NODES

D4.7 Rouen Application Report

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Main author	Marc Florisson
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Authors (full list)

Marc Florisson, Cityway
Chloé Spano, Cityway
Stephen Wise, RBC
Caroline Hoogendoorn, UITP

Project co-ordinator

Caroline Hoogendoorn, UITP
Rue Sainte-Marie 6
1080 Brussels, Belgium
Tel.: +32 2 788 01 11
Fax: +32 2 660 10 72
Email: caroline.hoogendoorn@uitp.org

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Introduction

The NODES project aims at building a **Toolbox to support European cities, transport authorities and operators in the design and operation of new or upgraded public transport interchanges**.

These tools were identified in Work Package (WP) 3, tested and validated in WP4 and evaluated in WP5 in terms of increasing accessibility and integration, intermodality, safety and security, enhancing environmental and energy efficiency, costs, savings, etc.

The test-phase took place within **nine partner** sites distributed around Europe, where interchanges are being built or upgraded. It will **validate the tools and their efficiency and provide a feedback loop for their improvement**.

Rouen's interchange "Théâtre des Arts" is one of those nine reference site. The tools which have been identified within the project are related to **five topics** which cover the key functions of Public Transport interchanges. Partner CITY has been testing and validating tools in one of these five topics: Intermodality and ICT (NODES topic 3).

This deliverable D4.7 summarizes the work that Cityway has carried out as part of Task 4.6 of Work Package 4. After describing the test site and its stakeholders, the report gives an overview of Cityway's demonstration activities. These activities are described per tool and in more details in the Appendices.

Application activities actors in Rouen

Rouen is one of the NODES project reference cities. The urban public transport operator in Rouen is TCAR a company which is a subsidiary of the Transdev Group, the global leading player in transit operations and mobility services, member of the Group Caisse de Dépôts, a French Public investor serving general interest and the economic development of the country.

Cityway is the NODES partner which in particular has implemented application activities in the city of Rouen.

Cityway is an Information Technology company created in 2001 and specialized in multimodal passenger information and more widely in all types of people mobility. Cityway solutions combine all the different modes of transport available on a specific territory, seamlessly, without boundaries including: personal car, public transport, personal bike, bike-sharing, car-sharing, carpool, plane, ferry...

Cityway works for transport network operators, transport companies, local transport authorities and major actors in transport (Transit Agencies, Ministry of Transport, Department of Transport, Institutions and Organizations...). Cityway is the Information Technology Engineering subsidiary of Transdev Group.

Introduction to urban public transport in Rouen

TCAR employs 660 drivers (95 of them are light rail drivers) and 173 maintenance employees (83 of them working at the Saint-Julien depot).

TCAR main sites are "Deux Rivières" (which are the company's Headquarters as well as a Bus depot), "Saint-Julien" (with a Tramway depot) and "Théâtre des Arts" (with an operations control room, an operating agency and a commercial agency).

With a fleet of roughly 218 vehicles, TCAR operates several public transport modes: Tramway, TEOR (Bus network with a high level of service), Bus, and Demand Responsive Transport.

TCAR traffic flow hits about 194 000 trips per week day. TCAR main network lines are light rail system and TEOR lines.

Light rail system

The light rail system is made of 2 lines having a total of 31 stations with 5 of them underground. The line ways length (double track) is 15.1 km, the tunnel part is 1.7 km with underground sections of 2.2 km.

The light rail fleet counts 28 vehicles, having an average commercial speed of 19.01 km/h. The headway is between 2 and 3 minutes on a common section, and 5 or 6 minutes in each branch. The commercial service opening hours begin at 5h00 and finish at 23h00.

Per year, the light rail fleet covers a distance of 1.399 million km that means 14.662 million passenger trips.

The light rail vehicle is the twin-directional rolling stock, built by Alstom. That rolling stock is a standard French tramway, made up of two articulated bodies mounted on two driving bogies and a low-floor middle section on a central carrying bogie.

TEOR System

The TEOR system is composed of 3 lines. The TEOR fleet counts 66 vehicles, having an average commercial speed of 17.19 km/h. The lines are 38 km long (with 14 km for the common section). The headway is 2 minutes on common section, and 4 minutes in each branch.

Per year, the TEOR fleet covers a distance of 2.647 million km that means 13.749 million passenger trips.

The TEOR infrastructure is made of different kind of lanes. There are "Protected lanes" (two-way lanes exclusively reserved for TEOR lines, and separated from general traffic by an impassable barrier). In addition, there are "Reserved lanes" (Two-way or One-way lanes reserved for TEOR lines, and separated from general traffic by a passable barrier) and "Normal traffic lanes" where TEOR vehicles mingle with the general traffic except in stations, thanks to specific installations.

The TEOR infrastructure includes guide way specifications with priority at traffic lights, specific signals and visual recognition of TEOR infrastructure thanks to its colour (red).

TEOR vehicles use an optical guidance system in order to achieve an almost gapless docking so that PRM people in pushchair can enter easily.

TEOR stations have been laid out in the same way as those for the light rail: 38 stations are fully equipped stations (out of 55 in total) and station's platform may vary between 20 to 35 m long.

TEOR stations have been specially laid out for people with reduced mobility (PRM): access ramps to the stations, tactile surface strips, platform height at 31 cm.

Reference site in Rouen

"Théâtre des Arts" is an interesting place to experiment tools as it is one of the most important interchanges of the city.

<p align="center">Figure 1: Interchange "Théâtre de Arts" location</p>

The "Théâtre des Arts" interchange is located within the historical centre, next to the cathedral. Available modes and transport services are:

- 1 light rail system line,

- scheduled buses (lines 8, 10, 20, 21),

- high-level services buses (TEOR 1, 2 and 3),

- 1 night bus line (noctambus)

- bicycle storage ("cy'clic" for short periods, and folding or electrical cycles managed by CREA for long periods)

The economic functions available on site include shops, banks, restaurants, opera, pharmacy, market and an agency dedicated to the transport for people with disabilities.

Rouen Application

Partner CITY carried out two types of testing within the framework of Topic 3 "Intermodality and ICT": on the one hand, CITY has provided its expert feedback on tools that already existed, and on the other, CITY has tested tools that were under development.

For what concerns the tools that already existed, CITY gathered information on the tool implementation over a long period of time. This covered:

- information about the tool deployment phase and difficulties encountered;

- information about the required staff to keep the tool in use and staff needed skills;

- information about the cost for the first deployment, maintenance cost and related staff cost;

- information about the specific local environment in Rouen that may influence the tool efficiency;

- information about passenger feedback for tools directly dedicated to passengers.

The importance was given to the selection of all information that may be relevant for other cities who has to investigate the opportunity to deploy one of those tools. Thanks to the help of TCAR's IT experts, staff and managers, Cityway received a lot of information to make a relevant tool evaluation that crosses different points of view.

For what concerns the tool that is under development, the procedure consisted in describing the main issues that were dealt with during the development. This new tool that was included in the draft NODES Toolbox is the "Mobile application for user guidance at interchanges".

The picture below shows a digitalisation system view. Walking ways are drawn in green; the edition formular is related to the selected walking way (with the double orange circle in the middle of it).
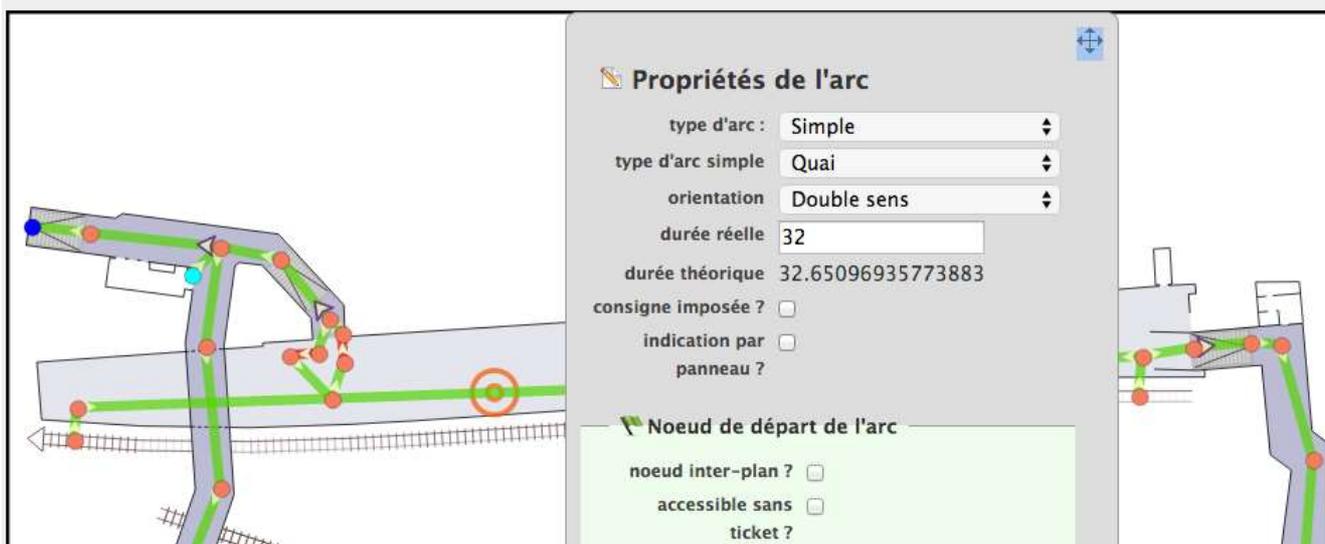
Figure 2: Digitalisation system view

Highs and low, difficulties and achievements

ITCS experiment

The most challenging tool to evaluate was tool n°2 ITCS. The tool is so deeply integrated at all the company's levels that it makes it difficult to identify all the tool's effects.

That's also a tool that requires the most IT skills. As the transport operation context evolves permanently, it happens quite frequently that a specific ITCS function has to be adapted in relation with the ITCS provider.

Last but not least, this tool is also tightly depending on the local public transport context. The choice of an ITCS solution depends on many factors: budget, transport modes, level of service expected, etc. Although ITCS providers have a product brand, customization of the product plays a key role for the tool's success.

IFOPT experiment

IFOPT is the Reference Data Model for fixed object which requires a public access to public transport.

First a simple CEN Technical Specification when the NODES projects began, IFOPT has become a CEN standard. In fact, IFOPT provides much more concepts than needed for an interchange like "Théâtre des Arts".

The selection of the main concepts among the IFOPT objects was easy-ily done. IFOPT data models (StopPlaceSpace, BoardingPosition, AccessSpace, Equipment, UserNeed) have been used to design the digitalisation of the system's database.

The picture below is an IFOPT data model sample using UML; it displays some relations between the Site model and the Equipment model.

Figure 3: IFOPT Site Accessibility Model

User Guidance Tool experiment

In the NODES Toolbox tool number 8 "Mobile Application User Guidance at interchange (indoor/outdoor)" didn't exist yet. User guidance supposes to have an interchange digitalisation, including at least all pedestrian ways inside and around the interchange.

Hence, the first step has consisted in implementing a complete digitalisation system. The IFOPT standard makes digitalisation design easier.

The second step consisted in implementing a user guidance service connected to a journey planner.

In Rouen there is already an existing journey planner (mob.reseau-astuce.fr) and mobile applications (available on "App Store" as well as "Google Play"). Those applications provide itineraries that may include a connection at "Théâtre des Arts". But the only available information for connections are average distance and walking duration whatever the user mobility needs may be. As available transport modes at "Théâtre des Arts" are scattered within the interchange area, walking durations are different if a traveller walks from TEOR line to the light rail system line, or if a traveller walks to a scheduled bus line.

Interchange digitalisation can provide a great improvement to journey planners. When journey planners give an itinerary with a connection at "Théâtre des Arts", a link to a user guidance service could be added.

However it was not possible to develop the "Mobile Application User Guidance" as an extension of the existing journey planner available. On a technical level, it turned out that a Transport Data Repository is a required condition to make an interface between interchange digitalisation and journey planner datas. We mean by "Transport Data Repository " a system (like Naptan within UK area) that provides a unique identification code to each public transport access point within the Greater Rouen area. Cityway was unable to obtain a Transport Data Repository.

Tools tested in Rouen reference site

The selected tools are listed below.

Topic 3 : Intermodality and ICT	
Tool no	**Tool name**
2.	Intermodal Transport Control System (ITCS)
5.	Multimodal journey planner
6.	Static/dynamic multimodal map of an interchange
7.	Real time multimodal passenger information at interchanges
8.	Mobile application for user guidance at interchange (indoor/outdoor)

Equipment purchased

In order to test the tool n°8 "Mobile application for user guidance at interchange (indoor/outdoor)", CITY needed to purchase equipment. The purchased equipment consists in virtual machines hosting.

The development of the digitalization system requires a machine (virtual or not) to host the application software and the related infrastructure: TCP/IP network, disk storage, CPU, RAM.

According to best practice for software development, 3 separate hosting environments were needed: one for development version, one for pre-production version and one for production version.

The hosting period began in January 2013 and ended in January 2015.

Conclusions

Participation in the NODES project has been a great experience for Cityway. We have learnt a lot from experiences coming from others public transport stakeholders throughout Europe.

Experiences led on different reference sites give us more inspiration for future digital solutions that will contribute to improved performance of interchanges elsewhere in Europe and beyond.

Before the NODES project, interchanges were just seen as a regular part of a passenger itinerary. But in fact interchanges concentrates many more issues for passengers as well as for transport stakeholders. We understand more deeply how interchanges play a key role for public transport success.

In addition, as passenger information system provider, this tool testing phase was also a great opportunity to get deeper knowledge on IFOPT standard and Transport Data Repository.

A practice of IFOPT standard

The IFOPT (CEN TC278 SG6 WG3) normative specification gives a sound basis to digitalise an interchange. As that normative specification covers miscellaneous concepts, the NODES project has been an opportunity to get a better understanding and to design an implementation compliant with that standard.

Cityway is now able to provide guidelines to interchange managers to make an easier digitalisation based on IFOPT.

Cityway solutions will promote IFOPT more widely than before the NODES project.

An understanding of Transport Data Repository issue

Without a Transport Data Repository shared by all transport stakeholders within Greater Rouen area (like Naptan for UK area), it becomes very tricky to develop an interface between a public transport information system (like a journey planner) and an interchange digitalisation.

A Transport Data Repository provides a common identifier for data shared between different systems or applications. Building a Transport Data Repository is a long term project because it implies many stakeholders.

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Appendix I: Tools tested summary sheet

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TOOLS TESTED (T4.1)			**Summary sheet**					
Partner	CITIWAY							
Integrated land use and infrastructure planning								
Tools	Date test 1	Relevance: yes now/yes in future/no/not ever	Report applicability, usefulness, effectiveness	Can the results be measured? Yes/No	Date test 2	Relevance: yes now/yes in future/no/not ever	Can the results be measured? Yes/No	Tool Score
2. ITCS	2008-2014	yes now	One of the most important and central tool for public transport operators. ITCS is a requirement for Real Time passenger information. But the ITCS price remains high.	no				12
5. Multimodal journey planner	2008-2014	yes now	Passengers are more familiar today with MM journey planner. It responds to a great expectation, especially when the transport offer is changing.	no				17
6. Static/dynamic multimodal map of an interchange	2008-2014	yes now	The larger the interchange is, the more important a multimodal map is. Static maps are quite easy to deploy.	no				20
7. Real time multimodal passenger information at interchanges	2008-2014	yes now	This tool responds to a high level of expectation from passengers. Cost for staff may be significant.	no				12
8. Mobile Application User Guidance	2014	yes in future	Applicability becomes complex without a "Transport Data Repository" (like NaPTAN). However those services require a system for interchange digitalization, which is very promising	no				17

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Appendix II: individual tool testing worksheets

Intermodality and ICT		
Tool 2: Intermodal Transport Control System (ITCS)		
Measurements/ Issues	Description	Notes
Definition of tool	Intermodal Transport Control Systems is an IT infrastructure (based on equipment and software) that enable vehicle tracking and tracing, driver guidance, operations control and monitoring.	ITCS is a system that should mainly: - help operating task for drivers - enable monitoring vehicle fleet on service - enable information exchange and communicate between staff and drivers - enable information exchange between vehicle on board and ground information systems
Analysis of tool		There are many more features for ITCS. The capabilities of ITCS have an great impact on the whole public transport company at all levels: - company's budget - operating procedure - level of service delivered for passengers For operating assistance, ITCS can have an effect on transport infrastructure:- traffic lights- road barrier (on walking streets mainly in city centre) ITCS can also change the scheduled service planned for the current operating day:- change destination- change part of a journey and re-route a bus on other stops- journey cancellation- regulate headway between vehicle depending on traffic. Data exchange between vehicles and ground information systems use different kind of telecommunication network:- fibre optic for tram- radio for bus lines. ITCS can display passenger information on vehicle board : • next passing time of lines in connection on the next stop • situation message like delays, strikes, journey cancellation • vocal way : directly live or prepared in advance. ITCS can localise each vehicle in real time. Thanks to that geo-localisation, it is possible to assess next stop passing times.

Measurements/ Issues	Description	Notes
Application at Rouen		In Rouen, the ITCS monitors 3 mode of transport:- tramway- bus TEOR (BHNS)- bus. Actually there are a part of the TCAR network that is not monitored by ITCS: • "Taxibus" lines • Responsive Demand Transport offered in some areas (those areas are far from city centre with a low frequency of service) • In general, all the lines that have been subcontracted with TCAR. As the ITCS doesn't monitor those lines, passenger can't have any access to real time information on those lines. But for legal reason it is very challenging to overcome labour regulation complexity in that situation. When a line is monitored with the ITCS, the driver may have to wait more at a stop and that can change his working hours and then have impact on his rest hours before the next driver's working day. If the driver is not employed by the same company as those that have taken the decision to make him work longer, it becomes a very complex situation for subcontracting companies.
Suggested improvements to tool		ITCS Providers sell a software package that has to be customised to match to the local context of public transport. Functionalities of the ITCS change all the times to be adapted to operating constraints change. It's necessary that ITCS is able to evolve and be adapted. That means that the public transport operator should have a thorough knowledge of such a system. Public transport operator has to express what change have to be develop and how can those changes be qualified. The tool required ITS knowledge and it is why the learning curve can last 6 months to 1 year.
conclusions		It is a very expensive tool that is one of the major tools in a public transport company. The tool is expensive because there are still few providers that can deliver and customize this kind of product.

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Measurements/ Issues	Description	Notes
Costs	-	To deploy a ITCS, it requires roughly: 1 year to define the ITCS requirements 1 year for deployment and tuning It is a heavy work
verdict on tool	-	ITCS is useful and needed for an efficient interchange. It is high maintenance and complex though.
Tool relevance to Interchange	Scale 1 to 5 (1 not relevant, 5 very relevant)	5 it's one of the most important tools; the other tools are reliant on it.
Resource cost	Scale 5 to 1 (5 low cost, 1 high cost)	2 relatively high cost over a long period of time - there is no finish point
Ease of use	Scale 5 to 1 (5 very easy, 1 not at all easy)	2 relatively difficult to achieve - reliant on multiple partners to contribute accurate data
Learning curve	Scale 5 to 1 (5 very easy, 1 not at all easy)	2 relatively difficult learning curve for partners supplying the data and learning how it created journeys
Time taken	Scale 5 to 1 (5 short time, 1 very long time)	1 very long term objective to provide meaningful multi modal journey planner
Total score	possible 25	12 reflects a very useful tool but relatively difficult to implement and relatively costly.

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Intermodality and ICT	
Tool 5: Multi modal journey planner	

Measurements/ Issues	Description	Notes
Definition of tool	As journeys via interchanges almost always involve the use of different modes of transport, the ability to plan a journey on these different modes is essential.	Depending on departure and arrival localizations, there are many journey planner services in France, like for example: - tcar.fr for a localization in Greater Rouen - atoumode.fr for localization in Normandy - ter.fr - voyages-sncf.fr for localization in France Those journey planners differ in terms of: - data provisioning and data quality (lines, schedules, routes, ...) - geographic coverage (size of the covered area) - modal integration (urban transport, interurban train, long distance train, all kinds of "demand responsive transport") - user interface and supported devices (web site, mobile site, mobile app, vocal service, access by call centre, ...)
Actual tool tested	website tcar.fr	tcar.fr is the journey planner with the most up-to-date information, the largest modal integration at Greater Rouen level ('demand responsive transport' like Taxibus is integrated). Compared to other journey planners, tcar.fr is the most popular journey planner web site covering Rouen area. TCAR manages data provisioning for the tcar.fr journey planner and also ensures the data provisioning (timetables for Greater Rouen area) for the regional Transport Authority's (TA for Normandy) atoumodes.fr journey planner.
Analysis of tool 1 Modal integration	tcar.fr was set up by the Public Transport Operator in Rouen.	Modal integration is one of the main issues for a journey planner: - How to connect private car mode (or bike mode) to public transport modes, with the issue of car park - How to combine new modes (but growing quickly) like: carpooling, demand responsive transport

Measurements/ Issues	Description	Notes
Analysis of tool 2 Data provisioning workflow		Data provisioning is a key issue for the quality of journey planner services. Data provisioning consists in merging data coming from different stakeholders. Stakeholder may be Transport Authority (a data provisioning for a regional journey planner, depends on many urban transport authorities), public transport operator (that can be an urban transport operator or a national railway operator), private transport operator (which can be a carpooling operator, car sharing operator, a demand responsive transport operator), ... For example, let's imagine a journey planner dealing with data coming from 2 public transport operators (one for urban network, one for long distance railway), the data provisioning workflow has to define the connections between stop points provided by the 2 public transport operators. Depending on the number and diversity of data providers, the data provisioning workflow requires a "passenger information system" which is more or less complex. In other words modal integration and administrative integration require developing a more complex "passenger information system" which has more provisioning interfaces. Despite there are some norms (like CEN Technical Specification Netex, English standard TransXchange, French standard Neptune NF, or German VDV specifications) or standards (like GTFS), it is not always possible to use it for many reasons. 1/ Tools like timetable scheduling don't have export function compliant with all those norms and standard. Usually the export function has to be customised 2/ Some data provider can't afford software for data provisioning. In some case, data is delivered in a simple Excel sheet if not paper timetables...Conclusion: **Delivering a journey planner service presupposes to have a team with required skills each time data have to be updated.**
Analysis of tool 3 End User interface		Whatever the device or media (regular website, mobile application, and mobile site) the user interface plays a great role in the success of the journey planner. Main issues for the user interface are those: - autocompleter for departure and arrival selection (seamless autocompleter for stop, address, Points Of Interest) - auto localization especially on mobile device - map integration, especially for the walk part of the trip (for example: from departure address to first stop) - user customization feature like "my favourite locations, my favourite trips" - keep same graphic identity on all device (responsive design may be a solution) - user interface should give an access to other services like stop timetables, next stop arrivals (real time)

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Measurements/ Issues	Description	Notes
Analysis of tool 4 Journey planner promotion		Delivering the journey planner service for different kind of devices is necessary to promote the service (regular website, mobile application, mobile site).- For journey planners delivered by a well know operator (like RATP in Paris, TCAR in Rouen), website promotion is pretty easy. - When a journey planner is delivered for a larger area (like a French "department" or "region"), it is much harder to promote the website. Advertising campaigns may be necessary (that was the case for the French region "Ile de France" with vianavigo.com website and mobile app).There is also another way to promote a journey planner. It consists in providing an API that delivers the same service as those on the website. The use of an API has to be clarified with a licence that could be commercial or open.
Analysis of tool 5 Passenger transport demand analysis based on data mining		After a period of usage (one or more years), it may be useful to analyse how the service has been used. Using service logs, it is possible to analyse "origin / destination" usage. Of course, each service request doesn't necessary mean that the user will execute the trip. But data mining (crossed with other data coming from ticketing for example) can give some useful information for a transport demand analysis.
Application in Normandy		TCAR delivers periodically its timetable service data's to the regional operator of journey planner website atoumode.fr Instead of an API access, TCAR deliver its data to a journey planner operator, according to a regional Public Transport Authority requirement. However this data are not delivered with "Open Data" access. However when looking at the area covered by the website atoumode.fr, the site audience is much lower than those of tcar.fr website.

Measurements/ Issues	Description	Notes
Application in Rouen	Modal integration	TCAR operates 2 kinds of demand responsive transport: • "Taxibus" which are composed of flexible lines with fixed routes (only the timetables are flexible) • "Filo'R" which are composed of lines having flexible routes as well as flexible timetables. "Filo'R" lines are not integrated in a journey planner yet. Bicycle is a missing mode in journey planners. But actually there are a limited amount of people using bicycles because streets and road mix cars and bikes. Bike user doesn't feel secure most of the time. There are 3 bike parks that are usually empty. Bicycle integration doesn't make sense before the Transport Authority decides to invest and adapt streets and road network. There are several sources for data provisioning: • Excel file from subcontracting operators • Specific export from Hastus (that is a commercial product used as the main timetable planner, Hastus is also a data provider for ITCS). Data provision consists in merging the different data in a same Passenger Information System and keeping it up to date.There are usually to 2 main periods in the year where the timetables are changing more largely at the beginning of September and before summer holidays. Data provisioning requires more effort from the staff and site audience peak are expected at that time. There is the same journey planner service for all media (web sites, mobile wifi and mobile applications).
Suggested improvements to tool		The main expected improvements are: - to make data provision easier - to integrate real time into the journey planner To make data provision more easy: Data provisioning is a kind of workflow distributed on many systems: timetables planning system, Excel files, Software for validation and visualization of provisioned data, Passenger Information System. It's quite complex and learning curve for a data provisioning manager can lasts 2 or 3 months. Real time integration: - integration of bus real time re-route - Integration of a predictive evaluation based on global real time traffic (roads and public transport network) and statistics as it has been done in the Optimod project.

Measurements/ Issues	Description	Notes
conclusions		The importance of the tool is self-evident. As soon as the service is disrupted (this happens quite rarely), TCAR receive complaints from users. The cost is not so important. However the tool requires to get staff with ITS skills to be able to validate: - the new journey planner versions - the data provision
verdict on tool		A Multi modal journey planner is useful and needed for an interchange. It is high maintenance and complex and can become unreliable.
Tool relevance to Interchange	Scale 1 to 5 (1 not relevant, 5 very relevant)	5 really useful tool
Resource cost	Scale 5 to 1 (5 low cost, 1 high cost)	3 relatively high cost over a long period of time - there is no finish point
Ease of use	Scale 5 to 1 (5 very easy, 1 not at all easy)	3 relatively difficult to use - reliant on multiple partners to contribute accurate data
Learning curve	Scale 5 to 1 (5 very easy, 1 not at all easy)	3 relatively difficult learning curve for partners supplying the data and learning how it creates journeys
Time taken	Scale 5 to 1 (5 short time, 1 very long time)	3 but it depends on the product used, number of data source for data provisioning, journey planner features
Total score	possible 25	17 reflects a very useful tool, cost depends on features and provisioning context

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Intermodality and ICT	
Tool 6: Static Dynamic map at interchange	

Measurements/ Issues	Description	Notes
Definition of tool	Development of a static or dynamic interchange multimodal interactive map (2D/3D), enabling users to get transport networks' information (stop points, routes, next departures, disruptions etc.) and to visualise the interchange outdoor environment.	The tool's purpose is to help passenger to visualize the station indoor and outdoor through a map representation. Maps make orientation easier for passenger. Dynamic maps have the advantage of providing more accurate information to passenger, compared to static maps.
Actual tool tested	Static maps of five interchanges (Boulingrin, Gare – Rue verte, Hôtel de ville de Rouen, Théâtre des Arts, Mont-Riboudet Kindarena)	All those maps are static maps.
Analysis of tool		Here are the questions one must ask himself when creating such a tool: - Which part of the station should be put on map: indoor part, outdoor part? - Which map scale should be used: station scale, neighbourhood scale, city scale? - Which equipment, facilities have to be on the map? - Should shops be located on the map or ignored? - Which transport information should be on map: quay or boarding position, lines, line destinations, line's transport mode etc.? - Which symbols should be used? - Which graphic charts should be used?

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Measurements/ Issues	Description	Notes
Application at Rouen		The tool is only deployed in large stations: - 5 metro stations (including Théâtre des Arts) - 1 TEOR station All maps cover the neighbourhood, so that's mainly the outdoor part of the station. As map are static, all map are displayed on paper support and on a digital format on the website (not on mobile application). On the map passenger can see: - where are quays and bus boarding positions; - which line stops on a quay and boarding positions; - where are the boarding position for shuttle operated only during infrastructure works period is; - where are the main shops around the station are. Maps are updated and printed once a year. However some Improvements are identified for future version of that tool : 1/ Some shops are located on the map because they are very famous and can help passenger to understand where he is. However more clear rules have to be defined to decide what kind of shops should appear on map. 2/ More clear rules have to define also for station equipment and facilities 3/ It would be more useful if mobile application could deliver such maps for station having one. That tool can be improved when it is available on different kind of devices
Suggested improvements to tool		That tool can be improved when it is delivered on different kinds of device: on displays located inside the interchange, on web site and on mobile application. Miscellaneous information can appear on a dynamic map (shops, public transport, service and equipment, touristic information). Potentially, the dynamic map interest increases with the number of available information, as long as the map stays readable. Translation of textual information on the map can be a real improvement also

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Measurements/ Issues	Description	Notes
Conclusions	_	The importance of the tool is related to: • Proximity to touristic sites of the city. • The size of the interchange (passenger per days, number of public transport lines).
	_	
verdict on tool	_	A Static or Dynamic map is useful and needed for an interchange. It is high maintenance, but is not complex and cannot become unreliable.
Tool relevance to Interchange	Scale 1 to 5 (1 not relevant, 5 very relevant)	3, although this evaluation depends on many criteria: - Station - size, - amount of lines in connection at interchange, - amount of entries and exits to the indoor part of the interchange, - amount of passenger per day (and at peak hours), and the occasional passenger part.
Resource cost	Scale 5 to 1 (5 low cost, 1 high cost)	5 relatively low cost. But it depends on equipment (screen, display) deployed in the interchange
Ease of use	Scale 5 to 1 (5 very easy, 1 not at all easy)	4 easy to achieve, except in very large interchange that changes all the time
Learning curve	Scale 5 to 1 (5 very easy, 1 not at all easy)	4 easy learning curve for partners supplying interchange maps
Time taken	Scale 5 to 1 (5 short time, 1 very long time)	4 short term objective to get a static map
Total score	possible 25	12 reflects a very useful tool but relatively easy to implement.

NODES

Intermodality and ICT		
Tool 7: Real-time multimodal passenger information at interchanges		
Measurements/Issues	Description	Notes
Definition of tool	Real time passenger information covers different kinds of information: audio messages at interchange, next departure/arrival times, traffic situation message	Real time information assists passengers during their journey.
Actual tool tested	Real time multimodal information tool can be delivered through many kinds of devices: • on displays • on a vocal way • on mobile application • on web site • All those kind of devices have been tested in Rouen.	All those devices don't deliver the same type of message. But they all deliver real time passenger information.
Analysis of tool	Real time passenger information is provided by both systems and dedicated staff.	The information is provided by: • the ITCS • the passenger information staff at the Operation Control Center. • Information delivered by announcement is: • • unusual traffic • delay, • traffic situation, • rerouted lines, • line cancellation, etc.

Measurements/Issues	Description	Notes
Application		Real time displays are distributed over the network: • for all the tram and TEOR stops : ◦ dynamic content is displayed on screen: duration before the next 2 arrivals, given for each line at that stop, priority is given to shortest coming arrival ◦ if necessary effective terminus of arriving vehicle is also displayed • ~ 50 Passenger Information Kiosks with a smaller display size, mainly located in city centre ◦ dynamic content is displayed on screen: duration before the next arrival ◦ all that stops are related to line under the ITCS (no stop from subcontracted lines)At interchange station (main tram stops) there are also audio information • pre-recorded messages (an ergonomic software can make it easier to record message in advance) • live vocal messageAccessibility note:PRM people have a special access to real time information. Using a remote command device, they can get all information in an audio format.
Information system in Rouen		Between all the Passenger Information Kiosks and ITCS, there is also a software component. Actually that component reveals to be the most fragile part of the whole system
Suggested improvements to tool		1/ To get a better connection between ITCS and Passenger Information Kiosks, that is still too fragile today. 2/ Enhance people training because staff under use live audio message broadcast, although it is an effective way to inform passenger. Actually staffs don't feel at ease when speaking directly without the ability to correct itself. 3/ As for tool n°5 "multi modal journey planner", urban public network is disconnect from long distance rail information. Display deployed in the bus terminal station (which is located just besides the main rail station) broadcast only real time information coming from urban public network and nothing coming from rail station. It's the same situation in the rail station. But for passenger coming in Rouen by train, it would be much more efficient to deliver urban public network information directly from the rail station. And why not during the travel by train, before arriving in the station.

NODES

Measurements/Issues	Description	Notes
identified costs		1/ Human resource cost is significant to have a staff during large opening hour. Shift has to be planned to ensure that the staff can broadcast audio messages in station during the whole operating day.When deploying such a tool the first time: A large amount of message has to be recorded before the staff can broadcast recorded message when necessary.It takes time even despite the help of ergonomic software.2/ Main maintenance costs for all required systems:- ITCS - software maintenance, mainly for web site and mobile application - electronic device maintenance
conclusions		From the passenger's point of view, real time information is intensively used by users. For example, each time the mobile application doesn't rely, many claims arrive quickly after. Real time information is necessary to promote public transport. From public operation point of view, a real time information tool can't be efficient without human monitoring. A fully automated system seems to still be impossible. Currently a dedicated staff member is still required.
verdict on tool		A Real Time passenger information system is useful and needed for an interchange. It is high maintenance and complex, and can sometimes become unreliable.
Tool relevance to Interchange	Scale 1 to 5 (1 not relevant, 5 very relevant)	5 even if the tool is at first dedicated to transport operation and not for passengers, this tool is very important for real time passenger information provisioning.
Resource cost	Scale 5 to 1 (5 low cost, 1 high cost)	2 relatively high cost over a long period of time - there is no finish point
Ease of use	Scale 5 to 1 (5 very easy, 1 not at all easy)	2 relatively difficult to achieve - reliant on multiple partners to contribute accurate data
Learning curve	Scale 5 to 1 (5 very easy, 1 not at all easy)	2 relatively difficult learning curve for partners supplying the data and learning how it created journeys
Time taken	Scale 5 to 1 (5 short time, 1 very long time)	1 very long term objective to provide meaningful multi modal journey planner
Total score	possible 25	12 reflects a very useful tool but relatively difficult to implement and relatively costly.

NODES

Mobile application for user guidance at interchange (indoor/outdoor)

Intermodality and ICT		
Tool 8: Mobile application for user guidance at interchange (indoor/outdoor)		
Measurements/Issues	Description	Notes
Definition of tool	For passengers who have special needs, it's often difficult to find the best way to go from a quay to an exit at street level.	Interchanges often have all sorts of equipment's available for passengers. Certain equipment at interchange can allow passengers to interchange faster and in a more comfortable way. For people with reduced mobility (PRM), certain equipment may be a required condition for them to go through the interchange at all. An ICT solution devoted to user guidance can achieve different purposes depending on the user. One can identify different user profiles: - PRM who have special needs and - Occasional passengers who can't remember exactly where the interchange is located in the city or who find it difficult to find their way inside the interchange. Way finding depends on user profile and station typology. For occasional passenger, the guidance aims at finding the shortest path to go through the connection. For stations that are very large, the guidance may suggest a path having a maximum of signage all along. For stations that are usually crowded at peak hours, the guidance may consist in suggesting a path according to circulation route. PRM have to be ensured that they will be able to go in and out of an interchange on their own. So the application has to guide them to the appropriate equipment. For example, people in wheelchairs have to use lifts to go from a level to another. Occasional passengers expect to find the shortest way when using the application.
Actual tool tested	Interchange digitalization system	The mobile application has not been deployed. So the service has not been tested by passengers. However the back office (Interchange digitalization system) has been developed with an experimentation in station "Théâtre des Arts" (public transport operator in Rouen).

Measurements/Issues	Description	Notes
Analysis of tool	The tool has to be embedded in as plugin on a wider application.	The journey Planner and user guidance responds to itinerary requests but at a different scale. This multimodal journey planner covers at least a city or a larger area and gives User guidance at an interchange scale.
		For the user experience, it would be better to merge User guidance and multimodal journey planner in a single application. For Rouen, that means that the User guidance function has to be plug in the existing journey planner the service. Thus the journey planner can deliver more details on interchange parts of itinerary.
European legislative context	As the tool may be considered as publishing geographic data, it has to respect the INSPIRE directive.	Depending on how the tool publishes geographic information in the interchange area, the INSPIRE directive may apply. The directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) was published in the official Journal on the 25th April 2007 and entered into force on the 15th May 2007. This Directive is a bit complex with many parts like metadata and spatial data. As for the tool "Static/dynamic map at interchange", this tool may have to satisfy some requirements of that directive.
French legislative context	Accessibility legislation	Since the "Loi du Handicap" (n° 2005-102 on 11/02/2005), the political ambition is to achieve full accessibility to public area. The content of this law is long and complex and will have to adapted before becoming fully applicable. Accessibility can be a tricky issue when it's considered in a local context. This law will certainly leverage the accessibility of public transport in the next years and it will define even more accurately how public transport has to fit with accessibility requirements.

Measurements/Issues	Description	Notes
Application at Rouen		Who are end users for the tool? • Tourists: most of the tourism sites are spread in Rouen city centre which has become a pedestrian city centre. Although tourism is an important activity in Rouen, they are potential users of the tool as they are not familiar with how to access the interchange. • Occasional passengers: mainly inhabitant living in the "département Seine Maritime" or further in Normandy. What is the current status regarding Information Systems in Rouen? At the beginning of NODES project, there was no Information System that provided digitalization of interchanges. By digitalization the following is meant: 2D maps of interchanges indicating where certain equipment is located, where the exists / entries are, where scheduled stop points are, etc. "Scheduled stop point" means "a point where passengers can board or alight from vehicles" accordingly to Transmodel definition (http://transmodel-cen.eu/wp-content/uploads/2015/02/TRM6_Glossary-Part-123.pdf). This digitalization is necessary for any user's guidance tool. The digitalization has to reference scheduled stop point located in or around the station. In fact scheduled stop point identifier is the only way to make a relation between interchange digitalization datas and "Multimodal Journey Planner" datas. Scheduled stop point identifier is an interface between "User Guidance At Interchange" tool and "Multimodal Journey Planner" tool. The condition for connecting tools "User Guidance At Interchange" and "Multimodal Journey Planner" requires that the scheduled stop point identifiers are permanently kept up to date. Actually in Rouen the scheduled stop point identifier depends on the same data provider systems as those used for the Multimodal Journey Planner (see tool n° 5 Multimodal Journey Planner). The scheduled stop point identification may vary for each data delivery, in fact there is no "Transport Data Repository". The purpose of a "Transport Data Repository" is essentially to make it easier for different systems to share a common data identifier. In UK, Naptan is a central database that gathers all public transport access. In France the situation is very different. Since one or 2 years, there are only some Transport Authorities that have decided to produce a "Transport Data Repository". The area covered by the "Transport Data Repository" may be a "Région" or a "Département". For Rouen, there isn't one at this time.

Measurements/Issues	Description	Notes
Application at "Théâtre des Arts" interchange		The interchange can be split in 2 levels: - ground level with bus lines; - underground level with metro line. Hence, 2 maps are required, one for each level. Even if the tool n° 6 "static/dynamic map at interchange" is deployed in Rouen (see above), there are only static maps and no digitalised station maps. The station is mainly underground (similarly to the other underground stations in Rouen). There is no covered space at ground level, only bus stops connected to TEOR (BHNS) and to other bus lines. At ground level, the maps scale covers the neighbourhood.
Suggested improvements to tool		1/ Suggestion for delivering an integrated service of user guidance A "Transport Data Repository" (like Naptan for a national level) is a key condition to enable the integration of interchange user guidance in a journey planner.The CEN Technical specification IFOPT can be very useful to design a "Transport Data Repository" as well as the model of station digitalization. A "Transport Data Repository" does exist in the UK at national level, but not yet in France. There are some projects launched at regional level (Région "Ile de France", Région "Nord Pas De Calais"). 2/ Suggestion for an interchange accessibility evaluation Even without a "Transport Data Repository", interchanges can be digitalized. When all equipments are located and their accessibility properties have been described, an accessibility analysis becomes possible at interchange level. It is possible to evaluate the duration required for a passenger to go from an entry (or exit) to a stop point. This evaluation can take into account special need of a PRM for example.The evaluation is mainly useful to detect that a stop point is not accessible for a PRM (in wheelchair for example) or that the access duration is too high.

Measurements/Issues	Description	Notes
Conclusions	_	Beyond the user guidance at interchanges, a tool that enables interchange digitalization is very useful for a set of services.
		Some of those services are devoted to passengers; especially passengers having special needs. Other services are devoted to interchange stakeholders for accessibility evaluation purpose.
		Many of the services are in relation to accessibility issues. Legal requirements have to be considered and may vary from one country to another. Hence, the usage of a standard to design interchange digitalization is a key issue for the tool. Otherwise the tool will have to be re-developed for each special interchange or country.
verdict on tool	_	This tool is usefull and needed for interchanges. It requires low maintenance, although it is complex and may become unreliable.
Tool relevance to Interchange	Scale 1 to 5 (1 not relevant, 5 very relevant)	4 for occasional passenger, 5 for PRM
Resource cost	Scale 5 to 1 (5 low cost, 1 high cost)	2 relatively low cost - 5 if there is no "Transport Data Repository"
Ease of use	Scale 5 to 1 (5 very easy, 1 not at all easy)	4 relatively easy to keep interchange digitalization up-to-date - but difficult to initialize the first time (depends on size and number of interchanges)
Learning curve	Scale 5 to 1 (5 very easy, 1 not at all easy)	4 relatively easy with a back office path link and equipment can be edited on the interchange map view
Time taken	Scale 5 to 1 (5 short time, 1 very long time)	3 relatively high cost during starting period - depends on the size and number of interchanges
Total score	possible 25	18 reflects a very useful tool, but complex to deploy if no "Transport Data Repository" exists.