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One Eye On Preston

Lancashire's First CYCLOPS

Amardeep Sandhu & Michael Breathwick

In early 2022 Atkins were approached by Lancashire County Council (LCC) to support the design of their first CYCLOPS junction. Atkins were responsible for delivering the traffic signals design and supporting its implementation. This CYCLOPS junction forms part of the Preston Cycle Superhighway Scheme, which aims to improve cycling and walking facilities to Preston Railway Station, encouraging safe and sustainable multi-modal travel as well as improving active travel around the city. The project represented an interesting and exciting opportunity to deliver a project that can have a positive impact on the local area.

This paper is to share our experience designing our first CYCLOPS junction, and aims to highlight some of the design decisions that were faced.

A Background to Active Travel

Active Travel England's objective is for 50% of trips in England's towns and cities to be walked, wheeled or cycled by 2030. To achieve this objective, they highlight a need for local councils to provide an alternative to driving by delivering new, protected routes and junctions.

- The Active Travel initiative has the potential to bring significant benefits to health, communities and the environment through reduced congestion, reduced air pollution, reduced carbon emissions and better physical, mental and social health.
- As a result of this initiative there has been an increase in funding made available to local authorities to encourage investment into Active Travel and, subsequently, there has been a rapid increase in the number of highways improvement schemes that are centred around improvements for non-motorised users (NMUs).
- One of the most interesting Active Travel developments for traffic signals has been the CYCLOPS, a 'Cycle Optimised Protected Signals' junction.

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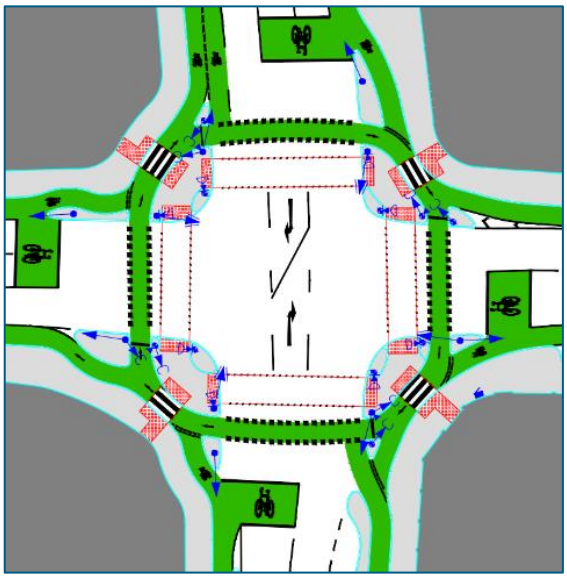
What is a CYCLOPS junction?

The CYCLOPS is a signalised junction that incorporates an external fully segregated orbital cycle track, connected by segregated signalised cycle crossings on each arm. It allows cyclists and pedestrians to move safely and efficiently around the junction without having to navigate too many shared zones or interact with motorised traffic.



CYCLOPS prototype illustration

Image taken from July 2019 'CYCLOPS – Creating Protected Junctions' paper by TfGM

- First developed by TfGM, the CYCLOPS junction is the evolution of the segregated cycle ways philosophy and is now being adopted and evolved by other authorities to meet the specific needs of new locations.
- The CYCLOPS is supported by the LTN1/20 guidance, which requires junctions to be designed in such a way that no longer treats cycling or walking as an afterthought.
- The CYCLOPS is typically designed to have an all-around cycle and pedestrian stage, promoting good progression around the junction for cyclists and safety for all users. However, each junction has its own unique characteristics, meaning that applying the CYCLOPS principal to new locations can introduce new challenges that require adapted solutions.

Preston's first CYCLOPS

The Preston CYCLOPS junction is located to the West of Preston city Centre on the banks of the River Ribble, at the Broadgate / Liverpool Road / Fishergate Hill / Strand Road intersection

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The Guild Wheel

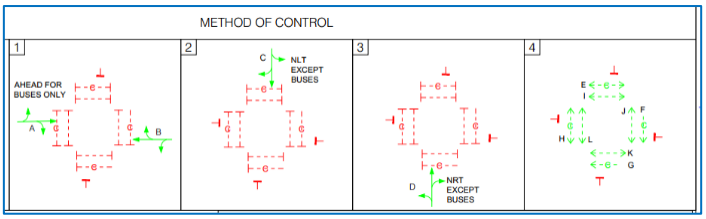
Imagine take from www.Bikemap.net

The Guild Wheel (NCN Route 622) is an almost traffic free 21 Mile "greenway" circular route which provides scenic and safe walking or cycling around the perimeter of Preston. The route is maintained and managed by Sustrans.

- The location was chosen as it formed a key part of the Penwortham to Preston cycleway and is located on the Preston Guild Wheel (NCN Route 622) which are popular cycle routes, but the previous junction arrangement included features that could discourage cyclists.
- Most notably, the junction arrangement provided 'walk-with' Toucan crossings where cyclists and pedestrians were required to cross each junction arm in multiple stages, meaning it could take some time to cross a single arm and even longer to make their way across multiple approaches.
- A new layout was therefore considered, with the aim to vastly improve the facilities for NMU's and to encourage more people to leave the car at home and switch to active modes of travel.
- Using the CYCLOPS prototype as a basis, the Preston CYCLOPS was designed with an external orbital cycle track but with some key additions to cater for the local requirements of the junction. This included sections of bi-directional cycling, facilitating key movements to and from the Guild Wheel and the Penwortham to Preston Cycleway, better meeting cyclist desire lines at the junction.

The Design

LCC requested Atkins to carry out a review of their design, provide suggestions to improve the geometrical layout and carry out an Active Travel review of the cycle movements. This led to the development of the final layout and signal staging, as shown below:



General Operation

The final staging sequence consisted of four stages, allowing the main eastbound and westbound movements to run together in Stage 1 with opposed right turn movements benefiting from an all-red extension facility.

The northbound and southbound movements are in separate stages to enable the two-lane southbound right turn movement to run unopposed.

The cycle phases and crossings then operate together in an all stop stage (stage 4).

The junction primarily operates with MOVA control. Vehicle detection system combines the use of both underground inductive loop detection and above ground radar vehicle detectors utilising the Multi Lane Radar.

There is also a hard-wired link to a manually operated level crossing 100m to the north on Strand Road which operates a local clearance strategy to ensure the level crossing is cleared of traffic before the gates are lowered.

Design Decision: Cycle Crossings

A key aim of the design was for cyclists to be able to make all possible movements at the junction in a single stage. This was made possible with the introduction of bi-directional cycle crossings to cater for key desire lines and reducing the overall distance a cyclist would need to travel.

Design Decision: Cycle Signal Equipment

Careful consideration was given to the type and layout of the cycle signal equipment. It was decided that the provision of two closely associated low level signals would be the best option. This reduces street clutter by not having large far sided signals whilst still providing the visibility and resilience of two signals.

The layout of the equipment and its distance from the carriageway and stopline was designed to provide adequate space and good visibility for cyclists.

Design Decision: Cycle Demands

LTN1/20 states that "*cyclists should be treated as vehicles and not as pedestrians*". To support this, it was decided to offer automatic detection for cyclists to further improve their user experience.

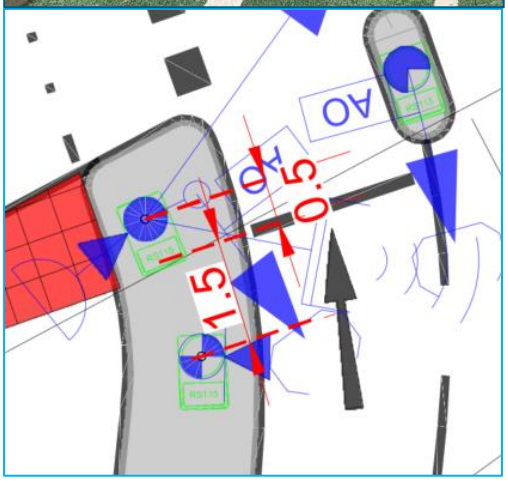
Therefore, in addition to push button demand units, above ground presence detection is also provided for all cycle crossings.

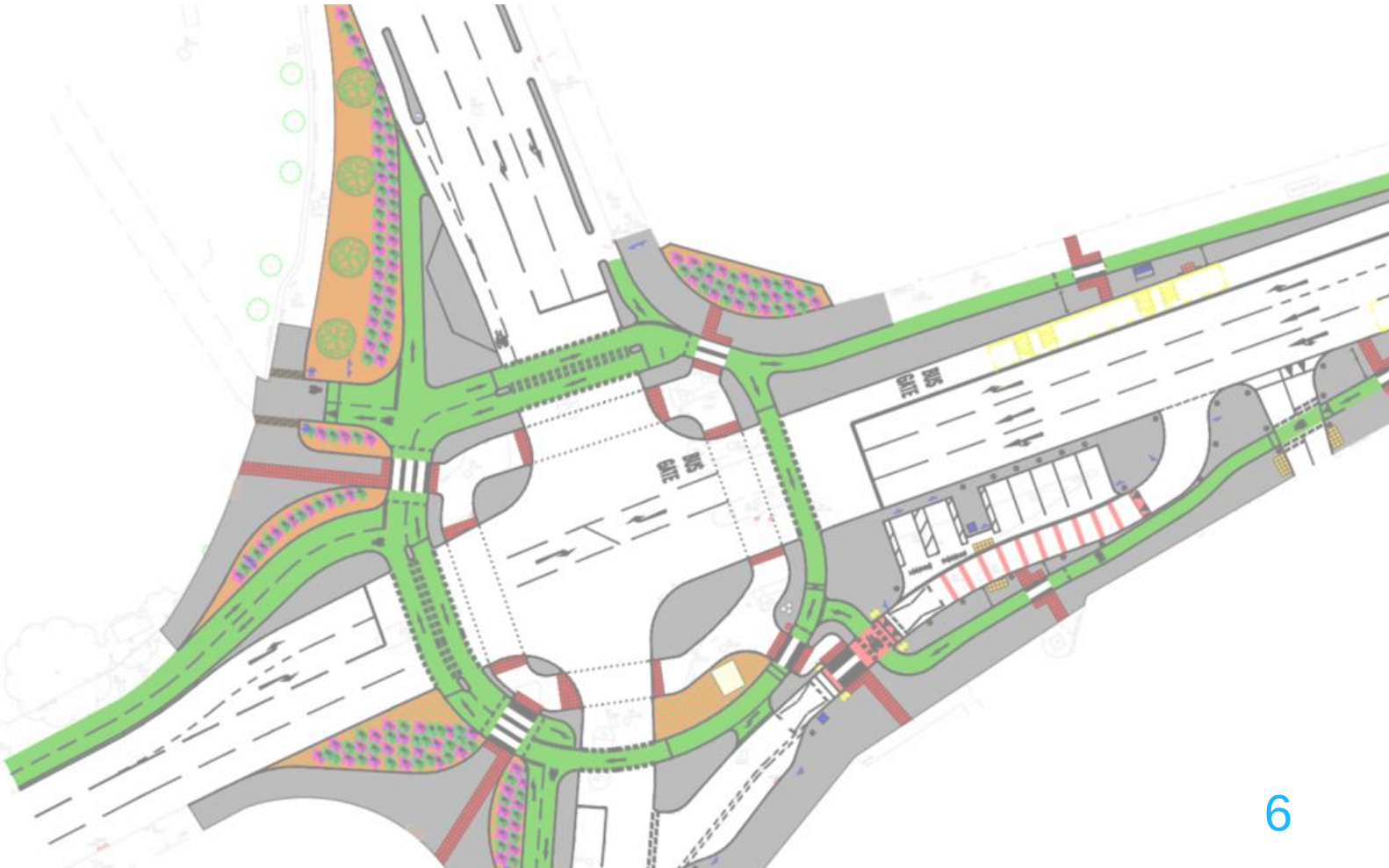
These enable cyclists approaching the stopline to be detected and unlatched demands to be inserted, preventing the need for them to stop and use the push button. Once a cyclist is detected, this illuminates the demand ring lamp on the push button demand unit providing cyclists with a visual confirmation that their phase has been demanded.

Design Decision: Safety Timings

Fixed 'Cycle to Traffic' Intergreens were used based on the timing calculations from LTN1/20, as cyclists arriving at the end of the green would already be moving and therefore would clear the crossing more quickly than someone setting off from stationary.

The design challenges identified, were resolved and integrated into the overall design proposal for the Preston CYCLOPS. On completion of the design, Atkins worked with Lancashire during the approval process before supporting the implementation of the scheme





The Switch-On

As the construction neared completion and the CYCLOPS layout took shape the Factory Acceptance Test and a pre-Site Acceptance Test site visit with the contractor was successfully completed.

Commissioning

Atkins attended the site to carry out the commissioning in collaboration with the signals contractor and the level crossing operator. An initial timing validation was undertaken which included some adjustments to intergreens, along with minimum and maximum phase timings. A bicycle was also used on site to validate the operation, to adjust radar detection zones and confirm stage minimum times.

Traffic volumes were very low compared to the modelled flows which may have been due to traffic re-routing during the construction works so full validation would have to wait.

Site Operation and Observations

As part of the commissioning and initial validation, Atkins spent time observing how the site operated and how users responded to the new layout.

Cyclist behaviour on approach to the stopline did vary; small groups of cyclists were observed arriving and chatting or checking their route whilst waiting, while other cyclists would look for a gap in traffic and cycle through the red signal.

The automatic detection and demand of cyclists appeared to work well, and cyclists were observed arriving without the need to push the button, acknowledging that the wait lamp had already been illuminated showing that the inclusion of Cycle Detection was working successfully.

Furthermore, the cyclists that did not wait for the green signal and proceeded during the interstage would be picked up by the above ground detectors. Consequently, their demand cancelled for the crossing stage. This proved to be a useful feature as it prevented needless delays to general traffic.

The cycle green extension function was tested and was proved to work. However, the above ground detectors used were not responsive enough to detect cyclists approaching, and only detected stationary cyclists at the stopline. The extensions therefore did not function in practice and was disabled during the commissioning.

One of LCC's key aims was to treat cyclists with priority. However, as the cycle phases appeared only once per cycle this led to what felt like lengthy wait times and consequently a number of cyclists crossing on a red signal. In response to this, the MOVA was re-configured to impose a reduced maximum stage time on the traffic stages when there was a demand for the crossings.

What we learnt

- The Preston CYCLOPS junction provided an exciting opportunity to deliver a project that can have a positive impact on the local area whilst exploring how the concept can be applied to a junction of this type and how the solution can be adapted for specific objectives.
- Many of the proposals worked well, but as we progressed though the design and implementation process we continued to learn and adapt the solution in collaboration with Lancashire County Council to give the best result for users. Beyond this, we also learnt some key lessons to take forward to future projects.
- The automatic demand and extension facility for cyclists has the potential to work well, although reliably detecting moving cyclists on approach to the stopline is a challenge. Achieving this will help meet the LTN1/20 guidance and help to make cyclists feel more like vehicles rather than pedestrians. It raises the question: Should cyclists have push buttons?
- The use of a fixed cycle to traffic intergreen worked well here, but we wouldn't rule out the use of on-crossing detection to extend this intergreen if the site conditions warranted it.
- Cycle crossings at junctions are often limited by the available space but making sure that the pushbutton, stopline, signal & carriageway offsets are adequate is vital for safe operation.
- Unlike a nearsided pedestrian signal, the cycle signal and wait lamp are on separate units. This requires cyclists to look at the push button to see that a demand has been inserted and then look at the cycle signal. Having the wait lamp on a low level cycle signal instead would mean that cyclists only need to look in one place to see the cycle signal and wait lamp, and would work really well in hand with automatic cycle detection.
- Understanding how to cater for cyclists was a particularly challenging task in the signal design with ongoing debates on whether cyclists at junctions should be treated more like cars or more like pedestrians. The implemented design shows a combination of demands for the crossings being inserted by both push buttons (as is done for pedestrians) and above ground detection (as is done for cars). Monitoring of this junction over the long term ought to provide some clarity on which demand system works better and what improvements could be made.

Our next steps

- Lancashire's Active Travel team have requested a trial which allows the cycle stage to operate more than once each signal cycle. This ties in with their aim to make this junction prioritised for cyclists and pedestrians. A revised staging order is being designed which will allow flexibility in when the stage operates within the signal cycle and how often.
- Operating the cycle crossing stage immediately after the main road as opposed to the quiet side road (Broadgate) may increase cyclist compliance. The side road often only has one or two vehicles during its green signal resulting in the perception of a long interstage time before the cycle crossing stage starts.
- Lancashire are planning to install Vivacity Sensors at the junction to collect data on junction use. This data may be able to provide indicators as to whether this CYCLOPS junction has achieved its aim and contributed to a modal shift from the motor vehicle to walking or cycling.

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Amardeep Sandhu
Traffic Signals Consultant
Intelligent Mobility and Smart Technology
Woodcote Grove
Ashley Road
Epsom
KT18 5BW

amardeep.sandhu@atkinsglobal.com

Michael Breathwick
Senior Traffic Signals Consultant
Intelligent Mobility and Smart Technology
Woodcote Grove
Ashley Road
Epsom
KT18 5BW

michael.breathwick@atkinsglobal.com