Electronic decisions for public transport lines

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Abstract

Public transport services in Austria require a license of the provincial administration for the lines and stops. The administration checks whether the public transport service is compatible with the road infrastructure and the traffic conditions. The stops must conform to common standards and to the safety requirements according to estimated use.

The Graph Integration Platform (GIP) is a common geographic reference system for traffic and transport infrastructure in Austria. It is now fully functional, constantly up-to-date and available in very good accuracy all over the country. Several administrative procedures have been converted to computer assisted processes and based on the common reference graph. The licenses for public transport are relevant for the administration of the province and for the public transport associations that procure public transport operation from private operators, promote the services and sell the tickets. The effort to match the schedules for public transport with the legal licenses issued by the administration was prohibitive in the past.

The licenses in all nine Austrian provinces are based on the same federal law. Nevertheless, there are substantial differences between procedures applied in the provinces. The progress of digitalization also differs: some provinces use text processor (mostly MS Word) others use administrative document management systems as a standard. Different approaches were discussed with the people in charge of the federally funded project GIP E-II. Finally, a prototype that would fit the requirements and procedures of the administration in Lower Austria and Burgenland was developed. Care had been taken, that the additional requirements of other provinces can easily be incorporated into a future version. The public transport schedule maintained by the public transport association was compared with the digitally available data in the provinces and became the basis for a basic data set to start with. As the bus lines are tendered by the traffic association in regular intervals, a fully up-to-date version of the licenses will be part of the system by 2020.

Keywords: public transport lines, eGovernment, License Assistant, Graph Integration Platform (GIP), routing, bus

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1. Public Transport in Austria

All public transport service lines and stops require an official license in Austria. Dependent on the mean of transport, the business model and the location of the route, there are different regulations and administrative responsibilities. This paper focuses on supporting provincial legal authorities dealing with licenses for bus lines. The "Kraftfahrliniengesetz" (KflG) is the Austrian federal law which is the legal frame for bus service for passengers on a regular basis. Whereas the law is federal, the license itself may be granted by the according organs of the provincial administration on behalf of the head of the province.

A first version of the software was presented to the digitalization working group of the association of European Metropolitan Transport Authorities (EMTA). We found out, that similar legislation applies in about half of the member sites whereas in the other half of Europe no public license or approval is needed to run a public transport service. Though the software was developed with the Austrian legal framework in mind it is quite relevant to other regions of Europe.

According to federal legislation ("Öffentlicher Personennah- und Regionalverkehrsgesetz", ÖPNRV-G) local public transport is organized by local public transport authorities in Austria. These transport authorities limited companies owned by the Austrian provinces. For their operation area they establish a fare system, coordinate timetables, split the proceeds, provide passenger information and tender public transport lines to operators. The operators are private or semi-private companies which place bids in the public procurement. After a bus operator won the bid, it has to apply for the license, if it doesn't already owns it.

The Austrian federal Ministry for Transport, Innovation and Technology (German: Bundesministerium für Verkehr, Innovation und Technologie, BMVIT) is responsible for licensing international bus lines. So if a line not only operates in Austria, the proceedings are coordinated by the BMVIT. Also in this case, the local authority must verify that route and stops fit for the requested service. Trolleybuses (in Salzburg and Linz) by law are licensed like railways and therefore are not part of the KflG.

1.1. Status quo

As described above, there are many players, when it comes to 'get a bus on the street'. The Verkehrsverbund Ost-Region is the biggest Austrian public transport association responsible of greater Vienna Region consisting of three provinces. Here the relevant area is divided in twenty regions, the bus services of each of this region is invited for tender as a bundle in regular intervals.

First the public transport authority plans the bus lines ans schedules and invites for tenders. Bus operators place their offers consisting of predefined lines and stops. The successful tenderer has to apply for a license at the provincial legal authority ("Verkehrsrechtsabteilung"). Some bus operators hold valid licenses which can be adapted. The legal authority investigates weather the streets, bridges and tunnel frequented by a route are capable to be used for the type of bus. Buses must always be able to drive in forward direction. Stops must be placed at points, where passengers can safely wait and enter the bus.

According to the KflG requests for a license must contain – besides other criteria – a list of all communities served by the line, an unambiguous description of the route and a list of all stops. Especially the point on describing of the route is handled inconsistent between the different provinces. The range goes from a detailed road-by-road instruction to a hand drawn map. Some descriptions come from the public transport authority, some from the bus operator.

To ensure compliance with all safety percussions, members of the provincial legal authority, members of the public transport authority, the bus operator, representatives of effected communities and sometimes additional experts inspect the whole route by bus. During this process parts of the intended route can change, because they are not suited for safe traffic. Obligations to fix problems can be given. The names of stops may be changed. Operational restrictions can also be enacted, weather temporary or fix.

Only after the license has been granted and the demanded amendments are in place, the bus is allowed to operate within the restrictions of the license. Then the operator informs the public transport authority and submits the

final timetable. The public transport authority then includes the timetable into its passenger information systems. The timetables in the passenger information systems are always up-to-date, any deviations from the actual bus schedules would be immediately detected by the passengers.

2. Basics for a new support tool

The "Kraftfahrliniengesetz" (KflG) originates from the year 1952 and was completely reviewed in 1999. Since then, the provincial legal departments, together with the BMVIT, are in a regular dialogue about the law. So the law was adapted several times since. The actual processes and responsibilities between the different involved parties has been adapeted as well. In the last ten years new new systems and tools for traffic management and egovernment have been developed and set to work in Austria:

2.1. GIP

The acronym GIP stands for Graph Integration Platform (German: Graphen Integrations Plattform) and means the joint, nationwide transport graph for Austria. The implementation started in 2006 in the Vienna region and became a nationwide effort by 2008 with the projects "gip.at" and "gip.gv.at". All GIP projects received a funding of 50% by the Austrian Climate and Energy Fund (KLIEN). The prototype was presented in early 2012. Since then network and software undergo constant optimization. By the end of funding by KLIEN in 2017, the organization changed to an operational structure. The ÖVDAT (Österreichisches Institut für Verkehrsdateninfrastruktur) now organizes cooperation and financing and leads the efforts to upgrade the GIP. ÖVDAT members are the Austrian provinces, ASFINAG (Austrian motorway operator), ÖBB (Austrian Federal Railways) and BMVIT. Associated partners are the Austrian Association of Cities and Towns. ITS Vienna Region was commissioned as the technical GIP operator for all nationwide tasks.

A basic principle of GIP is that every institution responsible for an element of the physical infrastructure will also maintain this element in the data set. For example the the motorway operator ASFINAG cares for the motorways. In each province there are different departments responsible for different kinds of roads. Finally every link of the graph has someone responsible for it. Junctions to other subnets are generated by the system. Various nationwide export formats were implemented. Due continued efforts the GIP-network has reached a state of accuracy and completeness that makes it a suitable basis for various administrative tasks. The GIP is also available as a open government data set and as a the INSPIRE data set for the traffic infrastructure.

2.2. Action Assistant

Serveral extentions to the GIP have been developed. The most prominent one is the Action Assistant (German: "Maßnahmenassistent"). It assists the public road administration with decisions concerning traffic signs and road markings. As important side effect it enriches the GIP with information gained from the traffic signs. Some traffic signs have influence on traffic flow and therefore on routing decisions. A speed limit extends travel time and a turn restriction demands a detour. Most signs only make sense when they are combined. The speed limit starts at one sign and ends at another. The action consists of the combination of associated signs. The Action Assistant and the road network GIP support public authorities with the legal decisions. In return the GIP benefits from the incremental updates of data relevant for routing.

The Action Assistant is implemented in the administrative procedures in five Austrian provinces and some bigger cities. Beside others, the tool has some handy features, usable for further thoughts:
- Portalverbund (PVP)
  The Portalverbund is the Austrian governmental portal for the assignment of permissions on shared systems. Every government agency runs its own portal. The portals are connected by interfaces and a common standard. The portals trust each other, so users from different agencies can access the same server with different permissions or roles. The Action Assistants login is compatible with the PVP.
- Elektronischer Akt (ELAK)
  To get rid of paper decisions, Austrian authorities run their electronic file systems. The Action Assistant provides an interface to the ELAK system.
- Routing
  To calculate the actions impact on the network, routing-methods are implemented in the Action Assistant.

- Text modules
  Based on the calculated route, the Action Assistant generates boilerplate texts which can be used in the decision documents.

3. License Assistant

Over the course of the "GIP Upgrades II" project, a similar tool to support the provincial legal authorities with bus licenses, should be implemented. As it turned out, the above mentioned features meet the needs of the administrative personnel. So the first idea was to enhance the existing Action Assistant with a new feature. We thought: a bus stop is just another traffic sign, and the course of a bus route is a linear reference like any other action. After considerations, it was decided to implement the License Assistant as an individual system. The work flow for bus licenses is considerably different, the challenges in the user interface differs between the two application. We therefor wanted use the benefits of the Action Assistant on the server side but not its client. So the tendering was split in two parts: Adaptations to the GIP server to ensure routing and text module generation and as a separated procurement a License Assistant server, client and database.

The Action Assistant grew to a versatile tool over the years, so the expectations to the License Assistant where quite high. Due to budget and time limitations, it was decided to implement the first phase of the License Assistant as a prototype for the needs of the provinces of Lower Austria and Burgenland. So some functions in the concept where shifted to the next phase and some limitations where set up.

The remaining principles for the prototype are:
- The management of user permissions is adaptive. User roles and permissions are managed via the Austrian Portalverbund.
- The connection to the ELAK electronic file system works with hyperlinks. A deeper integration is planned for the next phase.
- All user interactions happen via a graphical user interface. Geographic entities can be edited on the map. The design is responsive, so the application can be accessed outside the office via laptop, tablet or smartphone. GPS measurements on the devices can be directly used in the application and in case the internet connection gets lost, the data will still be kept.
- Documented import and export formats allow data exchange. All data are historized.
- The upgrades at the GIP server for routing and text modules enhance known methods and use already implemented objects.
- All rights to the developed software belong to the purchaser.

Two different companies were assigned the two parts of the project. The License Assistent client has three main sections corresponding to the three main types of entities in the application: lines, stops and operators.

3.1. Line license

The License Assistant client has a view for working with the bus lines.   A line can consist of multiple sub routes as the course of the line my vary.

Sub routes can be edited on the map. In most cases only a few points must be defined and the the correct route is calculated according to the road network. The routing happens at the GIP server and will be displayed immediately. Based on the routing a verbal description of the course is generated. This description can be altered and imported to the official document.
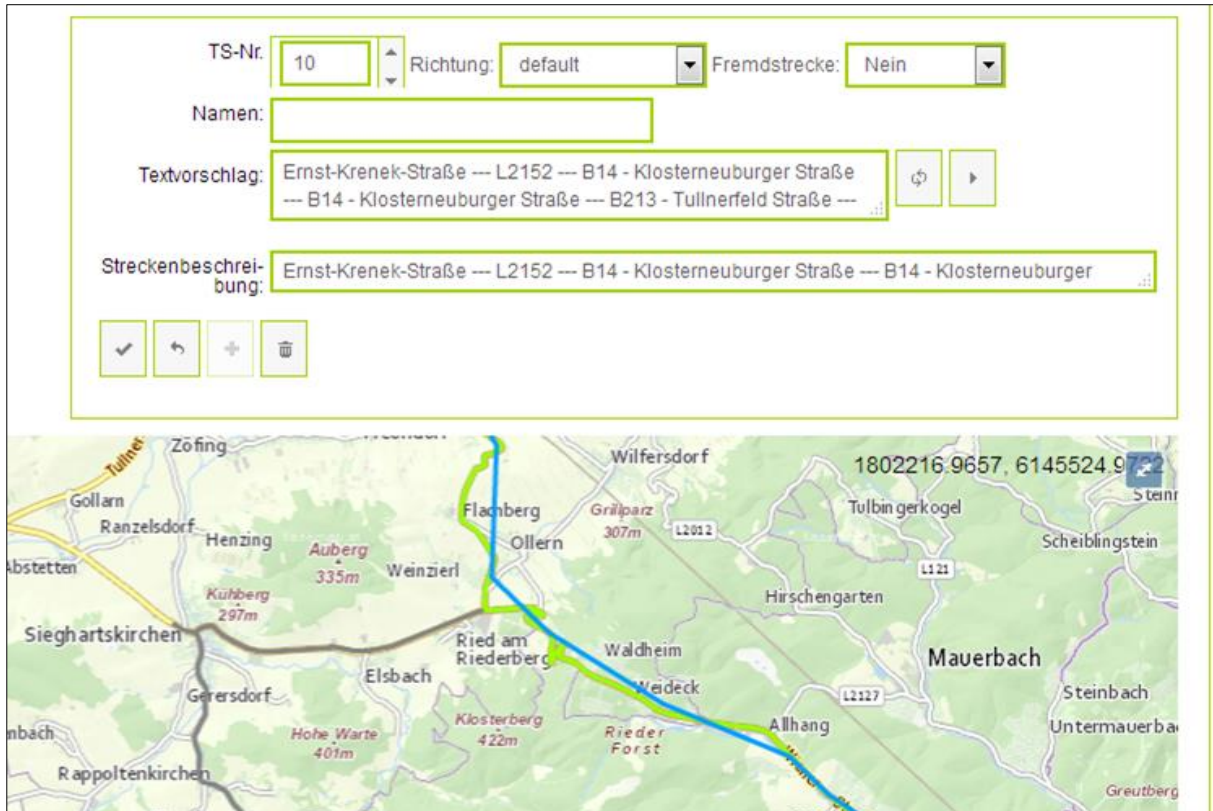
Fig. 1 a text module describing the sub route above the map with the user input (blue) and the route on GIP basis (green).

3.2. Stop vs. Stopping point / Platform

The word stop (German:"Haltestelle") needed to be disambiguated over the course of the project. According to the KflG, a stop is the specific location where a bus stops and passenger exchange takes place. Whereas in public transport timetables several stopping points or platforms together form a stop or station and all stopping points of a stop share a common name. In the project we had to introduce this distinction and both objects into the administrative framework.
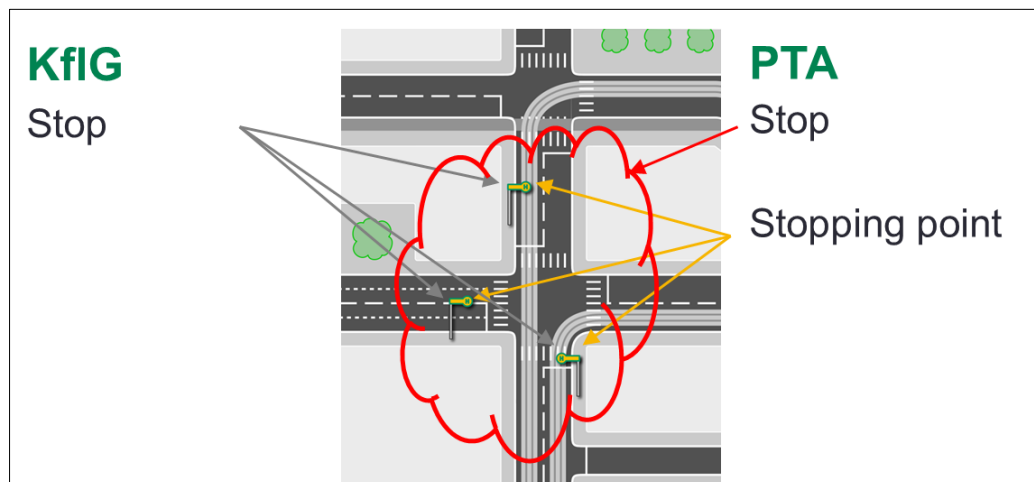

Fig. 2 different meaning of "stop" in KflG and by public transport authorities.

Following this definition, stops are not much more than a name, an ID and some metadata. Additionally each stop contains a list of stopping points.

Operators must seek for a permission to use a stopping point to ensure safety. Therefore a lot of attributes can be collected. The position of the stopping point can be entered on the map as well. The GIP interface calculates the next link on the road network and returns a verbal description of the position.
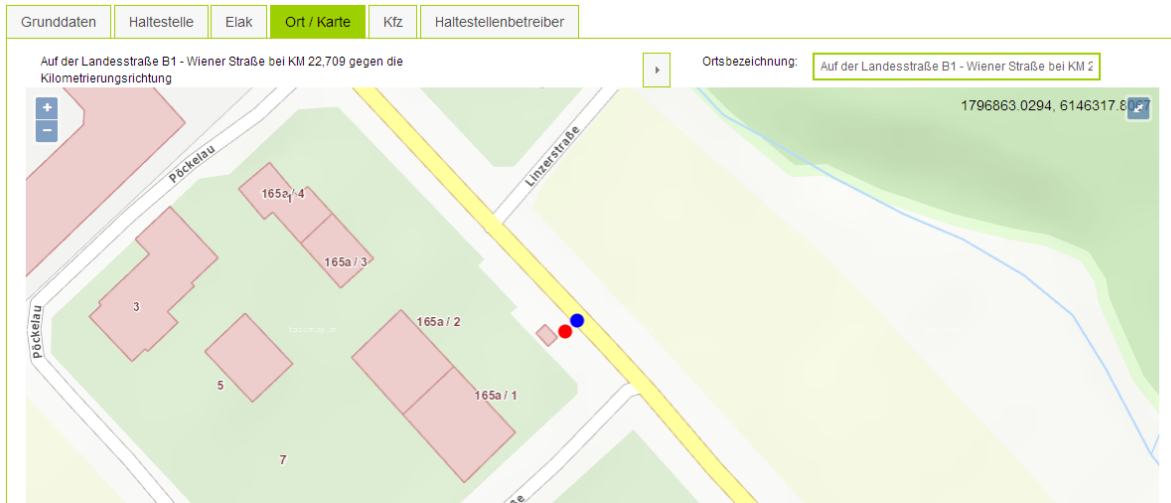

Fig. 3 position of the sign marking the stop (red), closest point on road network (blue) and verbal description above.

Stops and stopping points are tagged by an unambiguous IFOPT id (Identification of Fixed Objects in Public Transport).

3.3. License operators

By adding core information about license operators (German: "Konzessionsnehmer"), this information is linked to lines and stops as well.

Fig. 4 list of license operators (test data).

4. Future thoughts

At first the License Assistant was developed as a prototype for the provinces of Lower Austria and Burgenland. At least three other provinces are interested to use it as well. So if it turns out, the Assistant is a useful tool to support the needs of the provincial legal authorities and the public transport authorities, the prototype will be extended to be fully functional in a wide range of environments.

With the nine provinces in Austria, the market is limited for this specific implementation. We will share our experiences with the EMTA digitalization working group and hope that relevant elements of the tool will be useful in other European region. As the rights of use are with the public transport association of the Vienna region, it is easy to use synergies in various technical ways. In addition the work on the License Assistant generated another adaptive graphic tool, that accesses GIP functions over the documented server interface and proved the modular software design useful.

5. Conclusion

We expect various benefits from the new system. The licensing of the bus lines will be based on the digitally available data – mainly the GIP – and thereby become accurate. The location of the license will be electronically digitized; a textual description is generated automatically from the line on the digital map. Therefore, the location of lines and stops will be unambiguously defined. Comparisons of the digital schedules for traveler information and accounting will be regularly performed. Information on bus lines and stops is stored in the common reference system and will be considered when road works are planned.

The License Assistant as new electronic system for issuing public transport licenses adds an important step to the integrated electronic management of traffic and transport information in Austria. It is the first big step that integrates public transport administration into the initiative.

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