BHLS – Bus with High Level of Service
Spectrum of Bus-Based Transit

- **High performance, high capacity BRT**
  - Major infrastructure, rapid service, intensive services
  - Up to 1 million passengers/day
  - Bogota, Guangzhou, Istanbul, ...

- **High-performance, moderate capacity BRT**
  - Major infrastructure, rapid service, strong service
  - Range 100-250,000 passengers/day
  - Brisbane, Ottowa, Beijing, Mexico City, ...

- **Bus with High Level of Service (BHLS)**
  - Moderate/little infrastructure, focus on reliability and quality
  - Range 25,000-65,000 passengers/day
  - Amsterdam, Gothenburg, Paris, ...
Presentation overview

- **Part 1: What is BHLS?**
  - Why Europe has “BHLS” rather than “BRT”
  - Extent and technical characteristics
  - Images of BHLS systems – Nantes, Amsterdam, Cambridge

- **Part 2: ITS Practice in European BHLS**
  - Main ITS systems used in European BHLS
  - Images: AVM, Traveler Information, TSP, Fare Collection, ...

- **Part 3: How is ITS used for BHLS Quality Improvement?**
  - Quality standards and targets
  - Operations management techniques
  - Mode of use and evidence of BHLS-led innovation
EU-supported action (2007-2011)
- Networking, information exchange (no money for work!)
- Focus on BHLS – state-of-the-practice
- Participants from 14 European Countries, 25 systems visited

Four working groups
- Infrastructure
- Vehicles
- Operations (including ITS)
- Social, Economic Conditions and Networking

Final report (plus CD-ROM) in late-2011
Info at [www.bhls.eu](http://www.bhls.eu) (soon also on UITP website)
Part 1: What is BHLS?
What is BHLS?

- **BHLS?**
  - Derives from French term ‘BHNS’, maybe later another name
  - Generic term for a wide range of quality bus systems
- **Is it BRT?**
  - Not exactly, a different product in the spectrum of bus priority
  - Focus more on reliability/quality than on speed/capacity
- **Holistic approach**
  - Improved operating environment – reliability, better speed
  - Higher quality vehicles with better comfort and image
  - Improved passenger facilities – stops, terminals, ...
  - Branding, marketing, ‘repositioning the product’
BHLS role in Europe

- **European Context is different:**
  - Mass transit is often already well provided by metro and tram
  - Bus is rarely assigned the ‘mass transit’ role
  - Constraints of space, roadwidth and alignment in city centres

- **European cities have a different focus:**
  - Restore reliability and operational effectiveness to bus
  - Enhance image of bus, reposition the product
  - High focus on quality of vehicles and stopping places
  - In France, focus on “urbanism” – improve host environment

- **Strategic motivations for BHLS**
  - Mostly to upgrade quality and ridership of existing bus lines
  - Sometimes alternative to tram/LRT, especially if finances tight
<table>
<thead>
<tr>
<th>Country</th>
<th>Cities with BHLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>Cambridge, Crawley, Dartford, Leeds</td>
</tr>
<tr>
<td>France</td>
<td>Lille, Lorient, Lyon, Nantes, Paris, Rennes, Rouen, Toulouse</td>
</tr>
<tr>
<td>Germany</td>
<td>Essen, Hamburg, Oberhausen</td>
</tr>
<tr>
<td>Ireland</td>
<td>Dublin</td>
</tr>
<tr>
<td>Italy</td>
<td>Brescia*, Pisa, Prato</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Alkmaar, Almere, Amsterdam, Eindhoven, Twente, Utrecht</td>
</tr>
<tr>
<td>Spain</td>
<td>Barcelona*, Castellón, Madrid</td>
</tr>
<tr>
<td>Sweden</td>
<td>Gothenburg, Jönköping, Lund, Stockholm</td>
</tr>
</tbody>
</table>
Technical Performance of BHLS

- Peak and daily ridership are comparable to many tram systems, rarely operating at full system capacity
  - 1,000 – 2,500+ pphpd
  - 23,700 – 65,000 px/day

- Commercial speed and frequency are good
  - 16 – 35 kph (10-22 mph)
  - 12-40 vehicles/hour
  - equal to or exceed that of European street tramways

- Seating ratio at peak is medium to high
  - 34-84%

- Investment cost of facility is low and quite affordable
  - $3-16.5 million/km
BRT Running Way - Nantes
Nantes – city centre stops
Nantes - vehicles
Nantes – Precision docking
Nantes – park’n’ride
Running way - Amsterdam
Station - Amsterdam
BRT running way - Amsterdam

Source: David van der Spek, Stadsregio Amsterdam
Zuidtangent at Schiphol Airport
BRT Vehicle – Amsterdam
Precision docking – Amsterdam
BHLS - Bicycle facilities

- Bike’n’Ride
- Extensive bike parking
- Amsterdam, Almere
- Bike on bus is rare
Cambridge : Busway

Source : Cambridgeshire County Council
Cambridge: Busway track

Source: Cambridgeshire County Council
Cambridge: Guide wheel for Busway

Source: Cambridgeshire County Council
Cambridge : Park’n’Ride

Source : Cambridgeshire County Council
Part 2: ITS practice in European BHLS
ITS practice in European BHLS

- **ITS is used extensively in European BHLS**
  - ITS is ‘standard’ for urban bus operations in Europe anyway
  - Many cities/operators have long experience of ITS
  - Tend towards integrated approach, attention to architecture

- **Used for a wide variety of functions**
  - AVM, dispatching, operations management, incidents, ...
  - Traffic signal priority, traffic management, ...
  - Traveller information, web, mobile, at-stop, in-vehicle, ...
  - Fare collection, ‘conventional’, EMV, mobile, NFC, ...
  - Security, CCTV, incident response, enforcement ...
  - Resource planning, optimisation, management, ...
  - Service/quality monitoring, contract mgt., payments, ...
AVM, Operations Management, Control Centres
Hamburg – AVM Control Centre
Hamburg – AVM work station
Hamburg – AVM – route screen
Paris TVM – AVMS and Ops. Mgt.

*Advanced Vehicle Management System

Source: RATP
Paris TVM – AVM control centre
Paris TVM – control center – the basic unit!
Zurich – AVM Control Centre
Zurich – AVM information screens
Prague – AVM Control Centre
Oberhausen, Germany – Control Centre
Prague – in-vehicle driver’s unit
Florence – driver’s console
Operations Support systems
Rouen, France – optical guidance system
Castellon, Spain– Optical Guidance system
Traveler Information
BHLS - Real-time information – at stops
Zurich – RTPI at bus-stop
<table>
<thead>
<tr>
<th>Ligne</th>
<th>Destination</th>
<th>Attente</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>MENDES-BELLEVUE</td>
<td>9 min</td>
</tr>
<tr>
<td>12</td>
<td>PARIS UNVUHULI</td>
<td>8 min</td>
</tr>
<tr>
<td>21</td>
<td>CARF CHANTENAY</td>
<td>5 min</td>
</tr>
<tr>
<td>23</td>
<td>MENDES-BELLEVUE</td>
<td>11 min</td>
</tr>
</tbody>
</table>

*pass primo et rapido*
*inscriptions ouvertes*
Hamburg – RTPI at bus stop

- Linie 120: Geesthacht, ZOB (1 min)
- Linie 5: A Burgwedel (5 min)
- Linie 4: Wildacker (12 min)
- Linie 109: U Alsterdorf (7:23)
- Linie 120: Zollvereinsstraße (13 min)
- Linie 5: A Burgwedel (15 min)
- Linie 5: A Burgwedel (25 min)
- Linie 120: Zollvereinsstraße (25 min)
Oberhausen, Germany – RTPI at bus stop
Jonkoping, Sweden – RTPI at bus shelter
Oberhausen, Germany – RTPI at station
Amstelveen, NL – RTPI at bus station

Source: David van der Spek, Stadsregio Amsterdam
Stockholm – destination sign
Nantes – in-vehicle RTPI

<table>
<thead>
<tr>
<th>Ligne</th>
<th>Direction</th>
<th>Correspondances à l'arrêt FOCH CATHEDRALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
<td>JULES VERNE MENDES-BELLEVUE</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>FORUM ORVAULT COLINIERE</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>GARE CHANTENAY PERRAY</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>DERVALLIERES ST JOSEPH PORT.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Time</td>
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<td></td>
<td></td>
<td>7 mn</td>
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<td></td>
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<td>10 mn</td>
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<td>11 mn</td>
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<td>4 mn</td>
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<td>8 mn</td>
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<td>13 mn</td>
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<td></td>
<td>5 mn</td>
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<tr>
<td></td>
<td></td>
<td>23 mn</td>
</tr>
</tbody>
</table>
Oberhausen, Germany – RTPI in-vehicle
Zurich – RTPI – in-vehicle

- Next stop
- Transfer routes, times
- Announcements
Paris TVM – Passenger Information

Real time passengers information on display at bus stop

RATP – Paris: flash codes have been implemented on all tram and bus stations, you can memorize the link into your mobile

Source: RATP
Rouen, France – RTPI in real conditions
Castellon, Spain – the real info?
Lund – train information at bus exit
Fare Collection
Stockholm – on-street ticket vending
Kent, UK – ticket vending machine
Oberhausen, Germany – self-service TVM
Zurich – Ticket Vending Machine
Nantes – at-stop ticket vending machine
Paris TVM – Ticket Vending Machine

Ticketing Vending Machine:
- to buy ticket (magnetic technology)
- to reload your pass (contactless technology)

Source: RATP
Paris TVM – ticket vending machine
Paris – ticket vending machine

Ticket vending machine at bus stop

- Means of payment: bank card or coins
- Slot for the ticket (magnetic ticket) and receipt
- Reloading pass (contactless)

Source: RATP
Manchester – ETM at entry
Dublin – smart card ‘target’ on ETM
Stockholm – ETM and SCV at entry
Stockholm – smart card reader
Stockholm – smart card ‘target’
Florence – smart card reader
Traffic Signal Priority, Traffic Management
Lisbon – traffic signal
Stockholm – signal aspect for bus
Zurich – traffic signal
Nantes – traffic signal priority
Paris TVM – Traffic Signal Priority

Priority announcement helping driver to adapt the speed of the bus at cross road

*Effective taking into account when it is flashing*

Announcing a change of phase when it is flashings

*Source: RATP*
Zurich – traffic management centre
Madrid – VMS at entry to Bus/HOV lane
Amsterdam – controlled bicycle crossing
Customer Services
Paris TVM – Video Security

Source: RATP
BHLS - Customer comfort - Cambridge

- WiFi on bus
- Socket for PC, phone
- Leather seats
- CCTV for security
Cambridge – in-vehicle WiFi
Part 3: How is ITS used for BHLS quality improvement?
“Reliability is the most important factor”
- Everyone tells us that RELIABILITY is key for customers
- A lot of attention in the design phase – running way, TSP, ITS, ...
- ... but how do systems make sure that is actually happens

A short survey:
- 12 active BHLS systems in Europe
- We already had system data from the field visits
- Questions focus on whether/how ITS is actively used for Ops. Mgt.

Core questions:
- What quality targets, are they bound in to contracts and payments?
- What ITS, any unique features for BHLS?
- What Operations Management techniques?
Reliability - targets

- Formal reliability targets for all 12 systems:
  - the same as for non-BHLS routes in 8 of the systems;
  - different for the BHLS in 4 cases
  - set by the relevant transport or local authority in 10 cases
  - negotiated in 1 case; based on EN 13816 in one case

- Targets are set in the service/route contracts and linked to payments and penalties (all but one case)
  - targets for the planned no. of trips or planned-kms in all cases
  - targets for on-time departures in 10 cases, and for headways in 3 cases; 2 cases do not have targets for either
  - targets for timekeeping/intervals along the route in 9 cases
Use of AVM systems

- AVM (also known as AVLC, SAE, CAD) are used by all 12 BHLS systems surveyed.
- Primary responsibility for Operations Management of the BHLS is mostly with the Transport Operator:
  - In 6 cases, the Transport Operator(s) are solely responsible to manage the BHLS operations, and do so from their own Control Centre;
  - In 5 cases, the Transport Operator(s) manage the BHLS operations from their own Control Centre, but the Contracting Authority has a monitoring role and can intervene when it deems necessary.
  - In one case, the Contracting Authority manages the BHLS operations from its own Control Centre.
<table>
<thead>
<tr>
<th>Operations Management Techniques</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional recovery time built into normal schedule</td>
<td>7</td>
</tr>
<tr>
<td>Dynamic schedule adjustment, based on ITS system analysis and prediction</td>
<td>2</td>
</tr>
<tr>
<td>Dispatch additional vehicles from the depot, if required</td>
<td>9</td>
</tr>
<tr>
<td>‘Hot reserve’ at terminals</td>
<td>2</td>
</tr>
<tr>
<td>‘Hot reserve’ at key points along the route</td>
<td>4</td>
</tr>
<tr>
<td>Turn vehicles early to fill gap in opposite direction, transfer passengers.</td>
<td>6</td>
</tr>
<tr>
<td>Instruct driver to halt at designated location mid-route to restore headway</td>
<td>6</td>
</tr>
<tr>
<td>Instruct driver to skip stops to reduce headway to vehicle ahead</td>
<td>3</td>
</tr>
<tr>
<td>Instruct driver to leave terminus out of service to a point along the route, and commence service from there</td>
<td>6</td>
</tr>
<tr>
<td>In-vehicle units to assist drivers maintain even headway, periodic adjustment</td>
<td>7</td>
</tr>
<tr>
<td>Roving maintenance staff, to carry out minor repairs and keep buses in service</td>
<td>2</td>
</tr>
<tr>
<td>Co-ordination with traffic authorities etc.</td>
<td>12</td>
</tr>
<tr>
<td>Standard operating plans for disrupted situations</td>
<td>10</td>
</tr>
<tr>
<td>Supervisor at a key point, monitoring and controlling service</td>
<td>1</td>
</tr>
</tbody>
</table>
Findings of the survey

- The ITS concepts and technologies used for the BHLS are the same as for the rest of the bus system.
  - The scale, location and means of deployment varies
  - The devices, applications, software are essentially the same.
- None of the BHLS systems indicated that there was any function or application they could not implement due to a lack of suitable ITS tools
  - note that this is different from wanting to deploy more units, or having the financial capacity for facilities they would like.
- Implementers and managers of the current generation of European BHLS considers that the available range of ITS products and applications is sufficient for their needs.
  - But this may be “from within the comfort zone”
Observations on practice in ITS for AVM

- Many of the BHLS systems are still in the early phases of ITS deployment – there is an extensive learning-curve
- No observed innovative Ops. Mgt. techniques for the BHLS
  - BHLS services are being managed the same way as other bus lines.
  - No new techniques for headway management at short intervals.
  - No visible advance in dispatcher techniques v. 20 years ago.
- We have not observed much use of advanced features of AVMS (e.g. use of dynamic scheduling, active headway management, or active transfer/connection management).
- In general, there appears to be more interest in ITS for Traveller Information services (image) than to strengthen Operations Management capabilities (quality, efficiency)
Information resources for BRT, BHLS

- ITDP – www.itdp.org
  - Review of US BRT, case studies
- EMBARQ – www.embarq.org
  - Case study materials, usage guidance, evaluation
- COST Action on BHLS - www.bhls.eu
  - Final report available 11/2011 (at POLIS Annual Conference)
- SUTP – www.sutp.org
- Volvo Centre of Excellence, Santiago – www.brt.cl
- US TRB/TCRP - www.trb.org/TCRP/Public/TCRP.aspx
- World Bank, APTA, UITP, ...
- Thredbo 12 (conference) – www.thredbo-conference-series.org