

6 West of Laira Bridge



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6.1 Introduction

Following the completion of the main Eastern Corridor Study, Plymouth City Council commissioned an additional review of highway and junction options to the west of Laira Bridge. The road network to the west of Laira Bridge experiences heavy traffic flows from both the north and east to the city centre, in the AM peak and reversed in the PM Peak. These flows currently use Gdynia Way to travel into the city centre and Embankment Road and Laira Bridge Road to travel out of the city.

Revised traffic arrangements west of Laira Bridge are required to deliver public transport priority through Embankment Road, environmental improvements through Embankment Road and the Prince Rock area and to provide improved highway links to and from the port area. The study brief required the options to be modelled to assess:

- Operational feasibility;
- A preliminary engineering feasibility assessment of the required junctions and road links; and
- An assessment of the impacts on the strategic model in terms of public transport benefits.

It is important to note that the objective of this further work was to consider the detailed junction layouts and alignments, in one specific part of the eastern corridor network. As such the work was separate from the Eastern Corridor Study, which was more strategic in nature, and had different assumptions underlying it. These included:

- The do-minimum consisted of on carriageway bus priority along the A379, and did not include bus lanes on Laira Bridge or the segregated busway;
- The overarching purpose was to assess the engineering and operational feasibility of the three options outlined herein; and
- Journey times generated in this detailed assessment are only indicative of the benefits that could be achieved.

The outputs of this work can not therefore be compared directly with those from the Strategic Eastern Corridor Study, although the conclusions have assisted in taking forward the recommended package.

6.2 Revised Highway Options

Three options were considered for alternative highway layouts and arrangements (for maps of routes please refer to the West of Laira Bridge Final Report):

- **Option One:** Through traffic to and from the city centre is routed via Cattedown along an upgraded route following Gdynia Way, Shapters Road, Macadam Road and Finnegan Road to a new junction with Laira Bridge Road. From here traffic uses a new link to join Embankment Road or Laira Bridge to travel towards Marsh Mills or Plymstock respectively.

Figure 6.1: West of Laira Bridge Revised Traffic Arrangement Option 1



- **Option Two:** Through traffic to and from the city centre is routed via Cattedown. Traffic travelling towards Embankment Road and Marsh Mills uses Gdynia Way as a two way route. Traffic to Laira Bridge or Plymstock travels along an upgraded road following Shapters Road, Macadam Road and Finnegan Road to a new junction with Laira Bridge Road. Traffic travelling between Embankment Road and Laira Bridge uses a new link bypassing Heles Terrace.

Figure 6.2: West of Laira Bridge Revised Traffic Arrangement Option 2



- **Option Three:** Through traffic to and from the city centre is routed via Cattedown. Traffic travelling towards Laira Bridge or Plymstock uses Gdynia Way as a two way route and Laira Bridge Road. Traffic to Embankment Road and Marsh Mills travels along an upgraded road following Shapters Road, Macadam Road and Finnegan Road to a new junction with Laira Bridge Road. From here traffic uses a new link to join Embankment Road which also serves as a bypass of Heles Terrace.

Figure 6.3: West of Laira Bridge revised traffic arrangement Option 3



6.3 Base Year Engineering Feasibility

The base year assessment has been carried out in two parts:

- An engineering feasibility study looking at the possible junction design given the complex constraints of the river, railway and land availability; and
- A Transyt assessment of the operational feasibility of the proposed junction layouts under reassigned base year flows.

The three options have been modelled using Transyt with AM Peak and PM Peak hour flows and an assessment of the operational feasibility of the schemes made. The process of junction design has been iterative, feeding data from the engineering feasibility work to Transyt modelling to ensure that the most efficient design in terms of operation is achieved given the constraints of the physical network.

6.3.1 Option One

The assessment of Option One identified that it concentrates traffic movements at the junction of Finnegan Road and Laira Bridge Road. To facilitate the level of straight ahead traffic from Finnegan Road and the new link to Embankment Road, a cross roads arrangement would be required. The size of an appropriate junction layout here is significant and would require widening of both the railway bridge beneath Laira Bridge Road and Laira Bridge itself to accommodate road widening.

For a straight across junction, the alignment of the new link to Embankment Road will need to run along the existing water line to the east of the railway line. Two limiting issues arise from this option. The first is the existing shore line/high water mark and the second the current alignment of the railway track. To avoid encroaching beyond the existing water line, it will be necessary to realign the railway track to accommodate a single carriageway highway with

verges. Even if the track could be realigned, the limitation of curvature still severely restricts the space available for a new highway. The available space for a new road is therefore very tight and suggests that this option is not feasible.

Laira Bridge, the new link road to Embankment Road and the improved Finnegan Road all carry heavy conflicting flows in the Peak hours. This implies that a minimum of four approach lanes are required at each arm of the junction, and a fifth lane required on Laira Bridge Road if a Bus lane is to be incorporated. The results demonstrate that all of the major conflicting flows have a saturation of over 100% during both peak hours. Over-saturation means that the physical capacity of these links is not sufficient to meet the demands of the traffic, hence queues will form and the traffic will be delayed. The engineering feasibility assessment has demonstrated that there is limited scope for extra turning lanes, meaning that the preliminary traffic modelling of the proposed junction concludes that the proposed signalled junction in this location is not viable.

6.3.2

Option Two

This second option proposes that traffic to and from the city centre is split between the Cattedown route and Gdynia Way. This option results in lower traffic levels at the western end of Laira Bridge, which can be accommodated in a new staggered junction between Laira Bridge Road, Finnegan Road and the new link to Embankment Road. The dominant flows at this junction are between Finnegan Road / new link and Laira Bridge.

As part of this proposal, an additional traffic lane is proposed westbound over Laira Bridge – making three westbound in total – by the adjustment of the carriageway on the bridge structure. This will permit the inside lane to be used exclusively by traffic turning left into Finnegan Road and hence to operate free flowing. The other two lanes will be used by traffic turning right towards Embankment Road via the new link road. Buses will be able to use the left turn lane in order to make the straight ahead movement. This will reduce delay for buses heading into the city centre.

The new link road to Embankment Road will tie in with the proposed location of the access road from Laira Bridge Road to the Plymouth Gate Retail Park development. The link road will cross the existing railway line at a level crossing before joining Embankment Road at a new signalised junction opposite the concrete batching plant.

The junction of Embankment Road and Gdynia Way will be signal controlled to allow buses and local traffic to access Embankment Road (west). General traffic in and out of the city centre will use Gdynia Way. Local traffic and buses into the city will be routed via a J-turn left towards Embankment Lane before turning right onto Embankment Road (west).

Cattedown Roundabout will be reconfigured to permit the dominant flow of traffic between Exeter Street and Gdynia Way to pass directly through the junction without going round the roundabout. The whole junction will be signal controlled. Option 2 separates the flows from the North (A374) and the East (A379), and routes them along different paths to/from the city centre. This has the advantage of reducing the volume of traffic flowing through the new junction at the western end of Laira Bridge.

With base flows, the Option Two network runs without over-saturation, although a number of links are close to saturation, but with further refinement of the design it seems likely that this Option is feasible.

For Option 2 a secondary Transyt model was created for the Western network of junctions – Cattedown Roundabout, Gdynia Way/Barbican Approach and the new Cattedown link/Clovelly Road. The redesign of Cattedown Roundabout allows the predominant movement between Exeter Street and Gdynia Way to flow with minimal interruption, including the additional flow of vehicles that may no longer use Embankment Road. Several links are close to saturation, but none are over-saturated, suggesting that the roundabout is feasible. The roundabout would need further investigation into signals timing to ensure that excessive queues are prevented. This network was also identified as being feasible within the modelling assessments.

6.3.3

Option Three

The third option routes traffic to/from A38 March Mills via Cattedown, and traffic to/from Plymstock via Gdynia Way. This arrangement concentrates all traffic movements through the Finnegan Road/Laira Bridge Road junction. To accommodate the high level of straight across traffic between Finnegan Road and the new link to Embankment Road, a cross roads arrangement would be required. The size of an appropriate junction layout here is significant and would require widening of both the railway bridge beneath Laira Bridge Road and Laira Bridge itself. Even if this were feasible, preliminary traffic modelling of the proposed junction concludes that the proposed signalled junction in this location is not viable with the very high level of conflicting traffic.

Option 3 suffers many of the same limitations as Option 1. All general traffic between East Plymouth and the city centre now flows through a new junction at the end of Laira Bridge (Node 20), connecting Laira Bridge Road to the new link to Embankment Road and the improved Finnegan Road. This creates an over-saturation problem very similar to that in Option 1. Even with 4 lane approaches on each arm, these links are still over-saturated. The conflicting flows cause congestion at the junction, which again does not have the capacity to handle all of the general traffic flowing to/from the city centre. As with Option 1, at least one more approach lane would need to be added to the model in each direction before there is a possibility of it working.

6.3.4

Summary

The most highly congested area in every option is the new junction between Laira Bridge Road, the link to Embankment Road and the Upgraded Southern Route. In accordance with the wishes of Plymouth City Council, it has been assumed that this junction will not be grade-separated and has been designed as an at-grade junction. This requires the junction to be large, with 3 or 4 approach lanes on each arm for Options One and Three. The heavy flows at the new junction mean that a staggered junction will be more effective in Option Two where the north-south flow from the link to Embankment Road and the Upgraded Southern Route are low. The flow in Options One and Three are heavy across this movement making a staggered junction inappropriate. A staggered junction would impact upon the development site north of Laira Bridge Road as it would pass through the site entrance and alter access arrangements, however it would provide more options for crossing the railway and scope for greater capacity.

6.4

Future Year Engineering Feasibility

Option Two has been coded in the Paramics model, which is linked to a Mode Choice and Variable Demand suite of spreadsheets that models changes in PT demand share as a result of network changes. The Paramics suite also models the strategic re-assignment impacts and means that future year growth in the study area is constrained by the surrounding highway capacity in the Paramics model, the resultant future year Paramics traffic flows have been fed into the future year Transyt assessment. The assigned flows from the base and do minimum strategic Paramics model have been used to derive link specific traffic growth. An assignment of the future year option model has been used to determine strategic rerouting as a result of the option. These factors have been applied to the base year counts to generate future year flows for the more detailed operational assessment.

The option gives improved car and bus travel time resulting in an increase in bus mode share from the new development areas east of Laira Bridge.

6.5 Future Year Operational Assessment

The eastern area of the network has very similar flow patterns in future years as it did with the base flow data. Natural bottlenecks on Billacombe Road and Embankment Road prevent any major increases in flow into the network. The network is still heavily loaded in the future year assessment and close to saturation, but no links are over-saturated. Queues build up on Billacombe Road and Embankment Road travelling into the City Centre, but these queues are away from the critical junctions of the network so should not cause severe problems. The only other notable queues form on Gdynia Way, in both directions. These can be minimised by extending the widened section of Gdynia Way as far into the cutting as possible. The western part of the network is less saturated in future year assessment than with manually reassigned base flows. This is can be attributed to strategic rerouting of traffic away from the area combined with bottlenecks in the eastern network which, as previously discussed, prevent excessive traffic entering the system.

6.6 Summary

The modelling work has shown that the Option Two layout, with a staggered junction with Laira Bridge, has scope to be developed into an operationally feasible junction layout. The initial engineering feasibility work indicates that this layout provides the least constraints out of the three options tested. The railway line will need to be realigned to achieve a suitable route for the new highway, and the link road between Laira Bridge and Embankment road is required to cross the active rail line; details of the operation of the level crossing have not been determined within the scope of this work. Future year testing using the strategic Paramics model suggests that the Option Two layout would provide marginal journey time benefits over the current network layout.