THE BENEFITS OF CONCRETE

Guided Busways

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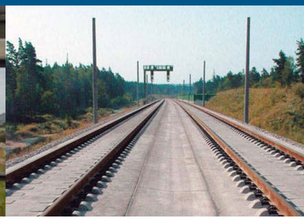
The British Cementitious Paving Association



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The benefits of bus travel

Extrudakerb

Accounting for two out of three public transport journeys, the humble bus plays an important, and can play an even greater, role in improving local commuting, reducing congestion and carbon emissions and creating more liveable cities. The benefits of bus travel are significant and include:

- Bus commuters generate £64 billion in output annually
- Bus users make 1.4 billion shopping trips a year and spend £27 billion
- 33% of city centre visitors made their most recent trip by bus, more than any other mode of transport including the car
- 50% of students depend on bus services
- Best used bus services in urban areas reduce carbon emissions from road transport by up to 75% *

Against this background, just a 10% improvement in local bus services in the 10% most deprived neighbourhoods across England could result in further significant socio-economic benefits including:

- 9,909 more jobs resulting from a 2.7% fall in employment deprivation
- 22,647 people with increased in come, resulting from a 2.8% drop in income deprivation
- 7,313 more people with adult skills**

However, the potential of bus travel is being stifled by increased congestion, for example:

- Bus journey times in the West Midlands have increased by 8% over the past seven years
- Passenger journeys in Glasgow have fallen by 22% in a decade, equal to 49 million fewer passenger journeys
- In Oxford which has one of the UK's highest level of bus usage, bus speeds have fallen to below 10mph
- In Gloucestershire, journey times on some routes have risen by 90% over the last 25 years.
- The forecasted increase in traffic of up to 55% by 2040 could see bus passenger numbers drop by up to 14% every ten years, putting the future of the bus sector under threat. ***

Given the wide range of benefits of bus travel and the fact that for every £1 invested on local bus priority measures delivers up to £7 in economic benefit**, it is understandable that many local authorities are considering the introduction of guided busways to realise the potential of the bus.

The guided busway

Guided busways provide segregated transport corridors for bus services. Such corridors remove the problems of traffic congestion, obstruction by parked vehicles and use of bus lanes by unauthorised vehicles. This allows the operation of regular, reliable bus services that are not subject to the vagaries and impediments of shared-use roads. In turn this results in:

- An improved public perception of bus travel and increased usage
- Faster journey times
- Improved transport connections
- Reduced traffic congestion
- Improved air quality

Guided busways are relatively simple to construct and are cheap in comparison with light rail. They typically consist of two 180mm high concrete kerbs set 2600mm apart on a concrete roadway. The kerbs act as both the guide for the bus and a physical segregation from other traffic. The bus enters the guideway using a funnel arrangement. Once in the guideway, the bus is guided by two lateral guide wheels with a gauge if 2605mm connected to the bus steering mechanism. The guide wheels are designed to be compression throughout the guideway thus ensuring continual contact with the guide kerbs. On leaving the guideway, both kerbs terminate equally and release the guide wheels allowing the driver to resume steering.

Short breaks in the guide kerbs for manholes or pedestrian crossings can be accommodated without the need for full entry splays.

There are three guided busway approaches:

Precast running beams on concrete sleepers

The use of precast running beam sections gives a high degree of control over finish and lateral tolerance between the guide kerb faces. Ride quality is good, even for high speed operation. Fine adjustment of the beam elements for line, level and gauge can be carried out following construction. Because the guideway elements are precast, they may be formed offsite and delivered to site as needed. On major projects, an on-site or local factory for the precasting of beams and foundation pads should be the preferred option. The number of curve variations along the alignment should be limited to reduce the cost of the precast elements.

Insitu/slipformed concrete with hand laid precast kerbs

With this approach pre-cast concrete kerbs hand-laid into the reinforced concrete running slab in order to form the guide kerbs. Manual kerb laying is becoming increasingly problematic due to HSE guidance. In order to lay 914mm long precast kerb units kerb-lifting

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equipment will be required. The precast kerbs are also a long term maintenance issue since they could become loose over time with continual running of the guide wheel. The laying of straight 914mm long kerbs around a tight radius curve may also give problems with ride quality and tolerance between guide kerb faces.

This method is suitable for short lengths or where difficult access means it is impractical to use slip forming equipment. It is not considered that this form of construction is well suited to high speed operation due to ride quality and tolerance issues.

Slipformed guideway

Constructing the guideway in a continuous process by slip-form plant has been shown in the UK to be an economic alternative to in situ and precast construction techniques for lengths typically greater than 600 metres. It also offers a very smooth ride quality. The slip-form construction process integrates the running slab and kerb form within the single pass of the paver. The guideway can be formed either as a one-piece slab or as two separate running surfaces. i.e. independent nearside and offside guideways. Recent UK experience suggests that a one-piece slab is preferable to two separate running surfaces; the guideway is constructed in one pass to ensure the required gauge and level tolerances between guide kerb faces are maintained.

All three approaches share the long-term performance and minimum maintenance attributes of concrete infrastructure.

Compared to trams or light rail, guided busways' other great advantage is that at either end of the guided sections, the buses can transit to and from existing roads and access city centres without infrastructure modifications. The buses themselves are basically standard vehicles with minor adaptations for the guided phase.

References

*Claire Haigh, CEO Greener Journeys; LEP Transport Workshop 'New Engines for Growth'; 2016

**The value of the bus to society; KPMG and the Institute for Transport Studies; 2016

***The impact of congestion on bus passengers; Professor David Begg; 2016

Case Study:

LEIGH TO ELLENBROOK GUIDED BUSWAY, GREATER MANCHESTER

Slipformed concrete was chosen to build the £27m, 6.5km Leigh to Ellenbrook busway in Greater Manchester. Main contractor Balfour Beatty in partnership with slipform specialist Extrudakerb determined that slipform offered lower start-up costs and the technical benefit of being able to form any required curve or super-elevation without the restrictions of a limited range of radii associated with precast construction. A major consideration for the construction choice was improved ride quality which was achieved due to the use of continuously reinforced concrete pavement (CRCP) which has no movement joints and resists possible long-term residual settlement and/or movement.

The busway features two 3m wide monoliths complete with upstand kerbs and a central drainage channel. The use of the precision grinding machine allowed the achievement of the required 2600mm +/-gauge. Of note, was the achievement of +/-3mm horizontal and +0/-5mm vertical alignment precision. Also notable was the impressive slipformed pavement output of 11,000m^3 PQ concrete at a rate of 32m^3 per hour and a grinding operation that delivered the precise finish in excess of 200m per shift.

Latest figures from First Manchester, which runs the Vantage services on the busway, show patronage continuing to grow, with 45,000 people a week now on board – almost equivalent to the population of Leigh. Since Vantage launched in April this year, it has already carried one million customers and a recent survey found that a fifth of passengers have switched from their cars – which equates to 460,000 fewer cars on the roads over a year.

Case Study:

ASHTON VALE - TEMPLE MEADS, BRISTOL METROBUS

Plans for a £29 million 50km Metrobus scheme to combat the traffic congestion experienced in Bristol are being implemented by Bristol City Council, North Somerset Council and South Gloucestershire Council. The scheme will be a combination of guided busway and non-guided sections. It will provide a high capacity rapid public transport with the aim of improving journey times, reducing carbon emissions, and supporting a better quality of life plus business growth.

Contractor Balfour Beatty is currently constructing the Ashton Vale – Temple Meads section. This will link the Long Ashton park-and-ride with the mainline Temple Meads station. This section underlines the flexibility of guided busways as part of it will be constructed as a dedicated guided busway and part will merge onto the existing road network. In the guided section, the busway will be 700m single carriageway constructed using hand laid continuously reinforced concrete pavement (CRCP) with fixed forms (upstands will be steel rails) with the troughed 2.6m cross section of each carriageway dipping into a central drain featuring a gulley every 50m. For the non-guided sections 200mm thick layers of roller compacted concrete (RCC) placed above a cement bound material base will be used for the road pavement. This is the first time that RCC has been used for a UK public highway and of offers the ease of installation advantages of flexible pavement construction plus long-term durability and reduced maintenance. The Ashton Vale – Temple Meads section is due to completed by July 2017.

Further reading

1. Guided busway design handbook, BP10, Britpave, 2006
2. Guided busway construction handbook, BP24, Britpave, 2006

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Britpave, the British Insitu Cementitious Paving Association, promotes the better and greater use of concrete and insitu cementitious infrastructure solutions. Its members include major contractors, specialist equipment and material suppliers, consulting engineers and interested trade associations. Together, they provide an important forum and voice for the infrastructure sector.

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