherals and roadside equipment allowing motorist to visually identify them in advance and react accordingly.

It should be noted that where possible, colour scheme should be chosen to blend in with the environment or stand out depending on the client and local requirements.

10.9 LIGHTING

See Phase 1 Memo for further details.

10.10 HEIGHT RESTRICTION

It is critical that any overhead gantries, cantilever masts and toll plaza canopies are designed and built with the minimum Highways Agency height restrictions.

There is no statutory limit governing the overall height a vehicle that can be clearly identified, however, wherever possible it should not exceed 4.95m (16ft 3ins), based on advice given to heavy loads, in order that the maximum use can be made of the motorway and trunk road network.

However, for toll canopies, it is recommended that a ground clearance of 5.7 m is provided making provisions for load deflections from canopy and other equipment which may impact the height and also provide a safety net or contingency.

Further consideration should be given and provisions are made for any canopy mounted tolling equipment if they could affect the height clearance.

10.11 WIDTH RESTRICTION

Width clearance needs to be reviewed in terms of toll lanes as well as toll islands. When designing the plaza geometry, consideration should be given to toll lane widths, toll island widths and clearance from vehicle to the toll island. Additionally provisions need to be made to accommodate wide load HGVs in at least one toll lane per tolling location.

Further recommendations for width clearances have been made in Phase 1

Placement of columns on the islands needs to be constructed in a manner that it is on the downstream side so as not to block approaching traffic to the tollbooth. Similarly columns to support canopies should be sized and placed not to take up toll island space required for staff manoeuvring in and out of booth or requiring access to equipment.
Even though not aesthetically pleasing, it may require adding protection barriers and extend toll islands to assist vehicles navigate upon exiting the tolling area.