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Transnational study on multimodal
integrated tariffs and ticketing

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(For the general introduction of this study please check D-T1.2.13)

1. Thematic transnational focus on multimodal integrated tariffs and ticketing

1.1. Contents - approach

Content of this study is partitioned to two main parts. The first part is a summary of territorial needs assessment reports on implementation and integration of tariffs and ticketing in the area. The second part refers to the best European practices on integrated tariffs and ticketing.

Territorial needs assessment has been surveyed by project partners of 10 participating regions in the Central European area:

- Province of Bozen (I)
- Friuli Venezia Giulia (FVG) Region (I)
- Veneto Region (I)
- Slovenia (SLO)
- Croatia (CRO)
- Western Hungary (H)
- Burgenland (A)
- Berlin-Brandenburg-Poland (D, PL)
- Pilsen Region (CZ)
- Győr-Moson-Sopron-Burgenland (H, A).

The results of the territorial needs survey have been collected via questionnaires filled in by local stakeholders. Reports have been elaborated for the respective regions based on the collected data. The transnational study wraps up the territorial needs on integrated tariffs and ticketing for the overall area addressed by the project. The study brings a review of common characteristics and variations in tariff and ticketing systems with focus on the systems' integration.

The second part of the study is focussed on analysis of European best practices on integrated tariffs and ticketing. The analysis provides on one hand an overview of best practices in implementation of multimodal tariff and ticketing integration in general; this involves multiple transport operators in the same transport area, regardless the transport mode. We believe that insight into integration of tariff and ticketing systems within the same transport area can efficiently be applied also in the cross-border integration models. On the other hand the already existing implementations of cross border integrations of tariff and ticketing systems are presented in operation. Cross-border integration practically stands for one or more cross-border public transport lines connecting the two neighbouring regions or countries where the same tariff and ticket is valid for the whole journey on this line or line system.

The following selected best practices indicating different level of integration and multimodality as well as technical implementation have been presented in the study:

- EuregionTicket in Meuse-Rhine Euroregion between Germany, Belgium and Netherlands
- "Region3tarif" public transport integration between Belgium and Netherlands
- Integrated PT in the border region of Geneva canton, Coppet region and France
- Malaga Area Metropolitan Transport Consortium
- Integrated Public Transport System of the South-Moravia County
- Integrated transport system in London
- Integrated public transport in Netherlands



- Integrated ticketing system in Austria
- EURO-NEISSE-Tickets
- Elbe-Labe ticket

The tariff and ticketing systems are characterised by many elements. For the purpose of this transnational study and other project documents referring to tariff and ticketing system scheme implementation have been defined:

- tariff system
 - o tariff model (based on distance, zone, combined),
 - o tariff products (type of tickets, dedicated users entitlements, ticket media discounts),
- ticketing system
 - o ticket mediums (registered paper, smart card ticket, smart card wallet, debit/credit card, print@home, mobile, ID-based-contract),
 - o sale (types of sale - ATC, ticket counter,..., in relation to a location and ticket type or medium; payment means),
 - o access to the station platform (gated, open),
 - o validation (method of validation in relation to ticket type or medium - automatic, conductor, on the platform in the vehicle; system of validation: CI, CICO...),
 - o control (method of ticket control in relation to ticket type or medium - manual, automated).

In cases where information was not available for all system elements (features of the system) the analysis was limited only to the available ones.

Level of integration of tariff and ticket systems was also assessed. Level of integration is defined by the number of integrated elements as well as by the method of integration. The more tariff and ticketing system elements have been integrated the higher level of the overall system integration has been achieved. Multimodality solutions have also been considered in the analysis.



1.2. Transnational analysis of tariff and ticketing systems in CE and level of integration

Analysis of tariff and ticketing systems in Central Europe is focussed on the regional as well as cross-border level between the Central Europe regions and countries. Analysis is based on data provided by the 10 CE regions participating in the CONNECT2CE project:

- Province of Bozen (I)
- Friuli Venezia Giulia (FVG) Region (I)
- Veneto Region (I)
- Slovenia (SLO)
- Croatia (CRO)
- Western Hungary (H)
- Burgenland (A)
- Berlin-Brandenburg (D)-Poland (PL)
- Pilsen Region (CZ)
- Győr-Moson-Sopron-Burgenland (H, A).

Data have been collected through the questionnaires answered by the relevant stakeholders engaged by the regional project partners. Based on the collected information and data, partners have elaborated for each participating region a territorial needs assessment report.

The analysis in this study brings a review of common characteristics and variations in tariff and ticketing systems in the CE area with focus on the integration thereof. The analysis is based on selected system elements that are discussed hereinafter.

1.2.1. Tariff

A tariff model determines the model to calculate a general ticket price as well as determines basic principles of the ticket use (e.g. terms of ticket use in a zone, open access). In general distance based and zone tariff models exist which can further be modified or combined depending on the specific regional situation. For tariff integration the same tariff model should be applied in the integrated transport areas as well as price harmonisation is required.

Tariff products encompass a general ticketing product and its variations issued as passes (time use discount), to particular passenger group (e.g. students, elderly...), on a particular medium (e.g. lower price for electronic ticketing mediums - smart card,...) and other.

1.2.1.1. Tariff model

Tariff model in **South Tyrol** is *based on distance* (kilometres of journey). The ticket prices are unified for the whole region. Every journey has a minimum length of 10 km. Hence, all urban routes in Bolzano and Merano, even though the distance is shorter, are considered equal to 10 km. Distances covered by cableways, Renon trains, funiculars and specific tourist bus routes are counted with a separate system featuring flat rates. The integrated tariffs of passes vary according to the km covered in a year by following the simple rule “the more you travel by PT, the less you pay per km”. Five levels are available: they go from 12 to 0 cent/km for Südtirol/AltoAdige Pass and from 10 to 0 cent/km for EuregioFamilyPass (see Table 1).



Table 1: Unit price for AltoAdige Pass and EuregioFamilyPass - depends on the travel per year

| | Rate Classes | AltoAdige Pass | EuregioFamilyPass |
|--|--------------------------|----------------|-------------------|
| 1 | From 1 to 1,000 km | 12 €cents/km | 10 €cents/km |
| 2 | From 1,001 to 2,000 km | 8 €cents/km | 7 €cents/km |
| 3 | From 2,001 to 10,000 km | 3 €cents/km | 2 €cents/km |
| 4 | From 10,001 to 20,000 km | 2 €cents/km | 2 €cents/km |
| 5 | From 20,001 km | 0 €cents/km | 0 €cents/km |
| Maximum amount in a single year | | 640 € | 530 € |

In **Veneto Region** the tariff system of extra/urban services, disregarding some minor discrepancies, defined as (some contexts and operators) a distance based tariff system. This approach is going to be further developed in the planned unification of the fare system at regional level. There are some differences between rail and bus service fares: bus services operate on 10 km distance whereas the ranges in the railways vary between 5 and 18 km (larger ranges are associated to longer trip distances). Urban and local public transport waterborne services, a part from specific cases/connections (e.g. to/from airports, island in the Venice lagoon distant from the main city centre etc.), are mainly based on zone tariff schemes (i.e. a unique zone encompassing the urban area and differentiation in terms of time validity of the ticket).

Except for urban bus where zone tariff system is applied all other modes (rail, tram, water) and territorial scope of transport service in **Friuli Venezia Giulia** use *distance based* ticket price calculation.

In **Slovenia** all urban transport applies zone tariff systems. Multiple zones are charted only in Ljubljana city transport, the other transport systems use a single zone with a flat tariff. As opposed to the urban transport all inter-urban and national transport, be it bus or railway, applies distance based tariff system. Bus and railways tariffs are mapped in different tariff classes: 5 km for bus and 10 km for railways. Integrated tariff system introduces dynamics zones that define the routes/lines that are available for a travel between origin and destination where the price is determined by the shortest available route among them.

Railways in **Croatia** apply distance based tariff system in urban, inter-urban and national level of transport. Tariff classes are variable ranging from 20 to 30 km. Public transport network of Zagreb Electric Tram is divided into five tariff zones.

Except for urban bus travel in **Western Hungary** and in **Győr-Moson-Sopron county** all modes of transport use distance based tariff system. Passenger in urban transport is obliged to buy ticket for each single ride - vehicle interchange is not possible. GYSEV railway operators use variable tariff classes; 5 km for distances up to 50 km, 10 km class up to 100 km, 20 km class up to 300 km and 50 km class up to 500 km. Above that a fixed tariff is valid.

All transport modes in **Burgenland**, Austria, including urban transport, since 2016 use so-called personal zones that are defined between origin (A) and destination (B) of the ticket route. With weekly, monthly or annual ticket the passengers can choose among the transport modes running on the routes/lines that lie within the personal zone, connecting A and B. The zone may also allow travel beyond the points A and B if defined on the personal zone map (electronic) that is created when buying a ticket.

Tariff models in **Berlin** and **Brandenburg** apply different solutions. Operators of national buses can freely select the tariff model to be used whereas national railways calculate ticket price based on distance in consideration of market conditions. When it comes to inter-urban and urban transport, a distance based system is used for regional transport and zones in the cities.

Pilsen region has integrated the area of **Pilsen** metropolitan area radiating appx. 20-50 km from the city centre. *All transport modes, buses, trains, trolley-buses and trams, passing this area, be it urban, inter-*



urban or national subject to the zone tariff system for the travels originating and ending inside the area. Ticket price for journeys partly or completely outside the **Pilsen** metropolitan area is calculated on the basis of the route distance between origin and destination.

1.2.1.2. Tariff products

Ticketing system in **South Tyrol** is based on an integrated tariff scheme applied in 6 ticket mediums. *Südtirol/Alto Adige pass* provides special price for students, older people (65+), free ticket for the people with disabilities and EuregioFamily pass. These passes are nominal and non-transferable. The *bikemobil Card* provides renting a bike and using South Tyrol's Integrated Public Transport network, including the PostBus Switzerland service between Malles and Müstair (CH). It is available for 1, 3 or 7 consecutive days. The *museumobil Card* combines museums and all means of public transport in South Tyrol and can be valid 3 or 7 days. Prepaid tickets can be bought as value cards at values of 10, 25 or 50 €. Users of prepaid tickets will save one third off the price for every kilometre of inter-city travel as well as of urban travel. Nightliners, i.e. buses that circulate only on Saturday night, have a special tariff: a ticket for the single ride costs €3.00; a ticket valid for all nightlines costs €5.00. It is also possible to buy a coupon ticket for 10 rides (cost €30.00).

In **Veneto** exist two main ticket types: *single tickets* (also carnets of 10 tickets) and various options of *period travel passes* (esp. weekly, monthly and annual). Particularly in urban transport some additional tickets are available (e.g. daily, currently tested validity on the whole Metropolitan City of Venice). Moreover, also combined tickets integrating specific services and connections are available. Specific discounts are offered to students and the elderly people. Furthermore, some specific products for touristic purposes are provided through multipurpose cards, for instance “Venezia Unica City Pass” (RFID contactless card with RFID) that provides public transport as well as touristic services to visitors and residents in the Venice area.

Transport operators in **Friuli Venezia Giulia** generally apply simple tariff product schemes with limited time and user entitlements. This is especially true for water transport where only general transferable tickets are provided as opposed to the national rail operator Trenitalia where complete variety of tariff products are available. The other transport operators in the region beside single ticket also offer at least some time period travel pass.

In urban transport users in **Slovenia** can mostly buy a single ticket or a monthly pass, except for special passenger categories with unlimited access to the transport. Full selection of period travel passes (week, month, semi-annual, annual) are available to the passengers on interurban and national transport. Carnet tickets we seen to be replaced by electronic purse (Ljubljana), while return tickets in inter-urban transport are being pushed out by the daily passes. Daily passes are already available in railway city transport in Ljubljana.

Ordinary tickets in **Croatian** national and inter-urban transport are sold as transferable in case of single and return ticket whereas monthly and annual pass can be obtained as personal (nominal). Special tickets are also available for children, students and seniors. The impaired can only buy single and return ticket at special price. In Zagreb city Public Transport Rates are adopted defining ticketing products and rates per tariff zones and tariff areas. ZET, the Zagreb tram operator provides single ticket as well as daily, monthly and annual travel pass. With implementation of new electronic tickets that fully replaced the old ones some additional tariff products have been rolled out.

In **Hungary** passengers can buy transferable single and return ticket as well as monthly and semi-annual pass. On the railways also annual tickets may be transferable. Coupon tickets are available for urban buses. In general also personal (nominal) periodic travel passes are available. All operators provide discounts for students, seniors and impaired. GYSEV also provides discounts for big families and civil servants as well as for EU and EFTA citizens above 65 years that are eligible to free travel. 3 cities in **Western Hungary** and in **Győr-Moson-Sopron counties** also provide combined city - intercity tickets. Railway passengers in **Western**



Hungary and in Győr-Moson-Sopron counties are entitled to a *discount for on-line ticket purchase*, additionally for off-peak trains running to touristic areas. Also ATC-served, e-tickets and print@home tickets are cheaper than over-the-counter sold tickets, with additional discount on long-distance routes.

Ticketing products scheme in Burgenland takes full range of products from general tickets to special entitlements for children, students, seniors and the impaired for all transport modes. Also combined city-intercity tickets are available. Single and return tickets as well as daily, weekly and monthly passes are transferable whereas annual pass is sold as personal (nominative) ticket pass.

National buses operating in Berlin and Brandenburg only provide single tickets which are at special price available for children and impaired passengers. Other transport modes beside single and return tickets also sell daily, weekly, monthly and annual passes where only daily pass is provided as personal. All university-students must buy a compulsory semi-annual pass when subscribing to the university whereas seniors only monthly one. Tickets for schoolchildren are strongly subsidised, in some areas of Brandenburg even free if there is a need to use public transport between home and school. A combined city-intercity ticket is available as a single ticket or as annual pass for combination of Deutsche Bahn with other transport modes but the national bus and free access long distance service operators.

All transport modes in Pilsen region including the integrated transport offer single ticket and semi-annual, annual passes as well as coupon tickets. Integrated transport provides periodic travel passes valid from 1 to 123 days. Passengers can also buy a combined ticket for all periodic travel passes and coupon tickets. Return tickets are only available for national and inter-urban trains. All tickets except for daily passes are also available at reduced price for children, students, seniors and the impaired.

1.2.2. Ticketing system

1.2.2.1. Ticket mediums

Bus operators in South Tyrol accept either magnetic stripe tickets (*bikemobil Card, Mobilcard and museumobil card, ordinary suburban and urban tickets*) or electronic tickets (*Südtirol/AltoAdige Pass and EuregioFamilyPass and value cards*). Trenitalia, the South Tyrol train operator, accepts paper tickets (Trenitalia official or printed at home), electronic tickets (Südtirol/AltoAdige Pass and EuregioFamilyPass), magnetic stripe tickets and tickets displayed through smart phone (with VQR and QR codes) for journeys with origin and/or destination outside South Tyrol, whereas for internal journeys only magnetic stripe tickets and electronic tickets can be used (this is valid also for SAD trains).

Figure 1: Integrated ticket mediums available in South Tyrol





In **Veneto** all transport operators provide paper tickets; however there is a growing availability of more innovative solutions. Recently UNICA VENETO smartcard has been introduced bearing different ticket types of different operators stored in the same medium. Under coordination of the regional offices, the operators share the same smart card application implemented in CALYPSO standard. In 2017 the smartcard solution has been adopted first by the Trenitalia rail operator and the Dolomiti bus operator (active in the province of Belluno). The infomobility tool DaAaB (mobile app) allowing to acquire and store e-ticket has been used at the operators directly involved in the initiative (ATVO, AVM, ATV, FAP, ALILAGUNA and MOM). With this ticketing solution a ticket inspector can verify its ticket validity simply through the screen of the user's smartphone.

In **Friuli Venezia Giulia** all transport operators provide paper tickets, either pre-printed or printed at home. Only one operator is still using magnetic stripe (inter-urban bus), whereas 6 of 8 transport operators beside ordinary paper or smart card ticket also provide "ticketless mediums" in the form of a digital (mobile app), QR code or SMS ticket. In the next 2 years it is planned for the ticketless mediums to spread over the entire regional territory.

Operators in all modes of transport in **Slovenia** accept paper tickets, except of Ljubljana city transport where only electronic tickets stored on smart card or NFC smart phone is available (users of mobile phone can also buy ticket on the bus by using voice data transfer - ref. Moneta). Also entitlement to railways transport in Ljubljana township is only stored on smart card. Smart cards are actually issued by all operators when it comes to periodic travel passes. Barcode is used mainly as a security element on general and print@home paper tickets. Some urban transport operators still use magnetic stripe tickets. A multi-application smart card has been rolled out with integration of public passenger transport in **Slovenia** in 2016, used for storing integrated tickets as well as other products of the card issuer (e.g. operator). Integrated ticket smart card application has been standardized at the IPPTA integrated public transport manager - Ministry of Infrastructure).

Railway passengers in **Croatia** can buy paper tickets or barcode tickets issued on a paper for national as well as urban and inter-urban transport. Lately also a mobile ticket is available by using a smart phone. It is planned to introduce 150.000 smart cards to replace existing paper period travel passes. Smartcards will also be additional medium for storing single tickets as well. In Zagreb city transport electronic tickets are available as addition to the paper tickets.

Railway tickets for domestic and partly for international service in the area of **Western Hungary** and in **Győr-Moson-Sopron counties** are also available in the form of digital and QR coded tickets. All bus and railway operators offer ordinary paper tickets as well.

All bus and rail tickets in **Burgenland** are available in paper. In **Burgenland** it also possible to buy barcode protected print@home and digital tickets (AnachB - smart phone), equally for all transport modes except for Micro Public Transport Systems.

In **Berlin** and **Brandenburg** area a traditional ticketing system based on paper tickets for short-term tickets is dominant whereas a mixed system of paper and electronic tickets for long-term tickets is in operation. Except for national transport by train and bus also NFC mobile ticketing is available (smart phone: "Handyticket Deutschland") in form of a single ticket or a daily pass.

National and inter-urban buses outside the integrated transport area of **Pilsen** region only use paper tickets. Urban buses, trolley-buses and trams, beside paper tickets, also provide mobile ticketing and use of bank cards whereas railway operators additionally to ordinary paper tickets also offer bar coded print@home and smart card tickets.



1.2.2.2. Ticket sale/purchase

Südtirol/Alto Adige pass passes in **South Tyrol** can only be requested on-line (https://www.sii.bz.it/richiesta_altoadige_pass/index.php?page=request.controller). These passes can be associated to a bank account or the work as a prepaid card (minimum top-up amount is 20 €). Ordinary ticket for urban areas and daily urban ticket for Bolzano or Merano can be purchased at authorised sales outlets, at the automatic ticket vendors as well as automatic ticket dispensers installed on all SASA buses. Ordinary suburban tickets are available on suburban buses, on authorised sales outlets. Value card can be bought on suburban buses, at authorised sales outlets and at the automatic ticket vendors. Trenitalia (train) tickets can be purchased online, at the Ticket Office or at Self Service machines.

In **Veneto** all main operators provide off-the counter sale of the complete products assortment, including the electronic cards, which can be purchased either from the operators ticket sale network or from the authorised sellers. The growing availability of electronic ticketing devices implies the possibility, at least for the main operators at provincial level, to roll-out on-line sales.

Except for one transport operator (water) in **Friuli Venezia Giulia** which is only selling on-board, all transport operators provide off-the-counter ticket sale of all products except of *electronic cards which can only be ordered on-line*. Agencies and subcontractors sometimes offer limited assortment of tariff products. ATC and on-vehicle sale channels are provided by all transport operators, at least for single tickets (usually). In **Friuli Venezia Giulia** 6 of 8 transport operators provide on-line ticket sales system via SMS, mobile app or website, some of them are available only with prior subscription. On-line sales are typically effectuated via credit/debit card functions; purchase via SMS is only applied for single tickets (with one operator).

All transport operators in **Slovenia** provide a counter ticket sale network through its own or contracted staff putting up complete product assortment of ticket mediums and ticket products. Smart cards can only be obtained at the counter. Automatic ticket counters (ATC) are only available in Ljubljana city transport and at the railways. Only monthly travel pass purchase and e-purse up-topping are available via ATC. The railways don't offer e-purse but make additionally available single tickets. In the vehicle it is usual for a passenger to buy paper single ticket, except in the urban transport where single ticket can be bought using e-purse on the smart card (automatically on the validation device). All interurban and national operators generally also allow renewal of ticket passes (for another period). On-line payments in **Slovenia** are currently available for period travel passes at the Slovenian Railways and some bus operators offering subsidized period passes for student. On-line purchased period passes are stored on smart cards or mobile phones. LPP (Ljubljana urban transport operator) also provides possibility to purchase a single ticket by using a mobile app or voice data transfer on mobile (called Moneta). On-line purchase doesn't affect the fares (no variation in price).

Users of railway service in **Croatia** can buy a single paper tickets at the counter, ATC, on the train and also on-line (web and mobile phone). Annual pass can only be obtained at the counter of the operator or at the other agents as well as E-card. Four ticket vending machines (ATC) are installed at Zagreb Main station and one per station in Osijek, Slavonski Brod, Vinkovci, Varaždin, Rijeka and Split allowing customers to purchase train tickets with cash or credit card. A modernization over-the counter sale is in the course involving 222 new counter terminals on railway stations and stops. All trams and buses in **Zagreb city** are fitted with ticket validation terminals where passengers purchase tickets upon selecting a travel zone for one or more passengers at once. The terminals can be operated in Croatian and four international languages. Tickets for city transport can be bought on board (1.3 €) or at newsstands (1.01 €).

All transport operators in **Hungary**, in particular **Western Hungary** and in **Győr-Moson-Sopron counties**, provide option to buy single paper tickets on all available points-of-sale. *Paper ticket is also sold in the urban transport vehicles. ATC purchase is only available for urban bus services* where users can buy any available ticket (single ticket, daily and monthly pass). Other transport providers sell periodic travel passes



over-the-counter only. Railway operators MÁV and GYSEV¹ both in **Western Hungary** and also in **Győr-Moson-Sopron counties** use common ticketing system MÁV-START that provides for on-line single ticket purchase as well. Since the end of 2017 when a discount is available for on-line ticketing a steep increase was recorded making currently around 10% of the total ticket sale revenue. On-line purchase is available for credit/debit card users and for mobile payments.

Paper tickets in **Burgenland** are available over-the counter, ATC, on vehicle and on-line. Online ticketing is available for single tickets, daily, monthly and annual pass which makes 4% of total ticket sale revenue. All tickets and passes can be purchased through all available sale channels except for the annual pass that is only available over-the-counter. Passengers in **Burgenland** can also buy tickets online against money transfer or credit card payment. In addition, paper tickets can sometimes also be purchased in the means of transport.

With exception of the smartphone ticket (sold on-line), the operators from **Berlin-Brandenburg** (VBB) sell tickets at counters or shops, via ticketing machines or bus drivers. Only in very rural stations without a ticketing machine, the railway staff on the train sells tickets. All ticket types (single ticket, daily, weekly and monthly pass) are available regardless where sold. Customers can buy tickets for the whole service area from every operator within VBB, tickets are issued exclusively through the single VBB sale system. Only the (few) open access long-distance operators on rail and road sell own tickets, which are not part of the VBB ticketing system. The selling operators are entitled to 5% or 10% commission of the sold ticket value.

All transport operators in Pilsen region provide ticket sale over-the-counter and in the vehicle. On-line purchase of tickets in **Pilsen** region is available for Pilsen city transport and several bus operators in inter-urban transport whereas interurban rail also offers ATC sale. *Smart cards can be obtained on all available selling points, also from ATC and on vehicles.* Passengers can always buy a single ticket in the vehicle, on national and inter-urban trains also daily and weekly pass.

1.2.2.3. Access to the station/platform

Access to the railway platforms and bus stations in **South Tyrol, Veneto** as well as **Friuli Venezia Giulia** is fully opened. All tickets are validated before on at the entry in the vehicle (check-in); passengers don't check-out of the system (*CI system*). For bus rides the tickets are validated on the bus. Ticket for railway rides are validated on the stationary machines at the railway stations; validated tickets are not entitlement to the platform as the stations are not gated.

Infrastructure in **Slovenia, Croatia, Berlin and Brandenburg** (Germany), **Western Hungary** and Austria (**Burgenland**) provides open access to the railway platforms and bus stops and stations by checking the passengers only with check-in control. The same is true for the urban tramway in **Croatia**.

Access to the railway platforms and bus stops in **Pilsen** region is open without the barriers - gates.

1.2.2.4. Ticket validation

In **South Tyrol** validation machines for electronic tickets are available close to every door of the bus, while magnetic stripe tickets are normally located only at the front door. A prepaid ticket - a value card used in **South Tyrol** must be stamped at the blue machines located at the train stations or on the bus before beginning of the journey. In future also digital tickets and home-printed tickets are going to be rolled out entailing the need to install additional validation devices. For railway journeys in South Tyrol also route's origin and destination needs to be entered for validation if not available on the ticket. Railway tickets need to be validated at the station through the Trenitalia machines or the public transport blue validation

¹ GYSEV uses MÁV-START information system only for over-the-counter sale.

machines. They are available also in the Austrian railway stations of Innsbruck and Lienz). The validation process varies per machine: in case of Trenitalia validation machine, it is sufficient to stamp the ticket. In case of SAD, a numeric code that identifies the destination has to be pressed.

Figure 2: Validation machines in South Tyrol



In **Veneto** bus tickets are checked-in when boarding the bus. The growing diffusion of smart and electronic ticketing solutions imply also more advanced on-board validating devices, based on contactless technology and also allowing to perform different operations (e.g. verifying the contents of the pass). Paper tickets, used on the railways are validated at fixed machines on station platforms before boarding.

All transport operators in **Friuli Venezia Giulia** except for a national train operator Trenitalia apply fixed validation device in the vehicle for a check-in (CI) validation. Trenitalia provides both - fixed machines at the station platform as well as mobile devices at the conductor. TT bus operator is the only *one still providing a conductor in urban transport*.

In **Slovenia** all tickets are issued either on the electronic medium or are digitally coded on the paper to allow machine validation and control (smart card reader/writer, barcode reader/writer). Tickets on the buses are validated on fixed validation machines at the front door or at the driver, serving also as ticket sale point in the vehicle. On the other hand all tickets at the railways are still validated by the conductor.

Ticket on **Croatian** railways are validated at the conductor. The conductors use portable validation devices for checking-in the passengers. In buses and tramways in urban transport passengers are required to validate the tickets at the entrance to the vehicle.

Validation of tickets in **Western Hungary** and in **Győr-Moson-Sopron counties** takes place in the vehicles only. On national and inter-urban buses it is done visually or with ticket purchase. Fixed validation machines are installed in in urban buses. Ticket validation on the railways is carried out by conductors.

Ticket validation in **Burgenland** is subject to check-in system. There is no electronic check-in system in the public transport in Burgenland. Tickets are visually controlled when entering the bus or tram whereas in the train tickets are validated at the train conductor.

National buses through **Berlin** and **Brandenburg** provide ticket validation in the vehicle, either visual or electronic. National railway system provides ticket validation at train conductors. For other transport modes ticket validation is supported by validation machines or sale machines issuing already validated tickets.

Passengers in **Pilsen** region need to make check-in ticket validation before boarding on the national bus. The railway operators offer validation at the conductors.



1.2.2.5. Ticket control

Tickets are periodically controlled by the ticket inspectors. Tickets are controlled by using handheld devices ready to read ticket information stored in available technology. It results in sometimes complex devices supporting many different R/W technologies. These devices may be complex and heavy to use. In general all transport providers or transport operators provide ticket control using devices capable to read the content of the ticket, otherwise the ticket is controlled visually.

Figure 3: Ticket control device used for integrated ticketing in Slovenia (smart card and 2D barcode readers)



In **Veneto** the control is carried out on-board by ticket inspectors, who mainly have to verify the validation of the ticket, already carried by the user when boarding (e.g. rail services) or before boarding (bus services) or automatically when acquiring the electronic ticket. The diffusion of smart ticketing solutions is generally accompanied by the adoption of advance controlling devices and handhelds. However, in the case of DaAaB app, the ticket inspector is in condition to verify its validity simply through the screen of the user's smartphone (hence with no need of further devices).

Ticket control in **Friuli Venezia Giulia** is secured by ticket inspectors. 7 out of 14 transport operators provide electronic ticket control. Visual control is still applied in the most inter-urban transport operations, regardless the transport mode.

On buses, railways and trams in **Croatia** only sporadic ticket controls are performed by the inspectors.

In **Hungary** ticket control on buses is mainly performed by drivers whereas railways employ inspectors giving periodic and sporadic checks of the passengers. All electronic tickets are controlled electronically - usually a customised smartphone.

Inspectors in **Burgenland** use electronic ticket control machines on railway and tram, paper tickets are stamped. The ticket control on buses is only visual.

Control of coded tickets (QR code or NFC) is machine-supported for all transport modes in **Berlin** and **Brandenburg** area. The other (paper) tickets are controlled visually.

Ticket control in interurban buses and national buses through the **Pilsen** region is done regularly by the driver on passenger's entry in vehicle. Ticket inspection on the trains and in city transport is only sporadic random control by the ticket inspectors.



1.2.3. Multimodal tariff and ticketing in Central Europe - integration

Integration of ticketing and tariff systems in **South Tyrol** has already taken place. The article 36 of the Provincial law 23 November 2015, n. 15 states that the Autonomous Province of Bolzano/Bozen encourages the integration in a unique tariff system of all public transport services operating in South Tyrol. This integration, which is valid for all owners of the *Südtirol/Alto Adige pass*, includes regional trains for routes within the jurisdiction of the Province as well as for those reaching Trento and Innsbruck, urban and long-distance buses, city buses and certain cable car lines and funiculars. The integrated system is currently in course of renovation. Integration is not limited to public transport, but it includes some important seasonal tourist infrastructures. Current *cross-border connections* from South Tyrol involve both Austria and Switzerland. Timetables are harmonized with the railway line Merano-Malles, but the integrated payment is not possible and separate tickets have to be purchased. Indeed, the bus connection from Malles to Nauders and Martina (and vice-versa), guaranteed by the provincial concessionaire SAD, is integrated into the South Tyrolean information and ticketing systems. Timetables for *AT-IT train connections* to/from Lienz and Innsbruck are harmonised; it is possible to pay with the South Tyrolean Mobility pass but tariffs are only integrated and not harmonized. Currently, Austrian tariffs are due to the ÖBB scheme, more expensive than that applied in South Tyrol. The ÖBB-Vorteilscard can be registered and associated to a Südtirol/Alto Adige Pass. For the journeys with origin or destination Lienz and Innsbruck, the reduced tariff is automatically calculated. However, with other types of tickets, the integration is not possible and a separate ticket from Brenner to Innsbruck or from Prato alla Drava to Lienz has to be bought in advance, either at the automatic machines at Brenner or in a South Tyrolean station (in this last case validation is required at the boundary station). All journeys and invoices are visible at the website <https://www.sii.bz.it/altoadigepass/>.

Veneto Region is actively committed the development of integrated ticketing and tariff at regional level. Apart from the integrated services provided by some transport operators and daily passes, the integration is mostly applied on a level of a ticket medium which lets the operators have their own tariffs and tickets. Coordinated by the regional offices, a multimodal (esp. rail and bus) UNICA VENETO smart card (CALYPSO standard) has been issued to store tickets by different transport operators (Dolomiti bus and Trenitalia in the first stage, with the idea of further spread the usage to the whole region). In Venice area the Venezia Unica City Pass is available for consuming transport as well as some touristic services. Venezia Unica City Pass is a smart card issued by AVM/ACTV transport operator. Several transport operators accept mobile tickets, including the one called DaAaB that features on-line validation which is visible to the inspector by just checking the mobile ticket stored on a smart phone. Among others, examples of the integrated service are to be mentioned are the Treviso - Venice service (jointly operated by “Mobilità di Marca” and AVM) or the integrated ticketing of rail connections provided by Sistemi Territoriali and Trenitalia with bus services in Venice. A successful case is also “Venezia Metropolitana 24” joining all lines of two main transport operators within a daily pass. The mentioned examples show the tendency to integration of tariff and ticketing systems in the region in terms of systems but also in terms of mergers of service providers.

Tariff scheme in the entire **Friuli Venezia Giulia (FVG)** region is unique within one transport mode regardless the operator. Now the region has launched an international tender to assign local public transport services (urban bus, extra-urban bus, tram and maritime services) in the whole regional territory to a unique transport operator with a single tariff and ticketing scheme. The purpose of the ongoing tender is also a start-up of innovative cross-border services through the harmonization of both timetable and ticketing services (running: Gorizia (I) - Nova Gorica (SLO) - no ticketing integration - and Udine (I) - Villach (A)). Multimodal ticketing integration (bus and maritime transport) is planned between Lignano and Merano (one operator - SAF) and train and bus integration on the route Udine - Gemona - Tarvisio (operators: Trenitalia and SAF). Another integration of tariff and ticketing has taken place in urban bus service in Grado, Lignano, Udine, Pordenone and Gorizia as well as trains from Udine to Cividale where a unique FVG CARD can be presented for the transport facilities (48-72h or 7 day pass). In compliance with the FVG regional transport plan road and rail tariff schemes will be integrated encompassing periodic travel passes in the first step. A



unified ticketing system will ensue the integrated tariff. Implementation of the ticketing integration is on a voluntary basis and controlled by the regional body.

Since September 2016 an integrated public passenger transport (IPPT) has been put in operation in **Slovenia**, encompassing complete national and inter-urban transport as well as urban transport of Ljubljana, Maribor and Murska Sobota. IPPT is regulated, controlled and co-funded by the IPPT Authority (IPPTA), provisionally organised at the Ministry of Infrastructure. Currently only students can benefit from integration but it will be extended to the passenger categories in a few months. Integration of the public passenger transport didn't bring a change to the financing model but to the fare revenue sharing (including need for a sale commission). As integrated ticket fare sharing raises income risk for the operators IPPTA has adopted solution of the transitional period where total fare revenue has been secured on the proportion of ticket sales in the selected base year (in the past). Fare revenue sharing model is still under development and testing. Integrated tariffs paid by the customer are the same whoever sold the ticket and with whichever transport operator has been used. Tariff integration in Slovenia is based on the same ticket price for the passenger and different total ticket price per operator (a temporary solution). At inception the integrated ticketing in **Slovenia** has only rolled out periodic travel passes. Single tickets will come up later, after the consolidation of fare revenue clearing. The fact that tickets at the railways are still validated by the conductor makes a big issue to catch all integrated ticket users in time for a check-in control which is needed for ticket income sharing based on the ticket use. IPPTA has made available ticket sale application, validation devices to be fixed on the buses and handheld validation devices for ticket sale/validation and control on the railways (control - also on the busses) to all transport operators giving transport (or sale) services in the integrated public passenger transport. The operators that joining the integrated ticketing system can opt between hiring the devices from IPPTA (upon availability) or to employ their own devices after passing certification procedure in compliance with IPPTA standard. IPPTA is using the existing operators' sale network points in **Slovenia** by providing its own ticket sale application at the counters and ATC-s selling the integrated tickets. The IPPTA sale application is exchanging sale data with the transaction server at IPPTA's in real-time. All tickets need to be purchased prior to boarding the vehicle. Sale commission still remains an open question to be solved.

Figure 4: Integrated multimodal ticket in Slovenia - IJPP - for urban and inter-urban (national transport) based on a smart card



In **Croatia** no unambiguously defined integral transport development policy exist. A research study for an integrated public transport tariff system on a national level was produced. The study can be considered as a first step towards an integrated transport and a unified tariff system on the city and national level. Monthly travel pass in **Zagreb** city is an inception of a ticketing integration as it is valid for all busses and trams in the city.

Integration of ticketing and tariff systems in **Western Hungary** and in **Győr-Moson-Sopron county** is scarce. Railway operators MÁV and GYSEV use common ticketing system MÁV-START that provides for on-line single ticket purchase. Also some combined tickets are available. A monthly combined pass valid for interurban buses and trains on the Zalaegerszeg-Körmend-Szentgotthárd line, Nádasd-Körmend-Szombathely and Püspökmolnári bus/ rail to Szombathely (possible combined with local bus ticket in Szombathely). Single combined ticket is also available for combination of spa entry and local shuttle bus from railway station



(Bük), then museum rail or museum entry in combination with rail (Nagyecenk), museum or ZOO entry in Győr combined with train, local buses with train in Győr, Sopron or Szombathely. Revenue for above mentioned integrated or combined tickets is shared on agreed rates. There is a plan for a nationwide integrated ticketing system in Hungary. *Integration will be based on national ID card* (issued in 2016) but until 2017 only some suburban railway lines of Budapest have adopted this option (without integration of other modes). GYSEV railway operators that operates both in Austria and Hungary provides separate tariffs for each country as determined by the countries themselves.

In **Burgenland**, the Verkehrsverbund Ost-Region (VOR) GmbH provides public mobility in the Eastern Region (Vienna, Lower Austria and Burgenland) as well as the integrated tariff and ticketing system, which is also supported by the infomobility system, online ticket shop and the app AnachB. Tariff and ticketing integration in Burgenland encompass all public transport modes. A national railway operator, the ÖBB, is included in the integration on the regional level as well.

Integrated ticketing has been established in **Berlin** and **Brandenburg** for all public services (except for long distance services) and includes all ticketing products. VBB provides a ticketing system for the entire region of Berlin and Brandenburg. Integration is multimodal and multi-operator. Passengers can use public transport with one (single) ticket which is valid for all transport modes and at all transport operators. One (single) tariff is valid for the whole transport area. Transport association VBB is authorised for ticketing and tariff integration. All transport operators should comply with the terms and conditions of the VBB if they want to get the corresponding subsidies. Revenue sharing among the participating transport operators is based on pondered combination of performed passenger kilometres (80%) and number of carried passengers (20%). Number of passengers are determined on the bases of extensive surveys run by VBB every 3 years. The ticketing system within **Berlin** and the larger cities in **Brandenburg** is zone-based. For journeys within Berlin, only two types of tickets are sold: Berlin AB for the entire city and short distance tickets for 3-6 stations (3 stations on the s-Bahn and underground network, and 6 stations on the bus and tram network). For journeys between **Berlin** and the closer suburbs, there is a zone-based system covering Berlin and a circle of 15 km around Berlin (Berlin ABC). For longer journeys and for journeys within Brandenburg the tariff is based on the distance travelled. *Currently the VBB migrates the ticketing scheme to electronic tickets.*

In order to provide competitive ticket prices for cross-border services VBB has introduced a series of **Berlin-Poland cross-border integrated tickets**. Currently VBB offers tickets for four destinations from Berlin: Szczecin, Kostrzyn, Gorzów Wielkopolski and Zielona Góra. The integrated tickets are valid for the trains between Germany and Poland in combination within the urban transport systems of Berlin and the Polish destination cities (tickets are issued by VBB, not by the operators). So with one Berlin-Szczecin-Ticket passengers can use public transport within Berlin, the train from Berlin to Szczecin and the tram or bus in Szczecin. Integration is on the level of a ticket (one ticket for the complete transport service) and on the level of a tariff (one stipulated tariff scheme for the complete service). The complete integrated ticket price (ticket is also valid in urban transport) is calculated as a reduced (fixed share) sum of national ticket fares between Berlin and the border point and between the border point and the Polish city. *Currently urban transport operators in Poland don't receive shares of ticket sale revenue (their service is complimentary).* Revenue sharing among transport operators is calculated on the basis of number of passengers and number of passenger kilometres (normal VBB basis). The Berlin-Poland tickets are available at ticket machines and at the counters of the operators in the relevant cities in Germany and Poland. In Germany tickets are sold in Euro, and in Poland in Złoty (PLN) at a fixed exchange rate. Currently these tickets are paper tickets only.

Integrated system is available in **Pilsen** metropolitan area. The integrated area encompasses only part of the region yet covering the majority of the population. It is based on electronic smart card (Pilsen card) and *integrated zone tariff for all public transport modes passing the area of transport integration* as addition to other ticket types. Users of the integrated system should register and subscribe for integrated travel



pass, valid optionally from 1 day up to 1 year. It is also planned for single tickets to take integration in the future, too, but the regional transport authority encourages regular travellers to use periodic passes. Tickets are sold via all available ticket sale channels at the transport operators. An integrated Pilsen regional information system providing on-line sales is also under development. *Access to integrated scheme is on the voluntary basis at the time but will be obligatory in the future.* Ticket revenue sharing is calculated on the agreed shares, backed-up by data on number of validations and passenger-kilometres. Until 2020 it is planned to integrate the whole Pilsen area by including also inter-urban rail and bus and local transport in smaller townships in the region. *The integration based on electronic card will provide better insight in transport demand in order to have better transport planning of future public transport.*

1.2.3.1. Findings

Advantages

- In many CE regions ticketing integration has already been implemented (South Tyrol, partially Veneto, Slovenia, Burgenland, Berlin-Brandenburg, Pilsen, FVG) the others plan to implement it.
- Cross-border ticketing integration has been implemented only in some cases (IT-A, D-PL, H-A) and also only partially.
- Integrated ticketing in South Tyrol also includes seasonal tourist infrastructures - additional offer.
- Online user account is associated with integrated ticketing based on e-card (South Tyrol); this is important for post processing - ticket price is lower if a passenger has recorded more passenger kilometres.
- Integration in FVG, and in the Venice area (Veneto) is also possible through a tourist card that besides other tourist services also includes public transport.
- Multi-operator, multimodal and multi-application e-card "IJPP" for using urban and inter-urban transport and based on unified tariff in Slovenia is only available for students.
- Zagreb city transport has rolled out a unified ticket for all modes of city transport.
- ID card is planned to be used in Hungary a means of ticketing integration on a nation-wide level.
- Burgenland as well as Berlin-Brandenburg provide multimodal and multi-operator tickets within one transport system; the systems are integrated by using combined tickets (urban - inter-urban).
- Majority of integrated ticketing systems are based on electronic means; Brandenburg is planning to transfer from paper to e-ticket as well.
- Passengers using Pilsen chip card can use all public transport modes that participate in integrated scheme on equally basis; in the integrated area all vehicles become included in zone tariff system.

Weaknesses

- Use of integrated ticketing systems is often limited: confinement to the area (Pilsen, FVG), to selected tariff products or to specific ticket media holders (e-card).
- Cross-border integration is mostly limited to combined tickets where total price is calculated by summing prices based on separated national tariffs (South Tyrol to Austria, Berlin-Brandenburg to Poland).
- Ticket validation at conductors on the train is not suitable where check-in ticket validation is required for integrated ticket revenue sharing.
- Integrated tariff prices in Slovenia are unified for the passengers but the actual full ticket prices for operators (mainly bus and train) are different (balance is paid by PTA).
- In Hungary only selected (bus or train) inter-urban lines provide multimodal combined tickets with a local bus system.
- Integration in Burgenland and Berlin-Brandenburg is based on paper ticket; revenue sharing is based on a model using regular on-field ridership surveys.



Transnational study on multimodal integrated tariffs and ticketing

- Ticket revenue from cross-border integrated transport between Germany and Poland involving train transport between the countries and city transport at origin and destination is not shared with Polish operators for administrative hindrances in international financial clearing (with the integrated ticket the passengers can use the relevant Polish city transport).
- High number of transport operators (e.g. in Veneto Region) needs good coordination of integration initiatives.



Transnational study on multimodal integrated tariffs and ticketing

Table 2: Analysis of CE tariff and ticketing systems integration

| IPTS - Integrated Public Transport System | | | | | | | | | |
|---|---|-------------|-----------------------|----------|---------|-----------------|---------------|--------------------|--------|
| CE regions | | South Tyrol | Friuli Venezia Giulia | Slovenia | Croatia | Western Hungary | Burgenland | Berlin-Brandenburg | Pilsen |
| Elements | | | | | | | | | |
| 1. | Transport system included in integration | | | | | | | | |
| | - cross border | ✓ | | | | | separ. tariff | ✓ | |
| | - national | ✓ | mode lvl | students | | | ✓ | | ✓ |
| | - inter-urban (regional) | ✓ | mode lvl | students | | line lvl | ✓ | ✓ | ✓ |
| | - urban (city) | ✓ | mode lvl | students | ✓ | cmbnd tckt | ✓ | ✓ | ✓ |
| 2. | Level of integration | | | | | | | | |
| | - multi-operator | ✓ | | ✓ | ✓ | ✓ | region | ✓ | ✓ |
| | - multi-modal | ✓ | | ✓ | ✓ | ✓ | region | ✓ | ✓ |
| 3. | Integrated tariff model | | | | | | | | |
| | - zone system | | | ✓ | ✓ | | | urban | ✓ |
| | - distance system | ✓ | mode lvl | ✓ | | | cross-border | inter-urban | |
| | - combined zone-distance system | | | | | | ✓ | | |
| | - combined inter-urban&urban/special | | tourist crd | | | cmbnd tckt | | ✓ | |
| 4. | Ticket medium | | | | | | | | |
| | - contactless e-card | region | tourist crd | ✓ | ✓ | | | | ✓ |
| | - contactless payment bank cards | | | | | | | | |
| | - mobile phone (app, SMS, MMS) | | ✓ | NFC | | | | ✓ | |
| | - paper ticket with a bar code | | ✓ | | | | ✓ | | |
| | - paper ticket | crs-brdr | ✓ | | | ✓ | ✓ | ✓ | |
| 5. | Integrated tariff products | | | | | | | | |
| | - single ticket | ✓ | ✓ | | | ✓ | ✓ | ✓ | |
| | - return ticket | ntnl rail | ✓ | | | ✓ | ✓ | ✓ | |
| | - daily pass | urban | ✓ | | | | ✓ | ✓ | ✓ |
| | - weekly pass | urban | ✓ | | | | | ✓ | ✓ |
| | - weekend pass | | | | | | | | ✓ |
| | - monthly pass | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | - semi-annual pass | | ntnl rail | ✓ | | ✓ | | | ✓ |
| | - annual pass | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | - coupon/carnet | | ✓ | ✓ | | | | | |
| | - pay-as-you-go tickets | | | | | | | | |
| | - e-wallet | | | | | | | | |
| | - group ticket | | | | | | | | |



Transnational study on multimodal integrated tariffs and ticketing

| IPTS - Integrated Public Transport System | | | | | | | | | |
|---|------------|-------------|-----------------------|----------|---------|-----------------|------------|--------------------|--------|
| Elements | CE regions | South Tyrol | Friuli Venezia Giulia | Slovenia | Croatia | Western Hungary | Burgenland | Berlin-Brandenburg | Pilsen |
| - employee pass | | | | | | | | | |
| 6. Integrated ticket discounts | | | | | | | | | |
| - passenger status (adult, student, apprentice, child, senior, group, disabled) | region | | ✓ ntnl rail | | ✓ | ✓ | ✓ | ✓ | ✓ |
| - loyalty/membership cards | crs-brdr | | | | | | ✓ | | |
| - ticket media (e-card, bank card, mobile app) | | | | | | | | | |
| - type of sale (on-line, mobile app) | | | | | | | | | |
| - time of the journey (off-peak hours, weekend) | | | | | | | | | |
| - total kms collected in a year | ✓ | | | | | | | | |
| 7. Types of sale | | | | | | | | | |
| - ticket counters | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| - on-line | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| - mobile app | | ✓ | ✓ | | | | | | |
| - via SMS | | | ✓ | | | | | | |
| - prepaid-card | | | | | | | | | |
| - ATC | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| - on vehicles | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| 8. Station platform access | | | | | | | | | |
| - open access | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| - gated access | | | | | | | | | |
| 9. Ticket validation method | | | | | | | | | |
| - "check in - check out" system | | | | | | | | | |
| - "check in" system | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| - visual | crss-brdr | | | | | | | | |
| 10. Ticket validation procedure | | | | | | | | | |
| - validation machines on vehicles | regional | | ✓ | bus | ✓ | ✓ | rail | ✓ | ✓ |
| - validation machines on stations | | | ntnl rail | | | | | | |
| - conductor on the vehicles | ✓ | | ntnl rail | rail | | ✓ | rail | rail | ✓ |
| 11. Ticket control | | | | | | | | | |
| - electronic control | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| - visual | crss-brdr | | ✓ | | | ✓ | ✓ | ✓ | |



1.3. SWOT analysis and findings on integration of tariff and ticketing in CE

1.3.1. Findings

Findings from the analysis of the current state on tariff and ticketing in CE area that are presented below are classified in as advantages and disadvantages from the perspective of future integration of the systems and may be considered differently if another criteria were applied. The findings are presented per system elements.

1.3.1.1. Tariff models

Tariff models in interurban and national transport in the CE regions are exclusively based on distance, zone model tariff model is only applied in the bigger townships and cities where multiple interchanges among vehicles are usual and journeys are not strictly in one direction. Below are the main findings drawn from the analysis of the existing tariff models in CE regions:

Advantages

- All regions apply either digressive price per kilometre or progressive tariff classes in terms of distance - the price is capped at defined distance.
- Mainly all regions apply zone system in urban areas - can be extended to regional level.
- South Tyrol and Croatia apply very large tariff (distance) classes in order to flatten the integrated tariff scale (20 km - 30 km).
- Tariff scale in South Tyrol is variable; the price for the same ticket depends on the number of kilometres a particular passenger has travelled in one year: after reaching a set kilometre threshold the next purchased ticket is cheaper; 4 km thresholds are defined.
- Integrated distance based tariff model in Slovenia applies the shortest distance between origin and destination considering all available public transport modes - sometimes the distance is defined administratively.
- Integrated distance based tariff model Austria and Slovenia defines dynamic zones calculated on ticket origin and destination points; ticket is eligible to use on any public transport line running through the particular dynamic zone.
- In Pilsen region an integrated zone tariff model is valid for all transport modes and systems (urban, inter-urban and national) operating the area of integration.

Disadvantages

- Tariff products which are pending to be integrated often use different tariff models and tariff classes per transport modes - example: interurban buses and trains in Slovenia use different tariff scale.
- In Western Hungary and Győr-Moson-Sopron county also urban transport systems use distance based tariff model.
- National buses passing Berlin-Brandenburg can freely select the tariff model.
- Coexistence of integrated and non-integrated tariff models for the same area in many regions - may be ambiguous for the users.

1.3.1.2. Tariff products

The basic observation of the tariff products is that the operators apply comprehensive schemes of products for protected groups of passengers and time passes. Beside those some innovative products, related to mode of purchase or ticket medium, were rolled out to give incentive for more efficient ticketing system use:



Advantages

- Most of the regions provide combined inter-urban and urban tickets or some discounts.
- Integrated Südtirol/Alto Adige ticket products range is reduced to cover the most frequent user needs.
- South Tyrol encourages use of value cards (pre-topped e-purse) by lower ticket price purchase.
- Majority of transport operators offer time period travel passes - easier to control in integrated system.
- Integrated city transport in Zagreb was able to new custom-designed tariff products with implementation of electronic ticketing.
- GYSEV offers free ride to all EU passenger aged above 65 years.
- Passengers in Western Hungary and in Győr-Moson-Sopron are entitled to a discount for on-line and ATC ticket purchase and e-tickets.
- All students in Berlin & Brandenburg should by long-term ticket pass when subscribing to university.

Disadvantages

- Integrated tickets in South Tyrol are only valid up to 7 days.
- Train operators mostly use very detailed product schemes; also inter-urban and national operators use more detailed schemes to the urban operators.
- National busses in Berlin & Brandenburg only provide single and return tickets.
- Operators keep a single ticket as a basic ticketing product - could be replaced by daily ticket.

1.3.1.3. Ticket medium

Ticketing mediums are diverse in all regions. Paper tickets still remain the ground for ticketing integration, at least in the initial phase but with printed barcode protection giving also possibilities for further extension to mobile ticketing, as shown in findings:

Advantages

- Most of the regions have at least partly implemented e-ticketing or mobile ticketing or are planning to do so - bringing experience for users and providers.
- All cross border operators offer paper tickets - making it an obvious first step for other ticketing integrations.
- Many operators provide print@home tickets - suitable for integration of transferable (non-nominal) tickets.
- QR² code or other 2D bar code is already used in Friuli Venezia Giulia, Slovenia, South Tyrol, Hungary and Burgenland.

Disadvantages

- Some operators still use obsolete magnetic stripe tickets (South Tyrol, Slovenia) which need to be replaced.
- Operators in Berlin-Brandenburg use electronic tickets only for long-term passes but renovation of ticketing systems is pending.

1.3.1.4. Ticket sale

Ticket sale in CE is versatile, especially in urban transport but over-the-counter sale is still kept with all operators although a share of on-line sale is growing. All sale channels are electronically supported. Detailed findings are available below:

² International Railway Union (UIC) has standardized 2D ticket barcode, called AZTEC code (UIC leaflet 918-2), to promote a Universal Rail Ticket (URT) - some railways have already applied it: NS, SNCB and Eurail Group, ZSSK.



Advantages

- All transport operators have electronic support for ticket sale
- Practically all transport operators provide over-the counter sale.
- In South Tyrol users can link their period travel passes to a bank account - subscription - automatic charging.
- In South Tyrol a back-office system is applied, based on user account, where digressive ticket price is charged based on total kilometres travelled in the past period
- Very often period passes are issued on electronic cards.
- In most regions at least some transport operators provide ATC - especially for urban transport where they may also be available inside of buses.
- A step to integration of ticketing systems is also integration of sales channels which is taking place in Hungary.
- A significant rise of on-line sale has been recorded in Hungary and Burgenland; based on price promotion.
- In Pilsen region smart cards used in integrated transport can be obtained through all sale channels, also in the vehicles.

Disadvantages

- Electronic ticketing cards in Friuli Venezia Giulia can only be ordered on-line.
- Urban transport of Ljubljana (Slovenia) only offers e-card and mobile ticketing - issues for occasional and less adaptive passengers.

1.3.1.5. Access to stations

Access to stations and railway platforms in CE regions is open, as given by the analysis:

Advantages

- All transport systems in the CE regions provide open access for passengers to bus stations and railway platforms.

Disadvantages

- All systems provide check-in control only - users are asked to validate tickets on every vehicle interchange - no automatic check-out system is available.

1.3.1.6. Ticket validation

Although paper tickets, which are controlled visually, are still very often used all regions provide also electronic ticketing where tickets are controlled electronically and thereby allow automatic detection where the ticket was used. The main issue is co-existence of many ticket technologies that entail installation of several validation devices on the same validation spot.

Advantages

- In all regions some electronic tickets are available which consequently needs electronic ticket validation - experience and availability of validation devices.
- In urban and interurban transport, validation is usually done on fixed devices in the vehicles or on the platforms, regardless the transport mode.

Disadvantages



- For national rail transport tickets are validated by conductors which cannot perform check in control on passengers' boarding.
- Result of different ticketing technologies applied at some operators is need of having more validation devices fixed in the vehicles (South Tyrol...) which is disturbing for the passengers; using different validation devices for using the same ticket may imply different validation procedure (e.g. MI.CO.TRA integration).
- In Friuli Venezia Giulia (TT bus operator) conductors validate tickets.
- Visual ticket validation (paper tickets) is still prevalent on trains.

1.3.1.7. Ticket control

Ticket control is done sporadically, mainly on the transport systems where automatic ticket validation is implemented or it is carried out by the conductors.

Advantages

- Most transport operators provide some sort of sporadic ticket inspections - ticket control and control if tickets have been validated if required so.
-

Disadvantages

- In the environment where multiple ticket mediums are offered by transport operators, the controllers need to carry heavy handheld devices supporting multiple R/W ticket technologies.
- Only visual paper ticket control is still applied in most inter-urban transport operations.

1.3.2. SWOT analysis of integration of tariff and ticketing systems for cross-border implementation

SWOT analysis reflects on the situation of implementation of tariff and ticketing systems in CE from the perspective of impact to the implementation of extension of cross-border systems' integration.

Table 3: SWOT analysis on tariff and ticketing - cross-border integration

| Strengths | Weaknesses |
|---|--|
| <ul style="list-style-type: none"> - at least partial tariff & ticketing integration has been applied in most regions, also cross-border integrated service - many tariff model are already "flattened" (not strictly distance based) - most operators already use various time-based travel passes which are suitable for integration - most of operators use combined tickets which can form a basis for integrated ticketing - use of QR codes (AZTEC) for paper tickets by many operators makes a suitable technology for development of integrated ticketing - strong over-the counter sale network - integration is usually supported by electronic means (e-card) | <ul style="list-style-type: none"> - integration doesn't cover whole areas (Pilsen), all passengers (Slovenia), all products - national operators, particularly in railway transport, have very complex tariff scheme - needs to be simplified and harmonised with other transport modes - use of electronic purse is bound by banking laws which need many registrations and may be difficult to provide especially for cross-border operations - ticket validation at the conductors (trains) is not efficient - ticket validation cannot be complete in peak-hours; no check-in control available |



| <ul style="list-style-type: none"> - open station access in all regions allows easier expansion of ticketing systems without investments to gates - ticket validation machines are mostly fixed within the vehicles - transport operator can operate them without additional interventions on station infrastructure - most of the operators have experience with e-ticket validation | |
|---|---|
| Opportunities | Threats |
| <ul style="list-style-type: none"> - simplification of some product schemes can lead to simplified integrated product schemes - intermodal integration will replace some obsolete tariff products (return ticket > daily pass) - promotion of periodic travel pass use - supports integration - uniformly available open station access may be opportunity for implementation of modern CICO technologies (e.g. BLE) - implementation of on-line user account allows additional ticket sale options (subscription) and better pricing (value cap) - the existing handheld ticket control devices could be used in integrated system after being upgraded - combined cross-border tariffs should be unified and integrated - separate tickets for cross-border lines need to be replaced by integrated ticket - multi-application e-tickets can offer additional services to the integrated transport (e.g. parking) - the existing parallel over-the-counter sale can be consolidated and optimised - e-cards issued by individual transport operators will be replaced with unique e-card (consolidation of number of e-cards) - the existing automatic ticket dispensers on the vehicles can be used after HW&SW upgrade - ATC sale which is limited to one transport operator can be extended for integrated ticket sale for the whole system - adaptation is needed - mobile ticketing applies various tickets (NFC, bar code: 1D, QR,..., MMS, SMS) - adaptation needed | <ul style="list-style-type: none"> - prevalent offer of single (directional) tickets makes tariff “flattening” more difficult - integrated e-tickets may be an issue if the technologies of the integrating stakeholders are not compatible - bank account ticket link - subscription model - may be hard to implement in international legal environment - handheld ticket control devices for sporadic ticket control need to be taken into ticketing integration budget account - ticketing integration on multiple ticket mediums could harm easiness of ticket control - administrative hindrances in international financial clearing of ticket revenue - use of paper tickets without electronic validation can be obstacle for ticket revenue sharing and transport planning based on ticket use (detection of interchanges) |



1.4. Highlighted best practices on tariff and ticketing integration

The best practices on tariff and ticketing integration that are highlighted in the following analysis were selected to support transport authorities and transport operators draw from the gained EU experiences in order to integrate services in the cross-border areas of CE. Most of the investigated area is rural with dispersed population but there are also urbanised islands and even the townships that lie on both sides of the border. The implemented practices on transport integration should therefore address wide spectrum of situations.

The initial criterion to select the highlighted EU best practices was a successful implementation; all the analysed systems are in full operation. Here we haven't evaluated a success of implementation in terms of return of investment, ridership increase, passenger satisfaction or impact on cross border migration in number of passengers or transport mode.

Our focus was to cover different elements and levels of integration in order to see different approaches in tariff and ticketing integrations brought by the best EU practices. In pursue of this goal the highlighted best practices encompass different level of geographical integration (national, regional, city), different level of transport systems integration (urban, inter-urban and national transport), multimodality, multi-operators, level of ticketing system integration (e.g. only integrated tariff) as well as different approaches to the integration (e.g. border to border tariff integration).

Although some highlighted EU integration practices only refer to one country or region they still cover the key integration elements can easily be transferred to cross-border application in the investigated CE areas.

1.4.1. EuregionTicket in Meuse-Rhine Euroregion between Germany, Belgium and Netherlands

Meuse-Rhine Euroregion is a Euroregion created in 1976, with around 3.9 million inhabitants around the city-corridor of Aachen-Maastricht-Hasselt-Liège. The Euregio Maas Rhein (Belgium-Germany-Netherlands) started developing a far-reaching and integrated system for cross-border public transport in 2003 involving the construction and planning of public transport infrastructure and also for selling cross-border public transport services. One of the important parts of cross border PT integration was establishment of daily passes for different PT transport modes.

EuregionTicket is a fixed price **tariff system** which only operates within the scope of one zone divided between three countries. Ticket is valid only for specific public transport (train, tram, bus) within the Euregio (Liege-Limburg-Aachen and Maastricht).

EuregionTicket only offers one **tariff product**. One day ticked is valid on weekdays for 1 person in 2nd class on trains. It is also valid on Saturdays, Sundays and bank holidays for a maximum of 5 people. In this case it is valid for 2 adults + 3 children under the age of 12.

Ticket medium

Euroregion ticket is only available as registered paper. Also online purchase and printing ticket at home is available.

Ticket sale and purchase

Service of Meuse-Rhine Euroregion ticket is provided from different transport providers which operate in different countries. In Belgium tickets are sold from PT operators NMBS/SNCB, De Lijn, TEC Liege and Verviers, in Germany from PT operators DB, Aachener Verkehrsverbund and district Euskirchen and in Netherlands from PT operators NS and Arriva. There are different sales points of the Euregio tickets depending on the operator. The Euregio ticket issued by SNCB is sold at the counters of the main train



stations through which Euregio integrated ticket is valid. Other operators also offer purchase of ticket at the bus drivers on certain bus lines.

Access to the station/platform

Access to the railway platforms and bus stations EuregioTicket is fully opened. All tickets should be validated before on at the entry in the vehicle (check-in); passengers don't check-out of the system.

Ticket Validation

For the ticket issued by SNCB, the validity date is indicated on the ticket. For the ticket issued by other participating transport companies, the validity date does not appear automatically on the ticket. In this case, to be valid, the ticket must be stamped with the bus driver or with the automatic validation machines, before using the PT. Person traveling with a PDF ticket (online ticket only issued by the "Aachener Verkehrsverbund"), must be able to show valid ID.

Sources:

- 1) <http://www.belgianrail.be/en/travel-tickets/abroad/aachen/euregio-ticket-aachen.aspx>
- 2) <http://www.belgianrail.be/en/travel-tickets/abroad/aachen/~media/DFAE0748723446CCA1B4268C7E2CCAA7.pdf>

1.4.2. "Region3tarif" public transport integration between Belgium and Netherlands

In order to improve cross border commuting obstacles consortium of transport operators between Belgium and Nederland developed "Region3tariff" integrated public transport service. System makes use of modern technologies in the field of ticketing and addressing customers and at the same time shows improvement of local public transport services for all demand groups especially considering leisure time traffic.

Tariff model

Cross border PT "Region3tarif" operates as a zonal system with three zones divided among the participating countries. All PT products are defined according to the zones in which PT takes place.

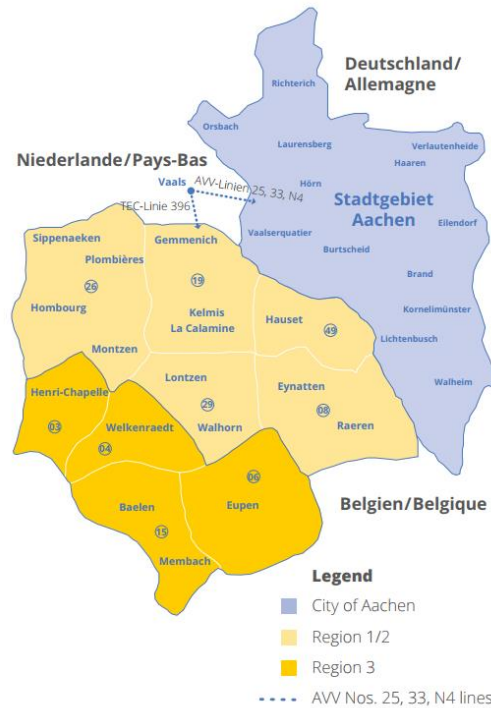
Tariff products

Ticketing products scheme between Belgium and Nederland takes full range of different products which can vary from general tickets to special entitlements for children (between 6 and 14 years of age), students (school age children, trainees and university students) and seniors. Single and day tickets are available and also monthly and annual passes can be bought. Prices depend on the number of zones travelled.

Ticket mediums

Before the travel, passengers have to take into account that the Province of Limburg an electronic chip card, called OV-chipkaart. Users can purchase anonymous chip card at ASEAG customer service centre (KundenCenter) in the Aachen Central Bus Station, the ASEAG ticket office in the Aachen Central Train Station, and the DeutscheBahn office in the Herzogenrath railway station. Users can also buy a non-transferable OV-chipkaart, for which they can add credit to their personal card's balance by credit card or PayPal.

Figure 5: Operating zones of “Region3tarif” cross border PT integration



Ticket sale and discounts

Depending on the ticket type and PT operator in specific country there are different ticket sales options. Single and day tickets can be purchased at the sales points of the PT operators (e.g. ASEAG, RVE, TAETER, TEC). TEC transport operator also sales tickets on public transit vehicles and ASEAG PT operator offers ticket also from vending machines.

Monthly/annual passes and fare supplement tickets for school-age children and university students are available for sale at the ASEAG and TEC customer service centres. Holders of AVV-Job-Tickets can receive fare supplement tickets from their respective employer. Fare supplements and discounts are mostly dependent on the ticket type and are given at the main service centres. Some operators also offer smartphone apps for ticket purchase.

Holders of a monthly or annual region3tarif pass (adults) can travel with one other adult and up to three children under 15 years from 7 p.m. in the evening and on weekends and national holidays in the respective zone at no additional price.

Children under 4 years travel for free on cross-border journeys. Children 4 to 14 years need to purchase a child's fare (25 % discount). Dogs travel for free. Weekly and monthly passes (adult) are transferable.

Ticket validation

Ticket has to be validated before beginning of the journey if they were purchased in advance for specific date.

Sources:

- 1) https://avv.de/de/service/downloads?file=files/.../tickets_in_der_emr_englisch.pdf
- 2) https://www.infotec.be/Portals/0/TEC%20Li%C3%A8ge_Verviers/PDF/Eynatten.pdf
- 3) <http://euregiobahn.de/de/aktuelles/neuigkeiten/neues-im-region3tarif>



1.4.3. Integrated PT in the border region of Geneva canton, Coppet region and France

In order to improve cross-border commute, seven most important transport companies in the canton of Geneva, the Coppet region and the border areas of France have joined under the Unireso fare network. In the year 2009 Unireso became an umbrella organization for a common tariff system for a network of various modes of public transportation in and around Geneva, Switzerland. Eight networks and transport companies are partners in the tariff community: the railway companies SBB and SNCF, river shuttles of Geneva taxi service, three urban networks concerned TPG (Geneva), TAC (Annemasse) and TPN (Nyon) and French bus companies SAT (Transdev) and Alp'Bus (RATP Dev).

Tariff model

Unireso cross border PT operates as a zonal system divided into ten tariff zones: five of them are located in Switzerland (one of which is cross-border) and the other five are located in France.

Tariff products

Unireso public transport network aims to simplify travel within and between described geographical zones by offering the following two tariff products:

- one single price plan: simple and consistent product valid for the entire zone and all modes of public transport offered by the partnering companies;
- one single ticket valid for the geographical zone covered by the network and with possibility to use the 4 modes of transport offered by the network's public transport operators: bus, tram, train and boat. The single UNIRESO ticket is valid for bus, tram, lake boat and local train falling within given Unireso zone. The most common ticket is valid for 60 minutes and is transferable (CHF 3). Alternative is short 3 stops ticket (CHF 2).
- Subscriptions tickets: weekly, monthly and yearly exist. Subscriptions within zone 10 may be anonymous and transmissible to another person. The regional annual subscriptions, including short travels, cost the equivalent of ten monthly subscriptions, while yearly subscription for zone 10 cost little more than for seven months.

Ticket mediums

Depending on a purchase location passengers in unireso system can buy paper tickets or travel card issued for urban and inter-urban transport. Lately also a mobile ticket is available sending SMS using a smart phone. Single tickets can also be used on prepaid card (Cart@bonus) which can be bought and uploaded on newsstands, supermarkets and in TPG agency. Passenger can buy Cart @bonus in prices of 20, 30 and 50 CHF and use it at the ticket machine to buy your ticket without any need of using the coins.

Sale system

Single tickets can be bought at the ticket machines (using coins, and offering no credit cards), located at every bus or tram stop in the city and inside the buses going outside of the city. As there are no ticket machines in the city buses, passengers should buy your ticket at the stations before the vehicle comes. The zone system applies for all travel cards in the entire unireso network area. The zone plan shows you how many adjoining zones (areas) you must pay for to go from your start to final destination.

Access to the station/platform

Stations and platforms are normally accessible since the ticket validation is performed before the transport. Validation is performed from random control checks performed by personnel of PT company selling the ticket.

Sources:

- 1) <http://www.unireso.com/fr/bons-plans-unireso-famille>
- 2) <http://unireso.com/en/tarrifs-plan>

1.4.4. Malaga Area Metropolitan Transport Consortium

Short description

The Malaga Area Metropolitan Transport Consortium was set up on the 18th of September 2003 as an associative Public Law Body comprising the Andalusian Regional Government, Malaga Provincial Council and the local councils of Malaga, Mijas, Benalmadena, Rincon de la Victoria, Alhaurin de la Torre, Alhaurin el Grande, Cartama, Pizarra, Almogia, Colmenar, Casabermeja and Totalan.

The initial aim of the Consortium was to establish economic, technical and administrative cooperation among the member authorities, thus enabling them to fulfil their responsibilities in terms of the creation and management of transport infrastructure and services in their respective areas in a collective and coordinated manner. One of the goals of the Consortium was the establishment of the introduction of a single integrated metropolitan public transport system. This fare system has been adopted by local and long-distance bus services alike and will subsequently be extended to cover all modes of collective public transport in the Malaga area.

Figure 6: Geographical Areas of Malaga Area Metropolitan Transport Consortium



Fare Systems:

Geographically speaking, the Consortium includes the towns of Malaga, Mijas, Torremolinos, Benalmadena, Rincon de la Victoria, Alhaurin de la Torre, Cartama, Alhaurin el Grande, Alora, Pizarra, Almogia, Colmenar, Casabermeja and Totalan. The Consortium's ticket system is based on fare zones. This means that the fare paid by the passenger is calculated according to the number of crossing fare zones made during a single journey (*fare crossing*). In addition, some special bus services provided by the Consortium have their own fares and are not governed by the zone system.



Integrated fare system includes over 80 long-distance bus services within the Metropolitan area, local bus services in Malaga, Alhaurin de la Torre and Benalmadena and the travel card that can also be used on other means of transport.

Tariff products:

- **Single Ticket:** The best option for occasional travellers, this is purchased in cash on board the bus and its price (special services excepted) depends on the number of zones crossed during the journey. This ticket does not offer a discount on transfers.
- **Travel Card:** This is a wallet card that entitles the holder to an unlimited number of trips, providing the card has sufficient credit. This is ideal for frequent travellers, who benefit from its ease of use and cheaper fares.

Ticketing system:

The card is configured for the type of journey most frequently made by the holder (0, 1, 2 or 3 fare crossings). On boarding the bus, passengers must inform the driver of their destination before placing the card in front of the reader, which will automatically charge the price of the fare in accordance with the fare crossings for which the card has been configured. It will also issue a ticket indicating the cost of the fare and the time limit within which the passenger will enjoy a discounted second fare if transfers. Up to 15 passengers can purchase tickets using a single travel card providing the last ticket is obtained within a maximum of 3 minutes after the first. Cards may not be configured for more than one type of journey at the same time; however, holders can have their cards reconfigured when topping up or simply by going to any sale point and requesting a change of configuration.

Ticket sale/purchase

Travel card can be purchased at any Consortium authorised sales terminal. Passengers must pay a deposit of €1.80 which will be refunded if the card is returned; any credit remaining on the card when it is returned will NOT be refunded. Once acquired, the card must be topped up with a minimum of €5. The card must also be configured for the type of journey most frequently made by the passenger (0, 1, 2 or 3 fare crossings). For subsequent top-ups, holders simply go to any authorised sale point, where they can add a minimum of €5 to their card (€500 is the maximum amount that can be stored on the card at any given time). During this operation, the card may also be reconfigured to cover a different number of fare crossings if required, except when using the vending machines located in Metro Malaga stations.

Ticket validation and control

Tickets must be validated before entering the PT. Ticket control is performed by personnel of the PT company you are traveling with. In addition, passengers on EMT local services in Malaga may change buses free of charge from the second stage onwards within a maximum of one hour starting from the beginning of the first local bus stage.

1.4.5. Integrated Public Transport System of the South-Moravia County

SHORT DESCRIPTION

IDS JMK system (Integrovaný Dopravní Systém JihoMoravského Kraje = Integrated Public Transport System of the South-Moravia County) is in use around Brno. Brno, the largest city of the area, and the area around, was at the first lap of the IPTS in the South-Moravia County in 2004. The reason for creating some IPTS was the increasing number of carriers and an unintelligible public transport which was the reason for an increasing number of people using their own cars for transport. The backbone network is



created by railway tracks and the supplementary network by road transport like in the previous system. In 2002 KORDIS JMK was established, which is the organizing authority of IDS JMK. It is responsible for: network and timetable planning, fare setting, system direct managing, and information service for passengers, marketing and promotion, revenues allocation, EU funded development projects managing. In 2004 the IDS JMK was launched. In 2010 IDS JMK was operating in the entire region. Revenues are allocated by the KORDIS - organizing authority. Bus operators have gross costs contracts, more operators on 1 line. Trains and Brno PT have net costs contracts.

IDS JMK is fully integrated (network, timetables, tariffs and fare, services and marketing).

TARIFF SYSTEM

TARIFF MODEL

The core is represented by zones 100 + 101 (Brno). Every zone has got the 3 digits number. The size of each zone is approximately 7 km.

They have a zone tariff, but there is a possibility here of changing the end of the journey, because in the IDS JMK they use tickets, in which the number of the using zones can be noted. The advantages of this tariff is the projection of the demanding transport and for this reason it is, therefore, more easily to put the costs of the carriers and the prices of the tickets at parity. Zone tariff can be used in huge areas and currently can be creating a tariff, in which a price for a short journey is lower. The disadvantages are a more complicated distribution of the tickets and tickets automats, because it is necessary to put down more information on the ticket. Automats in buses have to change a number of zones in every crossing border of the zone.

The fare is determined by the anticipated journey time and the number of fare zones. So long as you travel within the time and number of zones you have paid for, you can change as many times as you like, even from train or trams to buses and vice versa. For most journeys within the City of Brno a 2 zones / 60 minutes ticket is sufficient.

TARIFF PRODUCTS

Tickets are valid at least for 2 zones and have zonal and time validity. There are prepaid monthly/quarterly/annual seasonal tickets and are 20 % cheaper than single ticket. There are special offers for annual ticket holders etc. Both single fare ticket and seasonal ticket are valid in all integrated transport modes and operators.

In the Integrated Public Transport System of the South Moravian Region (abbr. IDS JMK) all the existing transport modes in the large part of the South Moravian Region as well as in its capital City of Brno are connected. Under the same conditions you can travel in local trains, regional buses, public city transport of Brno (trams, buses, trolleybuses) and city transport in the cities of Adamov, Blansko, Břeclav, Bystřice nad Pernštejnem, Hodonín, Kyjov, Vyškov and Znojmo (buses). In all of these lines you can use the same tickets and pay the same prices and the very similar regulations are used. There are some exceptions, but they are less important. The IDS JMK tickets you cannot use in speed trains and in Ex, IC and EC trains as well as in buses which are not operated by integrated public transport system. There is a variable tariff system used to determine IDS JMK fares. The fare is determined by the expected length (time) of your travel and the number of fare zones. As long as you do not travel more than the time and number of zones you have paid for, you can transfer as many times as you like, even from train or trams to buses and back again. You cannot transfer with following tickets - the one section and two section/10 min. ticket (sold at regional bus drivers, not valid in the City of Brno) and the two railway stops ticket valid only in train.

TICKETING SYSTEM

TICKET MEDIUMS



IDS JMK official mobile application for transport is Poseidon. It's allowing passengers to easily buy a ticket, plus learn a range of information needed for traveling. Poseidon is designed primarily for those who have a permanent connection to the Internet and to public transport in South Moravia. Through a bank account virtual money can be charged on the account and a ticket cheaper than a ticket at the cashier, the vending machine or the driver can be bought. Favourite tickets can be saved and when buying the ticket next time, a ticket ride with just two clicks can be bought. Purchased tickets are valid in all zones IDS JMK, urban transports, trains and regional buses. Tickets must be purchased at least 5 minutes before traveling on trains, on other vehicles 2 minutes after purchase. Application can find the necessary connection and find the ticket needed for the journey. The type of fare must be selected and confirmed. There are two types of tickets, either issued for a specific route (my ticket) or fast tickets, which are issued only from a specific zone for a certain number of zones. Poseidon can be also used for larger groups of passengers(for up to 10 passengers). Account for the whole family can be set up. After downloading app to the mobile phone, it can be available even without internet access. Poseidon is comfortable handling system with integrated electronic information and documents online.

SALE

Full assortment of tickets, passes and coupons can be bought at the integrated railway stations, DPMB (Brno Public City Transit Co. Inc.) offices, strategically placed (outdoor) coin-op vending machines, newsstands, hotels and some shops. The most important single-ride ticket to cover the fare and luggage can be bought directly from the driver in all vehicles of city transport (lines 1 to 99). There is extra payment for this convenience: The tickets sold by drivers are more expensive than ticket sold elsewhere. In buses numbered 100 to 999 it is possible to buy the full assortment of the one-way tickets and without the surcharge.

ACCESS TO THE STATION PLATFORM AND VALIDATION

Upon entering the first vehicle of the trip it is a must to immediately "punch" (time-stamp) the ticket in a validator machine, which is placed near all entrance doors of vehicles. If travelling by train, the ticket must be punched before entering the vehicle on the platform.

The ticket must be slide in, face up, as indicated by the arrows, and the entry zone, date and time will be printed at the bottom of the ticket. From this moment the time-validity of ticket begins to run. By changing vehicles, the ticket shouldn't be punched again. The ticket is valid throughout the zone that was first punched (three digits printed by the validation machine) and in neighbouring zones, up to the total number of ticket zones. The special full- and more-day tickets for the City of Brno are valid only in tariff-zones 100 and 101. The tariff zones are marked at signs at the stops, in timetables, and on the map of IDS JMK or Brno city transportation network.

CONTROL

The system has plainclothes inspectors who can ask for the ticket at any time. They are permitted to fine those traveling without a valid travel certificate the sum of 40 EUR - on the spot!

Sources:

- 1.) <http://www.idsjmk.cz/EN/basics.aspx>
- 2.) http://sputnicproject.rec.org/meetings/1wgmeeting/Market%20organisation/presentations/PT_CzechRepublic_Havlik.pdf.

1.4.6. Integrated transport system in London

Transport system in London is integrated and managed by integrated local government body Transport for London (TfL). TfL is responsible for London's network of principal road routes, for various rail networks



including the London Underground, London Overground, Docklands Light Railway and TfL Rail, for London's trams, buses and taxis, for cycling provision, and for river services.

In 2003 an electronic ticket on contactless electronic smart card "Oyster" has been introduced and by June 2012, over 43 million Oyster cards had been issued and more than 80% of all journeys on public transport in London were made using the card. Since 2014, the use of Oyster cards has been supplemented by contactless credit and debit cards as part of TfL's "Future Ticketing Programme". TfL was the first public transport provider in the world to accept payment by contactless bank cards, and the widespread adoption of contactless in London has been credited to this. TfL is now one of Europe's largest contactless merchants, with around 1 in 10 contactless transactions in the UK taking place on the TfL network.

Most of the transport modes that come under the control of TfL have their own charging and ticketing regimes for single fare. Buses and trams share a common fare and ticketing regime, and the DLR, Overground, Underground, and National Rail services another.

In 80's an inter-modal travel ticket "Travelcard" was launched. A Travelcard entitles the holder for unlimited use of all transport system managed by TfL. It can be used in the Greater London area and offers various services outside Greater London. Depending on where it is purchased, and the length of validity, a Travelcard is either printed on a paper ticket with a magnetic stripe or encoded onto an Oyster electronic smart card.

The revenues from Travelcard sales are divided according to a scheme agreed by TfL and the Association of Train Operating Companies. A quarterly survey known as the Travelcard Diary Survey is undertaken, where travelcard holders are asked to record all the bus, rail and tube trips they have made using their travelcard. Both "in-boundary" and "out-boundary" (i.e. Travelcards in or outside the zonal areas) are surveyed, as well as day and monthly, weekly and annual Travelcards. Ensuring that a statistically valid sample that will give a fair and accurate allocation presents a challenge. The average mileage recorded on each mode is then calculated to give allocation factors of the Travelcard revenue to tube, bus and rail.

With Oystercard in 2003 a pay-as-you-go system was implemented which allows prompt payment of performed journeys on the vehicles. This system allows debiting a fare at the beginning of a journey and calculation of the correct fare at the end of the journey.

Tariff model

Fares are calculated in accordance with the London fare zones system managed by Transport for London. London fare zones are used for calculating the cost of travelcard product, single and return paper tickets, Oyster card pay-as-you-go fares and season tickets.

London zone system includes 6 zones within Greater London area and three additional zones outside Greater London area. The zones are mostly concentric rings of increasing size emanating from the centre of London. Fare zone 1 is the central zone (surface: approximately 45 km²) and for most tickets, travel through Zone 1 is more expensive than journeys of similar length not crossing this zone.

Tariff products

The London tariff system includes different tickets. Integrated ticket "Travelcard" is issued as time limited ticket for period of one or seven days or for any period from one month to one year and can be used for unlimited traveling inside one or between several zones. On the other hand pay-as-you-go tickets are used as single tickets that are used for specific journeys and are cheaper than Travelcard tickets when passengers travel less than is validity period of Travelcard. The pay-as-you-go system can be used by Oyster card, where



ticket can be bought with pre-paid credit, or by contactless debit and credit bank cards (Visa, Maestro, MasterCard,..).

Ticket prices are calculated regarding to different status of users (adult, apprentice, 18+ Student, 16+, 11-15, 5-10), loyalty/membership cards, ticket media (Oyster card, bank cards, paper ticket), travel time (peak/off-peak hours) and duration of ticket validity (daily, weekly, monthly, annual ticket). Users can make calculation of fares with online tool “Caps and Travelcard prices” (<https://tfl.gov.uk/fares-and-payments/fares/caps-and-travelcard-prices>) and in case of specific journey with online tool “Single Fare Finder” (<https://tfl.gov.uk/fares-and-payments/fares/single-fare-finder>).

Ticket system in London enables to use different ticket mediums and diversity of tickets. It also supports the purchase of single (pay-as-you-go) tickets on the vehicles by Oystercard or different contactless payment Bankcards, online management of Oystercard, different payment means and automatically processing of ticket revenue data.

Ticket mediums

The main ticket media for Travelcards is contactless smart electronic card “Oyster” with RFID chip and NXP 1K MIFare chip. On the Oyster card must be hold a valid ticket (or tickets) that is available for the whole journey or sufficient pay as you go credit for the journey or the part of journey not covered by the valid ticket. Alternatively, paper tickets with a magnetic strip are available.

Picture 1: Ticket mediums



Oyster cards are also supported by Oyster app which allows users to top up and manage their Oyster card on the go. To use the app user needs an Oyster online account to sign in.

The ticketing system also supports contactless payment bank cards (debit, credit, charge or pre-paid cards) and some other methods of contactless payment (including mobile phone apps, key fobs, stickers and wristbands) which can be used to buy pay-as-you-go ticket for single journeys. The user can buy ticket with touch of that card on a contactless card reader during the traveling and following journeys and payment history online by contactless account.

Types of sale

All tickets can be bought at ticket offices and ticketing machines throughout London. For electronic ticket held on Oyster card an online purchase is available using Oyster account. Single trip tickets (pay-as-you-go) can be purchased on the vehicle at the beginning of journey.

Access to the station platform

The access to the metro and railway stations is gated. Other stations, in particular bus and tram stations have an open access.



Validation of ticket

Ticket validation is using CI-CO (Check in - Check out) system and smartcard or contactless payment bank card must be touched on the card reader at both the start and the end of the journey. The cards must be also checked on the card reader at the start/end of crossing points. The card readers are located at stations entrance and exit points where the access to the station area is gated. Where the access to the station area is opened (buses, trams) the card readers are located on the stations and/or vehicles.

The system uses two types of readers. Yellow card reader must be used at the beginning and the end of the whole journey. The pink card reader are located at a number of interchange stations and must be used to validate the ticket where change from one vehicle to another.

Ticket control

Passenger must show Oyster card (and supporting photo card, where needed), smartcard or contactless payment card (which is used to pay for single journey) on each journey, whenever is asked to do so. A member of staff or a Police Officer is authorized to examine it at any time during the journey. If the ticket is not valid the user may be liable to pay a penalty fare or be prosecuted.

Sources:

- 1) <https://tfl.gov.uk/>
- 2) <http://oystercard.com.w3lookup.net/>
- 3) https://en.wikipedia.org/wiki/Oyster_card

1.4.7. Integrated public transport in Netherlands

Public transport in Netherlands is integrated and based on a contactless smart card system “OV-chipkaart” introduced in 2005. OV-chipkaart system is a result of a collaborative initiative of five large public transport operators in the Netherlands: the main rail operator NS, the bus operator Connexxion and the municipal transport operators of the three largest cities: GVB (Amsterdam), HTM (The Hague) and RET (Rotterdam). Now all public transport operators in the Netherlands use the system. It is operated through a joint venture named Trans Link Systems (TLS).

Since July 2014, the OV-chipkaart has become the only ticketing system in all public transport in the Netherlands, although the system has not been adopted on most of the Frisian Islands and in the Caribbean Netherlands. On the island of Texel, originally the OV-Chipcard was used but replaced in December 2014 with a pay-per-ride ticketing system.

The OV-chipkaart is available in disposable form (for occasional passengers, such as tourists) and reusable versions (for frequent travellers, either in anonymous or personalized forms).

Implemented tariff model



The journey price consists of a basic fare³ and a fare-per-kilometre. In most cases the national basic fare is paid only once, to the operator with which the journey started. After transferring to another transport mode, except to train, only the additional kilometres travelled must be paid. It doesn't matter whether the change of operators is made. In the case of transfer from a bus, tram or metro to a train, the basic fare will be often charged again.

The fare-per-kilometre is determined periodically by regional transport boards. This means that at present ticket can be cheaper in one region than in another.

When the travel on credit is used, a boarding fare will be debited from the card at the card check in. At card check out, the boarding fare will be refunded and the user will be charged for the number of kilometres of the recorded journey. In case the card is not checked out, the full boarding fare will be charged. Boarding fare differs according to the card status (anonymous/personal card) and the transport mode.

Tariff products

The OV-chipkaart works in two ways: either as a stored-value card which is used to travel on pre-loaded credit or as a means of storing so-called "travel products" (tickets).

Passengers have at their disposal various national travel products and operators passes and travel products that can be added to OV-chipkaart. National travel products include a Anytime Discount (1 month/1 year validity), a Personal Net Pass (1 month/1year validity - unlimited travel by bus, tram and metro travel throughout the Netherlands), a Sentire (a fix single ticket discount for blind or visually impaired passengers) and a Public Transport Discount (a monthly pass, which must be added to a personal OV-chipkaart as a supplement to a valid Anytime Discount pass and enables user to additional 20% discount on all bus, tram and metro travel throughout the Netherlands). The ticket price also depends on the age of the passenger, the type of OV-chipkaart on which it is loaded and travel time (discount for off-peak hours).

The Examples of integrated travel products available per type of OV-chipkaart are shown in the following table.

Table 4: Travel products available

| Travel product | Mode of transport | Area or network (operator) | Disposable chipkaart | Anonymous OV-chipkaart | Personal OV-chipkaart |
|---------------------------------------|------------------------------|--|----------------------|------------------------|-----------------------|
| Travel on pre-loaded credit (e-purse) | All | All | ✗ | ✓ | ✓ |
| Single or return journey | Rail | National (NS) and regional (Arriva, Veolia and others) | ✓ | ✗ | ✗ |
| Weekend unlimited travel year pass | Rail | National (NS) and regional (Arriva, Veolia and others) | ✗ | ✗ | ✓ |
| Off-peak discount plan | Rail | National (NS) and regional (Arriva, Veolia and others) | ✗ | ✗ | ✓ |
| One-hour unlimited travel | Metro, tram, light rail, bus | Amsterdam (GVB), Rotterdam (RET), The Hague (HTM) | ✓ | ✓ | ✓ |
| Three-day unlimited travel | Metro, tram, light rail, bus | Amsterdam (GVB), Rotterdam (RET), The Hague (HTM) | ✓ | ✓ | ✓ |
| Student unlimited travel weekdays | All | All | ✗ | ✗ | ✓ |

³ The national basic fare for 2018 is € 0,90 and is subject to various discounts.



Ticket mediums

Since July 2014, the OV-chipkaart has become the only ticketing system in all public transport in the Netherlands. The OV-chipkaart is contactless smart card available in three versions: the disposable OV-chipkaart, the anonymous OV-chipkaart, and the personal OV-chipkaart. Disposable cards are for one-time or short-period use (and incur a surcharge compared with normal journey price), the latter two types valid for five years and can be used as a stored-value card, also known as electronic purse or e-purse.

Types of sale

The national travel products can be purchased from operators' ticket counters, their web-shops and picked up later from one of the 1200 devices around the country, ticket counters and other sales devices.

Access to the station platform

Larger metro stations in Amsterdam and Rotterdam as well as a number of railway stations in the Netherlands are only accessible by passing through a ticket barrier. These barriers are designed to make access to the platforms (and therefore any vehicle) impossible without checking in beforehand with valid travel product. Smaller railway and metro stations are often not equipped with ticket barriers. Instead, free-standing validator units (card readers) are used for checking in and out. All buses, trams and light rail stations have open access and card readers are located on vehicles.

Validation of thicket

Ticketing system is based on a CI-CO (Check in - Check out) system and one "checks in" at the beginning of one's journey and "checks out" at the end of the journey by holding the card in front of an OV-chipkaart card reader must be performed. When changing between most forms of transport, the user must check out when leaving the first vehicle and check in when entering the second vehicle.

When travelling on credit, a deposit is deducted from the card's credit balance upon checking in. Upon checking out, the deposit is automatically refunded to the card with the price of the journey deducted. The deposit is not refunded if the user fails to check out at the end of the journey.

Control

During a rail or metro journey, conductors or ticket inspectors use mobile card readers to verify whether passengers have properly checked in with their OV-chipkaart before boarding.

Sources:

- 1) <https://www.ov-chipkaart.nl/>
- 2) <https://en.wikipedia.org/wiki/OV-chipkaart>

1.4.8. Integrated ticketing system in Austria

Transport associations of local authorities and transport undertakings for the common and coordinated implementation of public local passenger transport (PT) have been established by local authorities and transport operators. Each transport association cover the geographical area of the certain region and offer uniform fares within this area. Users can use several means of transport with one single ticket based on one common fare system including the urban transport in many larger cities.



Tariff model

The implemented integrated systems in each region based on the distance tariff model. For example the transport association for regions of Lower Austria and Burgenland outside the Verkehrsverbund Ost-Region (VOR) (Verkehrsverbund Niederösterreich-Burgenland (VVNB)) introduced a model in which geographical area is divided into dynamic zones related to the individual ticket (personal or ticket zones). The ticket price is determined by digressive kilometre tariff and is calculated automatically from the optimal connections offered in the timetable to travel between starting and ending point. The level of the tariff therefore does not depend on the number of zones travelled, but on the tariff kilometres travelled between the starting and ending point. The tariff kilometres correspond to the distance between those points. In exceptional cases tariff kilometres were determined arbitrarily for reasons of price policy. Some tariff groups are considered as urban transport, where additional tariff offers exist (for example Wiener Neustadt, St. Pölten).

Ticket prices are calculated regarding to different status of users (pupil, student, senior), membership/loyalty cards, on-line sale and ticket media.

Tariff products

Various integrated products are available: day pass, weekly or monthly ticket (also transferable to other persons), annual ticket, semester ticket (for individual transport associations)

For all transport associations applies that in their area (usually a region) in local transport for all transport modes and operators only one ticket can be used. In addition, parallel traffic (i.e. the service between the same stops on the same route by different modes of transport) should be avoided as far as possible.

Ticket mediums

The integrated ticket is issued as paper ticket. Also a mobile ticket can be purchased on the smartphone via Ticket Shop App as well as via the Ticket App.

Types of sale

Transport association zone tickets are available from all members of a transport association, transport associations service centre, ticket vending machines, ticket counters, as well as aboard the vehicles.

Access to the station platform

Access to the station platforms is open.

Validation of thicket

The ticket is validated on board by conductor.

Control

The ticket is checked at sight by controller.

Sources:

- 1) https://austria-forum.org/af/AustriaWiki/Verkehrsverbund_Nieder%C3%B6sterreich-Burgenland
- 2) <https://www.vor.at/>
- 3) <http://www.oebb.at/en/angebote-ermaessigungen/zeitkarten>

1.4.9. EURO-NEISSE-Tickets

EURO-NEISSE- Tickets are intended for travel in the Liberec region and in German and Polish border regions. The EURO-NEISSE-Tickets are valid for all lines within the ZVON association area as well as for



many selected lines in the Republic of Poland and the Czech Republic. Likewise, the tickets are recognized with the RE-trains of the DB Regio AG and the trains of the Vogtlandbahn GmbH (Trilex) to Liberec / Tanvald and by the DB Regio AG to Zgorzelec.

Inexpensive EURO-NISA-TICKET one-day network tickets can be used on selected trains, trams, Ještěd cableway (extra additional fee) and buses...

EURO-NISA-TICKET offers inexpensive travel between Germany, Poland and Czech Republic. It is without limitation with respect to the number of kilometres travelled ideal for families and individuals alike, can be purchased for any day, including working days

Regions and zones are indicated in the figure below.

Tariff system and products

The ZVON-tariff is valid for all buses, street cars, narrow railways and regional trains of the ZVON federation area. There are different types of Tickets: one-day network ticket for one passenger (regardless of age), one-day network ticket for 2 - 5 passengers (regardless of age) and one-day transport document for a bicycle (as oversized luggage) or for a dog.

Ticket sale

All travel tickets (except for subscription- and yearly tickets) can be acquired in buses at all bus drivers and train attendants of ODEG and Vogtlandbahn within the ZVON, at the automats of the DB as well as at common reservation offices, also in street cars of the federation area, in customer offices of the transport enterprises as well as by other service providers.

Figure 7: Operating zones of “EURO-NEISSE-Tickets system

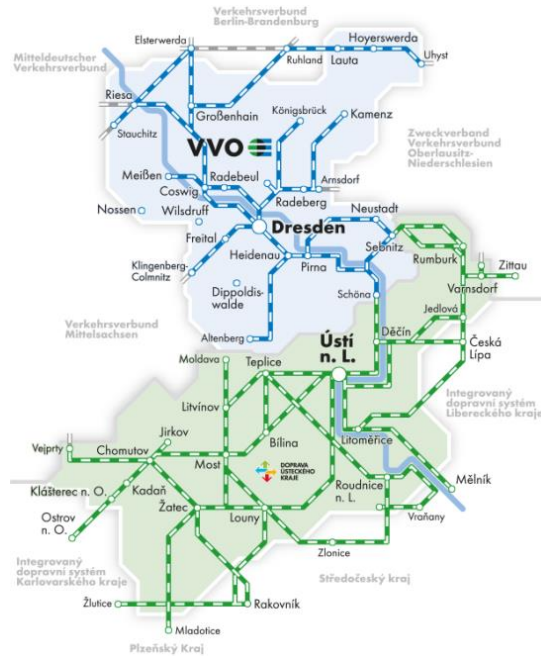


Validity of tickets

EURO-NEISSE-TICKET tickets are always valid for one day, and until 4:00 a.m. on the following day. These tickets cannot be purchased in advance sales.



Figure 9: Geographical area of Integrated Public Transport System of the Elbe-Labe ticket



Tariff system and products

There are three types of Elbe-Labe tickets: day ticket, small group ticket and cycle day tickets. They are valid up to 4am on the day following the day of stamping.

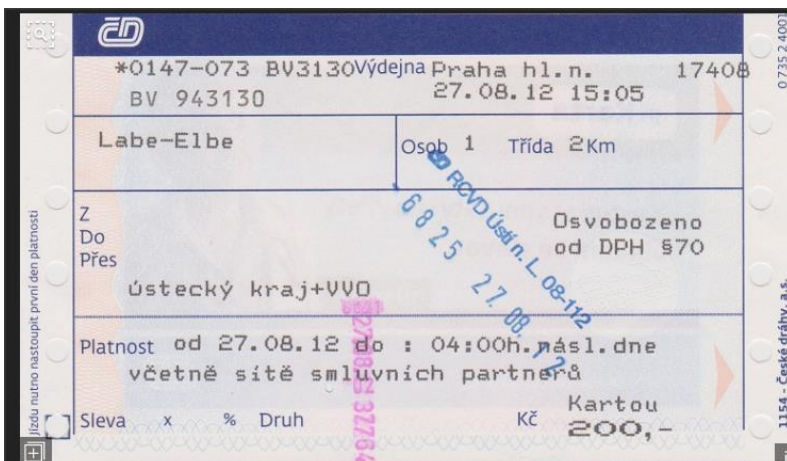
VVO Area

The VVO area is divided into 21 tariff zones. Whichever form of transport you use, and however often you get on and off, the prices you pay are based on these zones. When you travel, you simply count the number of zones you will pass through.

Ticket mediums

They use paper ticket only.

Figure 10: Ticket mediums





Type of sale

In the VVO area tickets can be bought at VVO partners' service centres and agencies, Deutsche Bahn ticket machines, Regional bus drivers and at the conductor on selected local trains.

Elbe-Labe tickets (Jízdenka Labe-Elbe) which have been issued for stamping may only be stamped in the VVO area. This means that if the return journey from the Czech Republic is to be made on a different day from the outward journey, a "Jízdenka Labe-Elbe" (for individuals, a small group or cycle) needs to be purchased in the Czech Republic.

In the Czech Republic, the "Jízdenka Labe-Elbe" is only sold to begin the journey immediately. In Czech the Elbe-Labe ticket is: "Jízdenka Labe-Elbe. People can buy tickets at ticket counters in stations, at Ticket counters and information offices of the transport companies involved, at drivers of selected regional buses (tickets get date-stamped) and on trains (surcharge possible).

Access to the station platform

It is open access to the station platform.

Validity for zones and time

The Elbe-Labe ticket is valid on all ČD trains, on "trilex" trains (Vogtlandbahn) between Zittau und Rybníště, on the National Park line (U 28) between Rumburk via Dolní Poustevna, Sebnitz and Bad Schandau to Děčín, and with almost all regional and urban transport companies in Ústecký Kraj (Ústí district) as per the routes and lines listed in the line directory, and on the cable car in Ústí n.L.

The Elbe-Labe ticket is valid on all forms of local transport in the VVO area as per the VVO tariff including cross-border transport on local trains between Bad Schandau, Děčín and Litoměřice, on the ferry between Schöna and Hřensko, on the 398 bus between Altenberg and Teplice, the 217 bus between Bahratal and Tisá, and on the 452/453 bus from Ústí n.L. to Bahratal border crossing.

The tickets are valid from the time of issue or stamping until the next day at 4am. In the Czech Republic, the tickets are only sold to begin the journey immediately.

Validity on special tourist services

Elbe-Labe day tickets are not valid on the Radebeul-Radeburg and Weisseritz Valley narrow gauge railways or the Bad Schandau elevator. On the Bergbahns in Dresden (Funicular Railway, Suspension Railway), on the Kirnitzsch Valley Tramway in Bad Schandau, and on the Meissen city tour, valid Elbe-Labe tickets entitle you to buy one reduced ticket per person for the relevant transport service.

Reduction on the Saxon Bohemian Switzerland cruise boat

If you are travelling with the Elbe-Labe ticket, the OVPS (Oberelbische Verkehrsgesellschaft Pirna-Sebnitz) offers a 10 % reduction on their Saxon Bohemian Switzerland cruise boat. Children can even travel free on their birthdays (ID required).

Validity in 1st class

Elbe-Labe tickets are only valid for travel in 2nd class. You may upgrade to 1st class in local trains within the VVO area. For using 1st class on local trains, single tickets are available to upgrade to 1st class. One upgrade (additional ticket) at the appropriate price level must be punched per person.

Once punched, tickets are non-transferable.

Sources:

- 1) <https://www.vvo-online.de/en/tariff-tickets/tickets/elbe-labe-129.cshtml>
- 2) <https://www.vvo-online.de/doc/VVO-Broschuere-Boehmen-Elbe-Labe-Ticket.pdf>



1.4.11. Findings on EU best practices on tariff and ticketing systems integration

EU practices on integrated ticketing and tariff systems show that:

- similar tariff products and discounts are offered regardless the integrated ticket medium
- single tickets are not a typical tariff product as opposed to non-integrated systems
- single tickets are often only available for pay with e-purse or bank-card; extended bank card schemes are available with post-processing or account-based ticketing (e.g. pay-as-you-go)
- zone tariff systems are prevalent
- traditional sale channels are still kept and are prevalent
- validation procedure is harmonised with the ticket medium type with information technology support if applicable
- paper tickets (visually controlled) are mainly used in cross-border integrated systems as opposed to regional systems where mainly electronic medium is applied
- electronic mediums support implementation of CI-CO ticket validation systems although CI is still the most frequently used
- electronic ticketing systems allow also easier implementation of closed access systems (both - closed and open are available)
- validation machines in open access environment are fitted in the vehicles



Transnational study on multimodal integrated tariffs and ticketing

Table 5: Analysis of EU best practices on tariff and ticketing systems integration

| IPTs - Integrated Public Transport System | | | | | | | | | | | |
|---|--|--|--|---|---|----------------------------------|----------------|--------------------|-----------------|---|--|
| Best practices | | Euregion Ticket in Meuse-Rhine (Belgium-Germany-Netherlands) | Region 3tarif (Belgium, - Netherlands) | Unireso fare network (Genova-Coppet-France) | IPTs in Malaga Area Metropolitan Transport Consortium | IPTS of the South Moravia County | IPTS in London | IPTS in Netherland | IPTS in Austria | Euro-Neisse Ticket (Liberec region, German, Poland) | Elbe - Labe ticket (Verkehrsverbund Obereibe area, CZ) |
| Elements | | | | | | | | | | | |
| 1. | Integrated tickets geographical scope | | | | | | | | | | |
| | - cross border | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ |
| | - national | | | | | | | ✓ | | | |
| | - inter-urban (regional) | | | | ✓ | ✓ | ✓ | | ✓ | | |
| | - urban (city) | | | | ✓ | ✓ | ✓ | | | | |
| 2. | Level of integration | | | | | | | | | | |
| | - multi-operator | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | - multi-modal | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 3. | Integrated tariff model | | | | | | | | | | |
| | - zone system | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| | - distance system | | | | | | | ✓ | ✓ | | |
| | - combined inter-urban&urban/special | | | | | | | | | | |
| 4. | Ticket media | | | | | | | | | | |
| | - contactless e-card | | ✓ | | ✓ | | ✓ | ✓ | | | |
| | - contactless payment bank cards | | | | | | ✓ | | | | |
| | - mobile phone (app, SMS, MMS) | | | ✓ | | ✓ | | | ✓ | | |
| | - paper ticket with a bar code | | | | | | | | | | |
| | - paper ticket with a magnetic strip | | | | | | ✓ | | | | |
| | - paper ticket | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ |
| 5. | Integrated tariff products | | | | | | | | | | |
| | - single ticket | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | - return ticket | | | | | | | ✓ | | | |
| | - daily pass | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| | - weekly pass | | | ✓ | | | ✓ | ✓ | ✓ | | |
| | - weekend pass | | | | | | | ✓ | | | |
| | - monthly pass | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| | - quarterly pass | | | | | ✓ | | | ✓ | | |
| | - semi-annual pass | | | | | | | | | | |
| | - annual pass | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |



Transnational study on multimodal integrated tariffs and ticketing

| IPTS - Integrated Public Transport System Best practices | | | | | | | | | | | |
|--|--|--------------------------------------|---|---|----------------------------------|----------------|--------------------|-----------------|---|--|--|
| Elements | Euregion Ticket in Meuse-Rhine (Belgium-Germany-Netherlands) | Region3tarif (Belgium,- Netherlands) | Unireso fare network (Genova-Coppet-France) | IPTs in Malaga Area Metropolitan Transport Consortium | IPTS of the South Moravia County | IPTS in London | IPTS in Netherland | IPTS in Austria | Euro-Neisse Ticket (Liberec region, German, Poland) | Elbe - Labe ticket (Verkehrsverbund Oberelbe area, CZ) | |
| - pay-as-you-go tickets | | | | | | ✓ | | | | | |
| - e-wallet | | | | ✓ | | ✓ | ✓ | | | | |
| - group ticket | ✓ | | | | ✓ | | | | ✓ | ✓ | |
| - employee pass | | ✓ | | | | | | | | | |
| 6. Integrated ticket discounts | | | | | | | | | | | |
| - passenger status (adult, student, apprentice, child, senior, group, disabled, tourist) | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | |
| - loyalty/membership cards | | | ✓ | | | ✓ | ✓ | ✓ | | | |
| - ticket media (e-card, bank card, mobile app) | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| - type of sale (on-line, mobile appl, ticket counter) | | | | | ✓ | | | ✓ | | | |
| - time of the journey (off-peak hours, weekend) | | ✓ | | | | ✓ | ✓ | | | | |
| 7. Types of sale | | | | | | | | | | | |
| - ticket counters | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| - shops, hotels, agencies | | | | | ✓ | | | | | ✓ | |
| - on-line | ✓ | ✓ | | | | ✓ | ✓ | | | | |
| - mobile app | | ✓ | | | | | | ✓ | | | |
| - via SMS | | | ✓ | | | | | | | | |
| - prepaid-card | | | ✓ | | | | | | | | |
| - ATC | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| - on vehicles | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| 8. Station platform access | | | | | | | | | | | |
| - open access | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| - gated access | | | | | | ✓ | ✓ | | | | |
| 9. Ticket validation method | | | | | | | | | | | |
| - "check in - check out" system | | | | | | ✓ | ✓ | | | | |
| - "check in" system | ✓ | ✓ | | ✓ | ✓ | | | | | | |
| - visual | | | | | | | | ✓ | ✓ | ✓ | |
| 10. Ticket validation technology | | | | | | | | | | | |
| - validation machines on vehicles | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | |
| - validation machines on stations | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | |
| - conductor on the vehicles | ✓ | | ✓ | | | | | | ✓ | ✓ | |



Transnational study on multimodal integrated tariffs and ticketing

| IPTs - Integrated Public Transport System | | Best practices | | | | | | | | | |
|---|-----------------------|--|--------------------------------------|---|---|----------------------------------|----------------|--------------------|-----------------|---|--|
| Elements | | Euregion Ticket in Meuse-Rhine (Belgium-Germany-Netherlands) | Region3tarif (Belgium,- Netherlands) | Unireso fare network (Genova-Coppet-France) | IPTs in Malaga Area Metropolitan Transport Consortium | IPTS of the South Moravia County | IPTS in London | IPTS in Netherland | IPTS in Austria | Euro-Neisse Ticket (Liberec region, German, Poland) | Elbe - Labe ticket (Verkehrsverbund Obereibe area, CZ) |
| 11. | Ticket control | | | | | | | | | | |
| | - electronic control | | | | ✓ | | ✓ | ✓ | | | |
| | - visual | ✓ | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ |



1.5. Proposed lessons to be told in transnational tool for integrated tariffs and ticketing

A transnational tool for the implementation of multimodal integrated tariff and ticketing schemes is aiming at providing a guidance for public authorities and public passenger transport operators in taking decisions on implementation of integrated tariff and ticketing schemes when planning implementation of ticketing systems integration. A decision support tool will focus on facilitation of conception and planning phases for interventions and actions in CE regions and cross-border connectivity as well as on other EU public transport networks.

The decision support tool will address the identified elements of tariff and ticketing systems that are crucial for successful integration thereof. The elements and the related issues the tool will address are specified in the chapter 1.5.1. If necessary, the tool will also bring other elements into analysis of decision process in order to allow for comprehensive decisions.

Identification of the main issues as described in the chapter 1.5.1 is based on comparison of:

- findings and SWOT analyses of the current state of the tariff and ticketing systems in CE regions and established cross-border services and
- identification of best practices on EU cross-border and regional/city ticketing and tariff systems implementation.

1.5.1. The issues to be addressed by the tool

1.5.1.1. Tariff models

Multimodal integration may bring in parallel operation transport modes that link origin and destination of a journey by routes which substantially differ in their length. In this case tariff is difficult to harmonise. The problem can be reduced or overcome by transition from a detailed distance based tariff model to a tariff model where tariff classes are bigger, or increasing with the distance, capping the longer distance, applying a combined zoned-distance based systems or transit into a full zone system where zone. The bigger the zones the easier the integration. As described, the integrated tariff models converge to flat rate models where the same rate is applied on large areas. The more diverse (multimodal) transport system entails a need for bigger changes to the distance based tariff models. Another problem is finding the reference distance to use for price calculation. Integrated transport providers use various definition of optimal distance. All regions apply some sort of price per km digression.

1.5.1.2. Tariff products

Integration of tariff systems should pursue a simplification of tariff products scheme in terms of personal entitlement as it highly impacts complexity of ticket revenue determination and distribution, especially in the systems without electronic ticketing. Due to lesser variation of entitlement products the ticket prices should be correspondingly low. The simplification of products scheme should encourage use of periodic travel passes - monthly, semi-annual or annual travel passes - on the account of use of single and return ticket. Single and return tickets should better be replaced with daily tickets because by using predominantly flat rate tariff models in multimodal transport systems giving multiple location-wise options of travel it is difficult to determine direction of travel. Tariff product should also promote use of new ticket sale channels and new (electronic) ticket mediums. Integrated tariff should also simplify migration between urban and



inter-urban transport by issuing combined products, if possible on a single ticketing medium (easier to use) and lower price.

1.5.1.3. Ticket medium

Integrated ticketing brings a lot of coordination and balancing among the operators and other stakeholders of the system in all phases of ticketing system to ensure eligible and justified revenue. The coordination and balancing is easier if sufficient data are available. Data can completely be provided only by automatic data generation and collection systems which are inherently electronic ticketing systems. Although bringing reduction of workload on the post-processing side the electronic ticketing systems can be quite expensive to implement on one hand. On the other hand they need to be interoperable in order for already implemented systems in use by the operators to be able to communicate and share data. Ticketing systems technology is strongly related to the applied ticket mediums. Therefore, paper ticket and if possible bar coded paper ticket medium seems to be a good fundament of integration. E-ticketing and mobile ticketing need a well-defined interoperability and security standard to be adopted and followed by the stakeholders in integrated transport operations in order to ensure secure and correct data interchange. Nevertheless, any type of e-ticketing or mobile ticketing implementation is important for bringing experience and basic infrastructure that is needed for the integration.

1.5.1.4. Ticket sale

Integration of ticketing systems should bring either reduction of stationary ticket sale network (over-the counter) by consolidation of parallel ticket sale systems governed by separated transport operators or expansion of the offer by increasing the number of points-of-sale. In the integrated network a passenger purchasing a ticket should be able to buy it at a ticket office/ticket counter that is run or commissioned by any of the transport operators included in the ticketing integration. The same is true for other sale channels. Even though an on-line or mobile sale is provided by several transport operator systems, all systems (web sale or mobile app) are required to distribute integrated tickets that are recognised and can be validated at any transport operator in the integrated ticketing system regardless the ticket medium (paper, smart card ticket or mobile ticket). An integrated ticketing therefore implies to unique sale network interface to the end-customer. As in CE area all ticket sale is information supported, it should be adapted or unified in order to be able to issue unique integrated tickets.

1.5.1.5. Access to stations

Access to stations can define use of the ticket in the system. In open access systems passengers are usually asked to check-in whenever they interchange from one to another vehicle. In closed, i.e. gated, systems passengers need to check-on entry in and check-out on exit of the system; use of transport system can be determined on the basis of calculation of the most probable or convenient route between check-in and check-out point. Use of transport system is important for the systems where ticket revenue is shared on actual ridership of the passengers with a particular transport operator. Finding the actual occupancy of the system is also very important for transport planning and control. Closed systems are more suitable for *back-office based ticketing systems* where tickets are replaced by token (ID card, bank card, e-purse) and the actual fare is recalculated in the back-office allowing the best price per travel or on a timely basis (weekly, monthly, yearly). Back-office ticketing systems represent evolution of the ticket-based systems. New technologies (e.g. BLE) allow back-office processing without physical gates (i.e. Be-in, Be-out systems) which are expensive to maintain.



1.5.1.6. Ticket validation

Passengers need to validate their tickets in order to check if their tickets are eligible for use of a particular transport service and to register their ride. Ticket validation is even more important in intermodal and multi-operator integrated ticketing systems where the same ticket can be used at different service providers. Furthermore, the same ticket can be provided for use at the operator only for a part of the complete service. Correct ticket validation is therefore crucial in the systems where ticket revenue is based or related to the actual ticket use at the single operator but also for monitoring of passenger ridership for purpose of better transport planning and control. In terms of gross financing of transport operator service where all revenue belongs to the integrated transport authority that remunerates transport operators for their service regardless of ridership, regular validation is less important but still needs to be examined.

1.5.1.7. Ticket control

Ticket control is performed sporadically by ticket inspectors. Ticket inspectors control if the passengers have duly validated their tickets in order to register the right for transport service. In the environment where conductors validate tickets the inspectors also control the conductors if they regularly control the passengers. Ticket validation and consequently ticket control are very important to assure the rightful revenue from the tickets to transport operators or to the integrated public transport authority (IPTA). In the net financing model of integrated public passenger transport where the operators are fully commercially responsible and strive for ticket revenue, the ticket inspectors are affiliated to the operators. If the gross financing model of integrated public transport has been applied to integrated public transport the ticket inspectors are affiliated to IPTA - IPTA is entitled to all ticket revenue to fill up the funds for full financing of the transport operators' service. As the gross financing model is easier to apply, without requiring complex ticket revenue sharing procedures, it may be a good option for inception phases of ticketing systems integration. Gross financing model usually also entails integrated transport authority as issuer of the integrated ticket.

Ticket controllers - inspectors should use ticket control devices ready to efficiently read the ticket content to confirm their validity.

2. Annex - definitions

For the purpose of this study and other documents referring to tariff and ticketing systems the following definition of the two systems will be applied. Tariff and ticketing system elements are induced from the standard EN 15320.

2.1. Tariff system

Tariff system determines a model and a method for calculation of values of tickets in the public passenger system as well as the terms of ticket use. Tariff model defines the required information elements that enter to the ticket value calculation method and are also parameters of the ticket to be issued complying with the tariff system. The information elements include:

- type of product (single ticket, timely pass, e-wallet, accompanying objects, additional services - parking...),
- personal entitlement (discounts for dedicated groups of passengers),
- calculation elements (geography or time based flat rate, distance fare, distance-time fare, volume discounts, transfer discounts, loyalty discounts, supplements, fines, calculation of additional services...),
- geographic validity of the ticket (route, zone, area, progression, degression),
- time validity/maturity of the ticket (hour, month, year),
- scope of use (personal ticket, anonymous holder...),
- miscellaneous (travel class, seat reservation...)
- etc.

Tariff systems integration implies integration of all tariff system elements in the observed transportation area.

The analyses of tariff system features within this project will focus on the main system elements which form the basis of tariff system harmonisation - as follows:

- **tariff model (based on distance, zone or combined),**
- **tariff products (type of tickets, users entitlements ticket, media discounts).**

In the integrated transport system the same tariff model and tariff products need to be applied in order to have a unified system and a common basis for a revenue sharing among the transport operators or transport authorities that collaborate in the integration.

2.1.1. Distance based tariff model

Distance based tariff model is a base tariff model where ticket value (price) is calculated based on the distance between origin and destination point of the journey. Method of calculation defines how the ticket value is calculated from the given distance (general price). It is very often for distance based tariff models to use:

- tariff classes (distance is segmented distance ranges of e.g. 5 km or 10 km); the tariff within the tariff class doesn't change,
- length degression - addition to the ticket price decreases with an increase of the journey distance (it is achieved with variability of tariff classes or with variability of unit price per tariff class).



The tariff calculation method additionally defines how the declared discounts (dedicated passenger entitlements, time travel pass ...) or supplements (higher class of travel, rank of transport, luggage ...) are added to the calculated general price.

The distance between origin and destination used in the calculation method is usually determined administratively and not strictly by the actual distance (transport line topology). *Despite the shortest distance between the two travel points A and B usually being taken as the administrative distance it may pose a huge issue when harmonizing multimodal tariff integration where transport network between the same points A and B varies substantially in terms of transport mode (bus and train network) or rank of travel (regular or express service network).*

2.1.2. Zone tariff model

In a zone tariff model public transport network in the area is divided in the territorial zones lying adjacent to each other so that they cover all transport area. The zones may have a look of belts distributed radially to the central zone or a honeycomb. Zone layout depends on the network layout and on their size. To cross a zone in the shortest directions it may take 5 km up to 20 km or even more.

Ticket value (price) has a flat rate within the same zone. Ticket value is defined in terms of number of zones the user needs to cross on his/her journey. Also zone prices may not be linear and usually drop as the number of the crossed zones increases.

Zone tariff model is typically implemented in urban public transport where travel patterns often feature non-directional journeys with multiple changes of transport vehicles (transfers) on the way. Cross-border zone tariff systems can be found between Denmark and Sweden, Austria and Hungary, Austria and Germany and elsewhere.

2.2. Ticketing system

A **ticket** is a contract between the user and provider of public passenger transport, be it PTA (Public Transport Authority) or transport operator. It gives a ticket holder or a ticket owner an entitlement to use a public transport service in compliance with particular data related to the ticket at its issue (e.g. origin, destination, time and scope of validity etc.) and with general terms and conditions of ticket use.

A **ticketing system** is a system for fare management and defines methods and tools for using a ticket in relation to the type of ticket medium and also manipulation of data produced in all phases of ticket use and after being used (post-processing):

- ticket issue (sales)
- ticket use (validation, verification, control; extension, top-up, blockade, change, black list, reimbursement of residual value, complaints, termination)
- ticket data post-processing.

A purpose of a ticketing system is to provide to passengers rules and technical means to use a public transportation service in accordance with the tariff terms and transport fare that has been duly calculated in line with the tariff in order to bring an income to the transport provider. Therefore a conclusion can be made that a tariff system and a ticketing system are closely related. The tariff system is essentially a constituent that is implemented in the ticketing system.

The analyses of ticketing system features in the framework of this project will focus on the main system elements that should be taken into account in integration of ticketing systems - as follows:



- ticket mediums (registered paper, smart card ticket, smart card wallet, debit/credit card, print@home, mobile, ID-based-contract,)
- sale (types of sale - ATC, ticket counter,..., in relation to a location and ticket type or medium; payment means),
- access to the station platform (gated, open),
- validation (method of validation in relation to ticket type or medium - automatic, conductor, on the platform in the vehicle; system of validation: CI, CICO...),
- control (method of ticket control in relation to ticket type or medium - manual, automated).

2.3. Tariff and ticketing integration

Ticketing and tariff systems can have smaller or higher level of integration, from partly to fully integrated system. Level of integration is defined in number integrated elements as well as method of integration.

Partly integrated system also refers to the systems when they are presented as integrated to the end-user (one ticket but different validation techniques, one tariff but different prices for the transport operators), usually requiring very complex post processing of data and ticket revenue sharing to fit specific ticketing rules and systems of transport providers.

For the purpose of system integration analysis a tariff system is considered as an essential element of the ticketing system and is not referred to separately.

Integration of ticketing systems is closely related to interoperability of the systems, especially in the integrated environments where the existing systems are not fully replaced with a new common integrated system but the passengers use integrated functionalities based on achieved interoperability.

Interoperability of the integrated ticketing system provides regulatory and technical substrate for system integration. All transport operators, ticket vendors (agents) and other entities involved in the integrated system should comply with integrated and harmonized terms of operation and should provide technical capability of standardized manipulation of ticket and ticket information in the entire ticket lifecycle. Integrated terms of operation and common technical standard for ticketing systems should either be imposed by the integrated transport authority in control or mutually agreed by the entities accessed to the integrated tariff and ticketing system.

UITP, a non-profit internationally recognised organisation headquartered in Brussels and the only worldwide network to bring together the whole public transport sector and all sustainable transport modes, has provided some baselines for assessment of ticketing systems integration, so-called IFM model⁴. IFM model (Interoperable Fare Management model) has been developed to investigate implementation of ticketing systems integration based on the concept of CEN Standard, ISO EN 24014-1.

The IFM model is focussed on ICT based ticketing systems but the information can also be inferred to the other ticketing systems. IFM model is general and indicative letting many options for practical implementation of specific solutions.

IFM model declares 5 levels of interoperability of electronic ticketing systems.

Level 0: a physical level of integration - all transport operators agree to use the same ticketing medium (e.g. smart card) as the basis for system integration and interoperability. The applied ticket medium should support multimodal use of transport system where passenger uses one single ticket or one ticket medium for a complete journey irrespective of the transport mode (railway, road, water...) and number of transfers

⁴ IFM model has been developed in the framework of EU 7th Framework Programme



(changes of transport means) on the same way. Multimodality can be available within the same transport operator. If more transport operators provide the service within the integrated system it is called a multi-operator system (multi-operator systems don't necessarily imply the same tariff).

Level 1: INTER-USABILITY; inter-usability implies that all operators in the integrated system accept the ticket regardless the point-of-sale where it was bought. For electronic ticketing mediums all ticket sellers and transport operators accepting the ticket should comply with the same technical standard (e.g. wireless communication standard ISO 14443) in order to be able to read/write to the ticket medium and thereby use the ticket data. *Technical compatibility of ticket mediums and ticket readers*⁵ (ATC, POS, platform gates, validation & control units...) in multi-operator or multi-agency systems can best be achieved via independent certification body based on agreed standards (e.g. ISO/IEC 10373-6:2001 - Identification cards - Test methods - Part 6: Proximity cards).

Level 2: INTER-MODALITY; inter-modality assumes all transport providers (also sellers, gated stations...) are bound to inter-usability and additionally share the same information system and encryption system (e.g. encryption keys stored in security application modules - SAM) allowing them exchange and collection of ticket data within an *integrated data management system* (usually centrally operated by the agreed ticket data management operator/agency). This is an intermediate level where a computer system takes care for data exchange among terminal devices (POI, ATC, validation...).

Level 3: INTER-AVAILABILITY; inter-availability provides system users full access of all systems of any operator at any point in the system. Practically, *any product or information related to any transport operator in the system should be available at any point the system* (e.g. ticket for a specific transport operator service can be purchased at any point-of-sale in the sale network and for the same and price. Back-office information systems at the operators' exchange data with all terminal devices (level 1 and 2) and also with the central information system (level 4).

Level 4: INTER-OPERABILITY, inter-operability of ticketing system stands for full integration. In terms of electronic fare systems it implies automatic fare collection (AFC) where all technical⁶ as well as commercial elements of the ticketing systems have been integrated in one fully integrated ticketing system. For commercial interoperability the transport operators should harmonize a single integrated tariff, general terms and conditions of transport, responsibilities, revenue sharing, define unified format of ticket record (layout - e.g. standardized ticket application on a smart card) and all system interfaces. *Level 4 is usually represented with the central information system located at integrated system manager (or technology provider). It takes care of financial clearing and keeps all common system databases and operational data.*

Before getting down to implementation of ticketing system integration it should be clarified which level of interoperability the integration of ticketing systems is planned to be attained. Experiences in previous implementations of integrated ticketing systems suggest the conclusion that institution of the first 3 levels satisfies most of passengers' needs and expectations.

Standardisation and application of open platform approach is very important for ticketing system integration to achieve transparency, better control of and easier development and modifications of the system and finally lower costs introduction and further developments ensuing from higher competition on technology providers' side.

⁵ Ticket readers (devices) produce transaction log (files) used for levels 2 and 3.

⁶ Levels 1, 2 and 3 are mainly dealing with technical aspects of ticket use.