Objectives and Definition

These guidelines aim to provide practical assistance to public transport operators and public transport authorities/associations. The guidelines aim to help these entities to achieve new and suitable integration of their public transport systems in a timely and structured manner.

Public Transport Integration – What Does It Mean?

In general, integration implies the opportunity to use the entire public transport system across a local or regional area (e.g. city, conurbation) independently of transport modes, tariffs, fares, schedules, ticket systems, etc.

Public Transport Integration – Why?

Non-integrated public transport systems tend to neglect the needs of customers, which ultimately results in a decrease of ridership. In particular, the absence of an integrated public transport system causes the following problems and inconveniences for customers and authorities:

- **Comfort**: More than one ticket is needed for a single-trip ride.
- **Information**: The customer faces a non-transparent jungle of tariff systems.
- **Travel time**: Timetables and connections between operators are not harmonised.
- **Costs**: In some relations, parallel, competitive services exist.

At the beginning of any public transport integration an analysis of these issues is needed. For example, before the implementation of Verkehrsverbund Oberelbe’s (VVO) unified tariff system in 1998 a customer survey was made focusing on the question matrix below. The answers regarding the survey’s three most important criteria are listed in the same matrix.

In this case the survey showed that public transport integration is essential for customer satisfaction because customers perceive public transport as attractive if the following points are fulfilled:

- Harmonised schedules (timetables) and connections.
### Preconditions and Side Conditions

The implementation of an integrated public transport system has certain requirements. Below we differentiate between preconditions (i.e. conditions to be met prior to implementation) and side conditions (i.e. conditions to be met during the first stages of implementation).

### Preconditions for an Integrated Public Transport System

The first step is to undertake an initiative in the respective local or regional public transport area. The initiative could either come from the authority or from the majority of operators. Regardless of who takes the initiative, the political willingness to change the current public transport system into an integrated system is essential.

It is also essential to develop a common understanding of the overall public transport strategy between operators and the authority. Both sides need each other for the successful implementation of an integrated public transport system. The authority or their assigned representative sets the political and strategic framework, while operators have to realise the system at the daily operational level.

The common understanding of an overall public transport strategy should allow for long-term urban mobility planning which can be extended, where reasonable, into regional mobility planning. An essential component of mobility planning should be a general public transport plan dealing with all public transport modes as a basis for network integration.

Linking the implementation of an integrated public transport system with newly established legislation can be very helpful, especially in terms of start-up financing as well as continuous and stable funding. However, if all actors agree on a common target, no particular legislation represents a binding requirement (e.g. SPUTNIC Best Practice Case in Southern Moravia, described in the SPUTNIC Best Practices and Recommendations Report).

### Side Conditions

Parallel to the implementation of an integrated public transport system, service quality has to be harmonised between the different transport modes and operators. Tariff harmonisation assumes the harmonisation of service quality because customers expect the same quality level on all usable transport modes if they pay one and the same fare.

The development of an integrated public transport system and tariff harmonisation requires network and timetable integration (see next section). An integrated tariff system is usable only if the network and timetable of participating operators are fine-tuned and the connections between the lines function correctly. Customers must be able to use the different transport modes of several operators with an integrated ticket, as if they were using only one transport mode belonging to one single operator.

Network integration assumes sufficiently reliable services: from the customer’s point of view, service frequency makes public transport systems more attractive and efficient by providing: support to stakeholders to anticipate and prepare for emerging challenges; an overview of state-of-the-art knowledge and research; and specific guidelines and practical tools.

---

**VVO Survey**

<table>
<thead>
<tr>
<th>“HOW IMPORTANT ARE THE FOLLOWING CHANGES IN MAKING PUBLIC TRANSPORT MORE ATTRACTIVE?”</th>
<th>Very important (for x% of interviewees)</th>
<th>Important (for x% of interviewees)</th>
<th>Less important (for x% of interviewees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One ticket for all means of transport</td>
<td>44%</td>
<td>39%</td>
<td></td>
</tr>
<tr>
<td>Integrative fares for several PT operators</td>
<td>29%</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>Transparency of tariff and fares</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tickets for larger geographical areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better possibilities for ticket buying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonised schedules and connections</td>
<td>62%</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>Introduction of shared taxi services at late hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More information concerning public transport</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
transport more attractive. Savings from the reduction of parallel services can partly be used to fund more frequent services.

The timetable system has to have pre-defined changing times at main interchanges (i.e. the hub principle) to ensure the connections between the public transport services.

Public transport integration determines the infrastructure needed. Timetable and network integration requires the availability of adequate infrastructure to overcome capacity minimising timetable constraints and bottlenecks. The benefits for customers with respect to improved public transport availability and usability must out-weight the disadvantages of more frequent interchanges.

Most important is the implementation of sufficient and barrier-free interchanges between several transport modes. To realise the vision mentioned above (“one network, one timetable, one ticket, one fare – from door to door”) the chain of transportation gains much more relevance in an integrated public transport system.

Measures related to infrastructure mainly refer to the following:

- Increasing the accessibility of interchange zones and the linkage between modes. This includes Park & Ride (the installation of car park facilities with integrated tickets for both parking and the use of public transport); Bike & Ride (the installation of bicycle stands at stops and bicycle stations at central public transport stations); Ride & Walk (luggage lockers at central public transport stations and market places).
- Providing consistent and readable signage and information for the orientation of passengers within the public transport system.
- Providing additional services in interchange zones (e.g. shopping facilities). This might even create opportunities for side businesses including extra revenues for public transport operators (e.g. renting the premises to shopkeepers).

**Integration of Network and Timetable**

The development of an integrated network and timetable system needs a systematic and hierarchic approach with respect to local and regional circumstances. As already mentioned under “Side Conditions”, the framework is defined in a general public transport plan as part of a long-term urban/regional mobility planning strategy. An integrated public transport system should use the different transport modes according to its strengths. Network and timetable integration should therefore be based on the following principles:

- regional railway for speedy regional connections;
- tramway/light rail to move high numbers of passengers within conurbations;
- area services to feed rail-bound services.

According to the principles above, the network and timetable should be designed with a few but high performance backbone lines and feeder lines. All lines in the network are connected with equal interval timetables. The definition of backbone and feeder lines depends heavily on local circumstances such as the extension and character (urban or rural) of the respective public transport area, demographic facts and current transport modes. A backbone line in an integrated public transport system could be a metro line, a rapid transit railway line or a high-performance regional bus line. On the other hand, feeding lines do not necessarily have to be bus lines.

**Actors**

The cooperation and interaction of political, legal and financial representatives is crucial, especially in the design and implementation phase but also at the operational stages of an integrated public transport system. While not mandatory, it is reasonable and helpful for the start-up of an integrated public transport system to go hand in hand with a simultaneous implementation of a public transport authority/association (PTA).

Transport authorities must have a geographical competence consistent with the reality of the citizens’ mobility. Otherwise, public transport will only be fragmented and sub-optimal and will reinforce the success of individual mobility modes. Against this backdrop, regional authorities have a major role to play.

The key actors in the successful implementation of a public transport association and/or an integrated public transport system are as follows:

- politicians at both the state and municipal levels;
- administrations at both the state and municipal levels;
- operators of railway, bus and tram services.

Politicians set the legal (at least concerning financial issues) and financial framework, thus their willingness to reform the public transport organisation is crucial and denotes the first cornerstone in any public transport project.

In addition to the willingness of politicians and administrations, the public transport operators involved must be convinced that the integrated public transport system will be beneficial for them. It has to be explained to these operators that they will experience neither financial losses nor drops in the number of passengers. Political pressure, while necessary, is likely to be insufficient to convince these players to become part of the project. However, because the public transport operators are the operational and essential part of any public transport system, they have to be a genuine and confident partner in any such project.

Operators are more or less commercial enterprises, whether they are owned privately or municipally. Thus convincing these entities will involve assurances that they will not suffer financial as the result of the implementation of an integrated public transport system. In addition to transport planning advantages and advantages concerning customer orientation, the financial guarantee is the most convincing argument for operators.
**Approach**

In the following chart an abstract and basic strategic approach is defined for the implementation of an integrated network and timetable. This approach must be adapted to specific local and regional needs.

**Integration of Tariffs and Fares**

Besides network and timetable integration, a further important step in implementing an integrated public transport system is the integration of tariffs and fares. Tariff integration usually follows network and timetable integration as a second step. However, tariff and fare integration is a milestone for reducing access barriers to public transport. Ideally, tariff and fare integration should be implemented in parallel with the network and timetable integration. The benefits of network and timetable integration are significantly reduced if the customer needs several tickets and tariffs for his trip depending on transport mode and operator. The customer will only use the public transport system if he/she can use one ticket inside a transparent and easy tariff and fare system.

Network and timetable integration is complemented by tariff and fare integration: both issues have to be resolved in order to enjoy their full benefit.

Within Europe there are many examples of tariff and fare integration at several levels of implementation. The following levels of integration can be defined:

- Mutual acceptance of tickets on the same route
- Mutual acceptance of tickets within the same network
- Tariff unions (integral or for passes only)
- Public transport associations/public transport authorities

**Mutual Acceptance of Tickets on the Same Route**

This is the first and lowest level of tariff integration. Operators with services on the same route mutually accept each other’s tickets. Mutual acceptance of tickets is often feasible without complex revenue allocation, especially if both operators have approximately the same shares concerning the scope of public transport supply, the number of tickets sold and the number of passengers. Obviously, if one operator sells many more tickets than the other (thereby earning all the respective revenues) or provides far more services than the other on a common route, compensation payment is needed.

With this level of tariff integration, network integration is less important because a customer’s trip with an integrated ticket is limited to one route, usually without changing.

This integration level is suitable in cases where national and regional legislation is weak. Often operators initiate the mutual acceptance of tickets on the same route by themselves.

**Mutual Acceptance of Tickets Within the Same Network**

The next level of tariff and fare integration is the mutual acceptance of tickets not only on the same route but across the whole network of two or more operators. Depending on the extension of the network and the number of participating operators an adequate revenue allocation is indicated.

Furthermore, network and timetable integration becomes more relevant because a larger number of customers will use several transport modes and operators for the same trip. This integration level is also suitable in cases where national and regional legislation is weak and politicians are insufficiently interested in the issue of public transport integration. Operators often initiate the mutual acceptance of tickets within the same network by themselves.

**Tariff Unions**

Tariff unions are the next integration level and once again offer higher quality and comfort for customers. All operators in a specific network establish a tariff union which aims to integrate several tariffs of different operators within the same region to create a transparent and easy tariff and fare system (i.e. one ticket for all). Tariff unions are also suitable where there is no supporting national or regional legislation. Al-
though often implemented by the operators themselves, tariff unions can also be established at the request of local/regional politicians. Within a tariff union involving several operators covering a large network area, revenue distribution is undoubtedly necessary. Similar to the mutual acceptance of tickets, tariff unions can also be distinguished according to their level of ticket acceptance.

**Season Pass Tariff Union**

Season pass tariff union involves the existence of one monthly or yearly pass for all modes of public transport and all operators within the whole union area. Only regular public transport users benefit from a season pass tariff union. As a result, season pass tariff union can lead to a welcome shift in ticket sales from single tickets (i.e. irregular customers) to season passes (i.e. regular customers), thereby increasing customer retention. Season pass tariff unions are often implemented as an intermediate step on the path to an integrated tariff union.

**Integrated Tariff Union**

In an integrated tariff union all ticket types (i.e. passes, single and multi-trip tickets, etc.) are valid for all modes of public transport and all operators in the respective union area. Occasional customers or tourists as well as regular customers can benefit from an integrated tariff union. Thus an integrated tariff union is very important in attracting potential customers.

**Transport Associations**

Transport association demonstrates the highest integration level. From the point of tariff integration there is no difference between tariff union and transport association. In the latter, service integration is much more developed.

In the case where the public authority (state and/or regional government) is interested to improve PT for the benefit of the customers the authority will set the framework (legislation, financing, rules etc.) and establish a responsible PT Authority (authority initiative).

**Tariff Design**

A great deal of attention should be paid to optimal tariff design, as this stands at the forefront of tariff and fare integration. While tariffs should be transparent and reasonable they must also ensure adequate revenues for the operator. Tariff design must balance out these two objectives. If it fails to do so, the integrated tariff will collapse sooner or later. Tariffs must also reflect the different benefits and willingness to pay of different customer groups.

**Basic Objectives for Tariff Systems**

The basic objectives for tariff systems are as follows:

- Simple and clear tariff system.
- Standardized ticket assortment.
- Uniform tariff regulations.
- Constant price differences between zones (for zone tariffs).
- Limitation of price hikes at zone boundaries (for zone tariffs).
- Declining tariffs for passes.
- Linear tariffs for single and multi-trip tickets.

**Types of Tariff Systems**

Various types of tariff systems exist across Europe, each with its own advantages and disadvantages. Most systems are...
based either on the zone tariff or the kilometre tariff, which again have several sub-types and hybrids. It is important to verify which type of tariff is suitable for a specific area.

Under a zone tariff, the service area is divided into different zones. The main types of tariffs are the ring zone tariff with a centre zone, the area zone tariff with relatively large zones (see schemes below), or the honeycomb tariff with smaller zones resembling a honeycomb. In a zone tariff several stops belong to one zone. Customers have to count the number of zones they travel through to find out the fare for their journey.

Under the kilometre tariff system, on the other hand, all distances between stops within the area of the public transport service are identified and defined. These tariff kilometres form the basis for price calculation and the distance travelled dictates the fare the customer has to pay.

### Check-through and Harmonisation Losses

Before the implementation of an integrated tariff and fare system, each operator has numerous individual tariff systems. The replacement of these individual systems by a single integrated tariff system causes costs in the form of revenue losses known as check-through and harmonisation losses.

<table>
<thead>
<tr>
<th>MAIN TYPES</th>
<th>IMPORTANT TO CONSIDER</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone tariff (ring zone, area zone, honeycomb)</td>
<td>• No cutting up of political municipalities • Natural boundaries to be considered • Fair for users • Fixed zone boundaries • Identical zones for passes and single tickets • Dimensions of zones • Fare level/tariff yield</td>
<td>• Transparency and simplicity • Customer orientation • Large zones • Easy handling for operators</td>
<td>• Low tariff yield, depending on tariff sub-type • Possible large price jumps at zone boundaries; tariff regulations for mitigation leads to unwanted complexity</td>
</tr>
<tr>
<td>Kilometre tariff</td>
<td>• Fair for users • Transparent for users • Fare level/tariff yield</td>
<td>• Easy handling for operators • High tariff yield</td>
<td>• Transparency for users</td>
</tr>
</tbody>
</table>

### What Are Check-through Losses?

Example: Prior to the implementation of the integrated tariff system the customer needed two different tickets for one journey, riding first by railway and then by bus. The integrated tariff system allows this customer to use both transport modes with only one ticket. This single ticket is usually cheaper than the previous two tickets because most tariff systems use degressive tariffs (i.e. the longer the journey, the cheaper the price per kilometre travelled). This fact results in revenue losses for operators, the so-called check-through losses.

### What Are Harmonisation Losses?

Example 1: Prior to the implementation of the integrated tariff system the customer had to pay for every kilometre of his/her ride. Now the customer only has to pay for the number of price steps or fare zones passed through. This could result in lower revenues for the operators.

Example 2: Prior to the implementation of the integrated tariff system one operator was able to establish a higher price level than others. After the implementation of the integrated tariff system, however, the operator will have lower revenues due to the harmonisation of prices.
To deal with check-through and harmonisation losses and to calculate them requires an independent clearinghouse, i.e. a neutral, external entity or consultancy. Difficulties can arise if one of the public transport operators takes on the responsibility for calculating and clearing the losses emerging from the implementation of the integrated tariff system.

Public transport authorities can act as independent clearing house, especially if the authority has already designed the tariff and fare system. If know-how is needed, the public transport authority can use an experienced consultant.

To prevent operators opposing tariff integration (see above under “Actors”), the potential revenue losses outlined above are in most cases offset by the authorities – at least at the beginning of the new tariff scheme. Later on these losses should be offset by revenue increases on the back of increased ridership (i.e. more passengers, higher yield).

Revenue Distribution

The implementation of tariff unions and transportation unions introduces the issue of distributing revenues to transport operators. Revenue distribution is negligible only if there are gross cost contracts between the public transport authority and all operators. Revenues of tariff union tickets go usually into one joint “pot”. These revenues have to be distributed based on suitable criteria and schemes. Revenue distribution schemes therefore allocate the revenues from jointly sold tickets to the public transport operators who actually performed the transport service.

The main requirements/objectives for revenue distribution schemes are:

- fair distribution;
- clear definition of basic criteria for distribution;
- plausible and transparent surveys and evaluation;
- representative samples;
- justifiable effort;
- compatibility with superior requirements (or framework conditions).

There are various distribution schemes. The most important schemes today are: distribution based on previous revenues (i.e. before tariff integration); distribution based on public transport demand; and distribution based on public transport supply. The distribution of revenues is a sensitive topic because it directly affects the revenues and cost coverage of a public transport operator. In some European countries (e.g. Netherlands, Switzerland, Germany, Scandinavia) demand-related distribution schemes that take into account passenger-kilometres and the number of trips have been successfully established and accepted.

Actors

The actors involved have already been described above.

Approach

The approach is essentially similar to that under “Integration of Network and Timetable”, but with extended tasks.

### Introduction of Demand-Orientated Revenue Distribution

- **Survey of demand structure**
- **Passenger counting or automatic data collection (if available)**
- **Sales data, separation into categories**
- **Concept for demand-orientated revenue distribution**
- **Demand basic figures for revenue distribution**
- **Calculations**
- **Distribution key**
- **Revenues to public transport operators**
- **Philosophy of revenue distribution**
- **Public transport network data (stops, length)**
MARKET ORGANISATION

Approach

### Political Phase
- Consolidation of willingness of all actors
- Setting up of legal and financial framework
- Setting up of a planning entity and clearing house (preferably PTA)

### Strategic Phase
- Elaboration of tariff and fare system (design, ticket assortment, etc.)
- Elaboration of revenue allocation
- Important: Collaboration between operators and authority/municipalities
- Installation of task forces

### Realisation Phase
- Implementation of integrated tariff and fare system as completion of network and timetable integration

---

**Integration of Services between Operators**

Service integration is another pillar of public transport integration and is closely linked to the integration issues mentioned above. Service integration is important for customer satisfaction (i.e. there is only one single contact point) and includes elements such as overall passenger information, overall complaint management, overall ticketing system, etc.

Common marketing is also very important for an integrated public transport network. The customer should always know that he is not simply on a trip with one operator but that he is using an integrated system with a unified service and quality.

It is also easier for operators within such an integrated public transport system to realise cooperation strategies to improve their cost effectiveness, such as technical cooperation, strategic alliances, acquisitions and mergers.

**Other Integration Fields**

Other integration fields that could bring benefits for both operators and customers are also conceivable. These include:

- Cooperation of operators with third parties such as suppliers and advertisement companies.
- Cooperation with other mobility service providers (e.g. car sharing, bike hire).
- Cooperation with green energy and public health agencies.
- Cooperation with public transport facilitators such as tourism industry.

**Sources of Further Information**

- SPUTNIC Project, especially Best Practices and Recommendations Report (Deliverable 4) which includes the following good practice cases on public transport integration (<www.sputnicproject.eu/sputnic-products.php>):
  - Public Transport Integration in Verkehrsrerbund Oberelbe (Dresden, Germany)
  - Public Transport Integration in the Southern Moravia Region (Brno, Czech Republic)
  - OSTWIND Tariff Union (Switzerland)
  - Revenue Distribution in Integrated Tariff Systems
  - VOYAGER – Project funded by the European Community under the Competitive and Sustainable Growth Programme (1998-2002)
  - MARETOPE – Project funded by the European Community under the Competitive and Sustainable Growth Programme (1998-2002)
  - PRECO – Project funded by the European Community under the Ecos Ouverture Program
  - UITP: A Market in Motion, April 2005 (<www.uitp.org/publications>)

**SPUTNIC Contact**

- Verkehrsrerbund Oberelbe GmbH, Mr Lutz Auerbach, Leipziger Straße 120, 01127 Dresden, Germany, Tel.: +49 351 85265 33, Email: lutz.auerbach@vvo-online.de
- Rapp Trans AG, Mr Martin Ruesch, Uetlibergstrasse 132, 8045 Zürich, Switzerland, Tel.: +41 43 268 60 30, Email: martin.ruesch@rapp.ch
- VTI, Swedish National Road & Transport Research Institute, Mr Bertil Hylen, Stockholm, Sweden, Tel.: +46 855 57 70 22, Email: bertil.hylen@vti.se

**Notes**

2. See SPUTNIC Guideline on Funding and Financing
3. For example Münchner Verkehrsrerbund (www.mvv-muenchen.de)
4. For example Verkehrsrerbund Oberelbe (www.vvo-online.de)
5. For example Main-Spessart-Nahverkehrs GmbH (www.msp-nahverkehr.de)
6. For further information on revenue distribution within integrated tariff systems see the SPUTNIC good practice case Distribution of Revenues in Tariff Unions in Switzerland, in SPUTNIC report D4 (Best Practices and Recommendations).