

LEEDS, UNITED KINGDOM

BRIEF: GUIDED BUS SYSTEM (SUPERBUS)

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LEEDS, UNITED KINGDOM

Brief: Guided Bus System (SuperBus)

CITY CONTEXT

West Yorkshire is the second largest metropolitan area in the United Kingdom, with a population of well over 1 million. It includes the cities of Leeds and Bradford and surrounding towns. Leeds is the primary city; it has jurisdiction over an area extending approximately 15 kilometers [9 miles] east to west and 13 kilometers [8 miles] north to south. Some two-thirds of the area is defined as “green open space”¹. Population exceeds 700,000. Automobile ownership was 0.391/person in 1991 and as national trends are likely to have been followed, now greater². About 14% of journey-to-work is by public transport, predominantly by bus, although bus use has been declining.

Public transport is the responsibility of West Yorkshire Public Transport Authority (WYPTA), a publicly elected body. Planning and coordination is carried out by an executive, “Metro,” staffed by experienced transport professionals. Bus services are supplied/operated by the private sector with both commercial and contracted routes; about 60% of services are subsidized. Passenger journeys (1998 to 1999) were 180 million.

PROJECT DESCRIPTION

The guided bus system (Superbus) includes five primary bus routes that follow a common alignment along A61 Scott Hall Road between the Northern suburbs and the Central Business District (CBD). The system has been operated since 1995 by First Leeds, a subsidiary of First Group, the largest bus operator in Britain³.

A guided bus system is also under construction along Route A64/A63 (York and Selby Roads) as part of the East Leeds Quality Bus Initiative.

The reported reasons for implementing the guided bus systems were the following: (1) in certain locations, the narrow width needed for guideways can save space as compared with providing extra traffic lanes, and (2) the guideways are self enforcing as queue bypasses, thereby ensuring unimpaired passage for buses.

The system uses segregated guideways with mechanical guidance at strategic locations. Exclusive continuous busway tracks are not provided for the guided buses over the full length of either corridor. The A61 has four sections of guideway totaling 1.5 kilometers [0.9 miles], and the A64/A63 will have three sections totaling 2 kilometers [1.2 miles]. Other sections of the routes are provided with conventional, with-flow, bus priority lanes and bus priority at traffic signals. Sections of guided busway track operate for 24 hours. Bus priority was considered necessary at key junctions to protect buses from traffic congestion.

A pragmatic planning approach has been adopted in developing the guideway. Busways are located both in the verge ([Figure 1](#)) and the median ([Figure 2](#)), which reflects the opportunity for construction of the track within the constraints of the highway limits and the need for frontage

and other access. (In some sections conventional bus lanes are used, which, of course, can be crossed more readily by other vehicles.)

The basic design of the busway system is the same as the O-Bahn (Essen and Adelaide). Small, lateral guidewheels are fitted ahead of both the standard front wheels of each bus and are attached to the bus steering arms; these guidewheels bear against rigid curbs that border the busway track (2.6 meters [8.5 feet] in width) and thus guide buses. The guidewheels can also be used to dock buses at conventional curbside stops outside the exclusive busway to provide gapless boarding and alighting (Figure 3). Curbs are raised slightly at stops to achieve level boarding.

Elsewhere on the route, where there is no guideway, other bus stops are also modified to provide a raised platform, as the guidewheels on the bus allow close alignment of the bus to the raised curb edge. Once again, level boarding is available.

The guideways are built alongside existing roadways leading up to intersections where queues develop. The guideways extend beyond the normal length of queues (up to 800 meters [0.5 miles]), thereby enabling buses to bypass the congested traffic. As the bus moves along the guideway, a detector linked to the traffic signal gives buses priority at the intersection. A paved block system that matches the axle width of the bus precludes use by other vehicles. The Leeds Superbus system has used Scania vehicles since its inception in 1995 and has also operated Mercedes Benz and Volvo buses. It has two park-and-ride sites, one at King Lane, adjacent to Allerton High School, with space for 150 automobiles, and a similar facility adjacent to Harrogate Road. The car parks are attractively laid out and landscaped, well lit, and have security features approved by the police.

COSTS AND BENEFITS

The unit cost of construction of the infrastructure of the Leeds one-way guideways within an existing highway including track, physical guidance, traffic signals, footways, road works and landscaping, is reported as £3,000 (US \$4,500) per bus⁴. The cost of the 10-kilometer [6.2-mile] East Leeds Quality Bus Initiative Scheme is reported as £10 million (US \$15 million) for infrastructure and £5 million (US \$8 million) to be invested in low-floor, low-emission buses. The package will be funded in partnership by WYPTA, the Leeds City Council, and the two bus operators in the corridor.

Since the introduction of the A61 scheme in 1995, the WYPTA states that the “advantages in journey time and reliability have become increasingly evident,” and, as a result, bus ridership is reported to have increased by over 40% to 50% in 4 years. Furthermore, journey times to the city center have been reduced by 10 minutes on a 30-minute journey in the AM peak⁵. Initial developments of 450 meters [0.25 miles] of outbound guideway saved up to 3 minutes per bus in the afternoon peak; and 850 meters [0.5 miles] of inbound guideway saved up to 5 minutes per bus in the morning peak⁷. Passenger attitude surveys showed positive response to service frequency, comfort, and travel speed.

IMPORTANT ISSUES/LESSONS RELEVANT TO U.S. APPLICATIONS

Several issues/lessons merge in the development of transit in Leeds that are relevant to conditions in the United States.

PASSENGER IMPACT

Although the guided busway sections are relatively short, they have been successful in improving journey speed and quality of bus service. As a result of these operational gains and the improved image of buses as a state-of-the-art mode, bus passenger volumes have increased in a generally declining market. The lesson is evident: *in developed cities with relatively high automobile ownership, busways can improve bus system service levels to the extent that the service can hold existing passengers, and attract new ones.*

INNOVATIVE FUNDING

The East Leeds Quality Bus Initiative Scheme included investment in vehicles, busway infrastructure, traffic management, and passenger facilities. The Quality Bus Initiative is financed by a public-private sector partnership with the private sector bus operators financing busway and traffic infrastructure, as well as the new vehicles, on a 50:50 basis. Two lessons stand out:

- The demonstrated success of increasing patronage of the original A61 scheme has created confidence for the private sector to invest in a busway scheme. It is reported that a similar busway arrangement is being followed in Bradford – another city in the WYPTA area.
- It has generally been a failing of busway transit that, unlike light rail transit (LRT), there has been no single promoter willing to finance complete schemes. The Leeds financing arrangements approach an LRT financing package.

PHYSICAL DESIGN AND TRAFFIC ENGINEERING

Unlike Essen or Adelaide, the busway has been introduced into existing roads. Key points are the following:

1. Although tolerances for guideway curb are stringent (track variation is 2.603 meters to 2.600 meters), they can be achieved with standard construction techniques.
2. Although guideways are not continuous, the bus guidewheels can be used to assist gapless, level passenger boarding at conventional stops outside the guideway.
3. Bus ride quality can be increased by using slip form paving for the track.
4. Center of the road busway configuration requires island platform-stops (Figure 4); although some agencies in the United Kingdom think that there could be passenger access safety issues, Leeds has experienced no problems.
5. Segregated busways ensure good compliance from other traffic.
6. Good traffic engineering is an essential support to the limited busway lengths; for example, pre-signals at the end of busway sections can provide direct and priority bus access to downstream main traffic signals (Figure 5).

JUSTIFICATION OF GUIDANCE FOR BUSWAYS

The following factors provide justification for busway guidance. First, the conventional justification for guided busways, as opposed to non-guided busways, is that they require less road cross-section width⁶. A one-way curb guided track is 2.6 meters [8.5 feet] wide curb to curb, whereas a non-guided busway would be about 3.25 meters [10.7 feet] (although 3 meters [9.8 feet] is possible where 2.6-meter [8.5-foot] buses are used). However, the curbs required for guidance and the tapered lead into the busways must be taken into account, and there is probably little in the width argument between guided and non-guided. Some sources cite the ability to support direct, level platform-to-floor boardings as the biggest advantage of bus guidance.

Guided busways have some drawbacks. These are the following: (1) they can be operated only by specially fitted buses and thus reduce the operational flexibility of a bus fleet; (2) the narrow, confined width means that in the event of broken-down buses, conventional recovery vehicles are difficult to use; and (3) a track can pose problems for pedestrians crossing a road and track.

Finally, non-guided busways can perform all the functions of a guided busway. Generally, it is considered that guided busways have little operational advantage over non-guided busways, and of course are of greater cost. However, the experience of Leeds is important; relatively short sections of guided busway have improved bus service levels and, most importantly, have raised the image of bus services to the extent that passenger demand has increased and private sector bus operators are prepared to invest in such schemes.

REFERENCES

- ¹ “Leeds Fax,” Leeds Junior Chamber of Commerce, Northern Media Group, ISBN 0953412504.
- ² These and similar data are derived from the West Yorkshire Local Transport Plan web site, namely www.westyorkshire/ltplan.co.uk/document.html.
- ³ Report on the FTA European BRT Vehicle Scanning Tour, November 9–17, 2000.
- ⁴ Metro Annual Report, Chapter TP17: www.metro-wyworks.co.uk/bestvalue/pdf/plan17.pdf
- ⁵ Guided Busway – Leeds UK: www.eltis.org/data/85e.htm
- ⁶ The remarks apply to curb guidance. Other forms of busway guidance have and are being trailed such as (i) guide-by-wire, (ii) guide-by-buried-guide-rail, (iii) guide-by-optical-recognition etc. No full-scale operational schemes as known at this stage.
- ⁷ <http://www.firstleeds.co.uk/superbus/html/howitworks.html>



Figure 1: One-way Busway Section Located in the Verge of the Highway



Figure 2: One-way Busway Located in Median of a Two-way Highway



Figure 3: Passenger Boarding and Alighting



Figure 4: Island Bus Stop-platform (Passenger Access Controlled by Subsidiary Traffic Signals)



Figure 5: Busway Pre-signals (Traffic Signals Located Some 50 m Before Main Signals)