Literature Review

Mini-hub concept

DRAFT

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1 Multimodal ‘mini-hub’

1.1 The general concept of an urban mini-hub

A passenger transport hub is normally defined as a place where passengers can exchange between different transport modes: a railway station, located in the central area of a city, is an evident example of transport hub. The basic aim of a hub is to provide different kind of travellers (commuters, tourists, simple citizens, etc…) with a set of facilities to make the modal exchange more friendly and efficient. A complementary objective, of primary importance in case of large urban agglomerations, is to promote a larger use of public transport and to offer more sustainable individual mobility options.

In the case of new infrastructure, given the significant expected impact under several points of view, its planning and design is usually developed in an integrated way, i.e., involving all the bodies and stakeholders affected by the intervention, with the objective of examining all economic, social, and environmental costs and benefits. This allows for the identification of the most appropriate option, able to give answers to all the questions related to the interconnection of different transport systems and to the sustainability of individual mobility choices.

On the other hand, when approaching an existing station, it is quite evident that significant infrastructural interventions are necessary to improve modal interchange facilities, however these interventions are conditioned by constrains determined by the existing urban environment and they have to be properly taken into consideration. This situation is particularly relevant, and very frequently witnessed, at stations located in historical urban centres, designed and built in historical periods characterised by completely different needs.

In fact, very often the physical layout of the station and/or its neighbourhood, the railways and underground existing plans, the limitation of available new areas, the historical and architectural constraints, and last but not least funding capabilities, determine all together strong limitations towards extended improvements.

The case of Genova, and of its two main stations named Genova Piazza Principe and Genova Brignole, is a clear example of the situation previously described: these two transport hubs are characterised by several constrains towards significant interventions, mainly due to the difficult territorial context:

- Principe station (Figure 1) was built between 1853 and 1860 and is settled between the historical centre of the city (part of the historical centre and Palazzo del Principe, both indicated in yellow in the figure), the hills and the sea; the station is used by about 24 million pax/year;
- Brignole station (Figure 2), built in 1868 and renewed in 1905 for the Genova international exposition, lies between the Bisagno river, the hills and the 18th century part of the city centre.

As it was mentioned, in this kind of situation, it is impossible to develop significant infrastructural interventions and, therefore, an alternative approach shall be followed in order to achieve the objective of improving interchange facilities, also in a perspective of sustainability.

Figure 1. Aerial view of the area around Genova P. Principe station (red = station complex, yellow = historical centre and cultural heritage)

Source: Comune di Genova elaboration from Google maps, 2017

Figure 2. Aerial view of the area around Genova Brignole station (red = station complex)

Source: Comune di Genova elaboration from Google maps, 2017

A way to partially solve these problems, or at least maximise the results taking into account all constraints, is to set aside large infrastructural interventions, and focus the attention on a wider spread of “mini” interventions, in terms of both physical interventions and service creation, strongly favouring their integration with the actual territorial context and the historic built environment.

Starting from this approach, an urban intermodal “mini-hub” can be considered as an area comprising an existing railway station and its immediate surrounding, where:

- the constrains impeding large-scale interventions are insurmountable for urban and/or historical and/or technical and/or economic (in terms of cost-benefit ratio) reasons;

- the exchange between different public and private transport means is fostered and promoted through the adoption of a set of smaller interventions, mainly focussed on their sustainability (in terms of mobility and environmental impacts) and on user needs.

1.2 The mini-hub design within SUMP strategy

The European Commission proposed in the Action Plan on Urban Mobility, dated 2009, to accelerate the take-up of Sustainable Urban Mobility Plans (SUMP) in Europe, and to support their adoption and development in cities and metropolitan areas.

In 2013 SUMP became one of the pillars of the "Europe 2020 Strategy for smart, inclusive, and sustainable growth" (E.U., 2013). It is quite evident that the design of an urban mini-hub must be deeply harmonised with the more general SUMP strategy developed by the Local Administrations, becoming a significant part of it.

Consequently, the general criteria proposed within the "Guidelines for developing and implementing a Sustainable Urban Mobility Plan", delivered in 2014 by Eltis for the European Commission (Rupprecht Consult, 2014) can be referred and adopted during the design and development stages of an urban multimodal mini-hub.

The following steps, each of them further subdivided into activities, are identified:

1. Determine potential for a successful plan;
2. Define the development process and scope of plan;
3. Analyse the mobility situation and develop scenarios;
4. Develop a common vision;
5. Set priorities and measurable targets;
6. Develop effective packages of measures;
7. Agree on clear responsibilities and allocate budgets;
8. Build monitoring and assessment into the plan;
9. Adopt sustainable plan;
10. Ensure proper management and communication.

The application of this approach, specifically targeted at SUMPs, is strongly recommended for mini-hubs too, personalising some activities according to the local situation.

1.3 Areas of intervention

Starting from the concept of mini-hub previously discussed, it can be useful to list and briefly describe the most relevant and frequent typologies of interventions, referring, where possible, to existing situations in real urban areas.

It must be underlined that the interventions described in the following paragraphs cannot be considered completely exhaustive, as other additional solutions can be studied and applied according to specific characteristics and local conditions.

Finally, from the considerations developed below, in order to increase the effectiveness of the different measures, it will be quite evident the need of improving the station and its immediate surroundings as a unique target area.

1.3.1 Interchange between railway and local public transport network

The area around a railway station positioned in a central area of a city is normally growing as the most important node to interchange between long/medium range public transport network (the railway) and the short range public transport network (local network of buses, underground, trams and in specific cases sea/fluvial boats).

Interchange facilities between these two networks are basically of two types:

- infrastructural facilities: escalators, lifts, moving walks, bus shelters, waiting areas, etc.
- information facilities: pre-trip and on-trip planners and integrated ticketing.

Infrastructural facilities are all the elements needed to physically connect the station with the city. The user (citizen or tourist) should be enabled to switch from one mode to the other in the easiest and most comfortable way.

Looking more in detail at the information facilities, the aspect of trip planning tools providing integrated information for the different transport modes (and particularly railway and local public transport) is crucial for an efficient interoperation inside the mini-hub. Pre-trip planning must give to the traveller all the possible alternatives to move from one point to another, with detailed information concerning schedule, prices, paying modalities, etc. On-trip planner must allow a real-time check of the previously planned trip, taking into account the real condition of the transport service (like vehicle position, abnormal situations, strikes, etc.) and, if necessary, support the traveller in rescheduling his/her plan (Nuzzolo et al., 2013).

Automatic Fare Collection Systems (AFCS), frequently referred to as electronic ticketing or e-ticketing, are based on integrated travel tickets, allowing the user to move from transport modes managed by different operators in a very easy way; these systems are generally based on electronic smart cards and on-board validators, more recently on specific technologies like Near Field Communication (NFC). Most interoperable AFCS are characterised by commercial agreements among the transport operators of an area, consisting in the emission of unique travel tickets, in the management of a common selling network and of a revenue sharing (clearing) of economic incomings.

AFCS are in operation in many European cities and urban areas: some examples along the Rhine-Alpine Corridor are SBME in Milano, BIP in Torino and Piedmont Region (Figure 3), e-ticket Rhine Main in Frankfurt, and RET system in Rotterdam.

To be noted that in most of these systems the use of the electronic ticketing is extended to additional services related to mobility in some way, like car sharing, parking and bike sharing.

Figure 3. BIP validator in Torino

Source: vivatorino.it, 2017

The concept of the integration between railway and local public transport can be easily extended to other transport modes, depending on the specific characteristics of the urban node.

Sea-based transport modes can have a local character: a sea/river/lake network of boats, providing a typically local public transport service. Trip planning and e-ticketing described in the previous section can be easily applied to this context. As an example, see “NaveBus” represented in Figure 4, a service managed by the local public transport company of Genova connecting the city centre to a peripheral area.

Figure 4. Navebus service in Genoa

Source: AMT (Azienda Mobilità Trasporti Genova), 2017

The interchange with long-distance services (air, ferries and cruises) has different characteristics, and normally dedicated transfer services (by bus or train) are available.

1.3.2 Sharing and rental facilities

Sharing and rental facilities represent one of the most effective solutions to be applied while designing a mini-hub as those services:

- may be easily used by both citizens and tourists;
- have a low impact in terms of use of space, when implemented;
- have a high level in terms of sustainability.

With respect to citizens, bike or car sharing services are good options to get to the railway station as an alternative to private cars as they:

- allow to reduce travel times between the station and home/workplace, considering that private cars, in the urban context, are usually the mean of transport with the lowest “commercial” speed;
- have a lower global cost for the user if compared to private modes (where fuel and parking fee have to be considered).

When a tourist arrives in a city, the possibility to dispose of “light” and sustainable means of transport allowing an autonomous mobility inside the central area is well appreciated. Electric bikes and scooters (Figure 5) are evidently the best solution, but also small sized e-cars can be proposed to a wider range of users. Relating to the concept of the mini-hub, where the railway

station is positioned within the historical centre, the offer to tourists of such services is one of the most qualifying measures. It's absolutely important that the service points are located inside the mini-hub area, easily accessible, well indicated and well connected with the urban mobility network, especially in the case of bike-lanes.

In addition to the basic sharing service provisions, some additional measures are very useful to increase attractiveness for tourists: not only the possibility to use the AFCS previously described to access the sharing service and manage payments, but also information facilities like the vehicle availability through dedicated apps or mini-navigators to facilitate mobility within the urban central area.

Figure 5. Bike sharing in Milan

Source: maxpixel.freegreatpictures.com, 2017

1.3.3 Private parking

A passenger transport hub must guarantee to travellers the possibility to make an easy and efficient modal exchange both between public transport and private mobility. Public parking, and in a secondary option, private parking next to the station, are often perceived by travellers like a surplus value above all, due to the frequent lack of space around a station. The terminologies "Park and Ride", P+R, used for cars and "Bike and Ride", B+R, used for bikes, are quite well consolidated; P+R and B+R areas are present in correspondence of many railway stations. More interesting and appropriate in the mini-hub context is recently "Kiss and Ride", K+R (Figure 6), derived from "Kiss and Fly" typical of the airports. In K+R areas cars can stop, free of charge, for a very short time, to drop-off or to pick up passengers. Such a facility requests a relatively limited number of parking slots, consequently it's quite feasible also in condition of areas with restricted availability, that is the typical situation of a mini-hub.

Bicycle parking is less space-consuming than car parking, promoting bicycle-train interchange means to contribute to sustainable mobility too and reduce car use, pollution and congestion. From an architectural and urban design/ planning point of view well organised bicycle parking prevents chaotic presence of bicycles degrading the quality of public space. The first step is a free parking, allowing bicycles to be secured in preferably covered area, and the second step is individual lockers, and the third one a bicycle storage with supervised entrance.

Figure 6. Kiss & ride sign

Source: Wikipedia, 2017

1.3.4 E-charging points for e-vehicles

The use of e-vehicles, strongly promoted by the Commission as one of the most relevant measures to reduce pollution deriving from transport (EU, 2014), is progressively increasing in Europe, although with different percentages in each Country. One of the key-factors in the progressive swap of users from fuel-traditional to electric vehicles consists in the diffusion and the effectiveness of the recharge infrastructure network. The charging points are the key elements of this infrastructure.

Figure 7. e-charging point

Source: Wikipedia, 2017

The technology presently on the market offers two different types of recharging: normal recharging points, where a medium size car needs more than one hour to be recharged, and high power recharging points, where in 10-15 minutes a car can be recharged (Figure 7). In both cases, it is supposed that the driver parks the car in front of the charging station just for the time necessary to recharge, and then releasing it for the next user. Starting from this consideration, it is quite evident that the installation of e-charging points inside the mini-hub area around the station must be carefully designed. In particular, dedicating part of the few available space for parking to e-

charging points may have a double positive effect: discourage the use of conventional private car to reach the stations and offer an additional incentive for e-vehicles use.

In any case, a necessary condition is the installation of a sufficient number of charging points, in order to reasonably ensure an adequate availability to e-vehicle drivers.

1.3.5 Wayfinding and passenger information

The term wayfinding was introduced for the first time in the book “Image of the City”, (Lynch, 1960) where he described way-finding as a consistent use and organisation of definite sensory cues from the external environment. Environmental psychologist Romedi Passini (Passini, 1984) published "Wayfinding in Architecture" and expanded the concept to include the use of signage and other graphic communication.

The wayfinding concept was further expanded in the book "Wayfinding: People, Signs and Architecture." (Arthur, et al., 1992). They extended the concept of the term wayfinding by relating it to architecture and signage and described the essential principles for wayfinding. They concluded that wayfinding is a spatial problem solving.

Some years later the new term “Wayshowing” was conjugated, used to cover the act of assisting wayfinding; wayshowing facilitates the wayfinding strategies (Mollerup, 2013).

A friendly approach to intermodality in an area around a station must be based on the application of the wayfinding concept, consisting in a spread of different supports, and related technologies, to address passengers when evaluating and selecting different mobility options, and then when moving themselves.

Traditional supports to provide information are panels, eventually integrated with audible notifications, and desks provided with tactile facilities for interaction. In recent years, due to the development of information technologies, new solutions based on specific apps for smart devices are growing everywhere, allowing formore efficient, detailed, and personalised information (Figure 8). The provision of complete and accurate information originated by different operators (transport, tourist, economical, institutional, etc.) needs filtering, harmonisation and integration before being accessible by the app; the “governance” of the information is a key-aspect to ensure accurate information and higher utilisation by users.

Figure 8. WAM APP in Genoa central area

Source: IIC, 2017

1.3.6 Security and PRM facilities

Many regulations and many projects defined rules and best practices related to two major problems concerning design and management of a railway station: security, with an increasing special focus on prevention and protection from terrorist threats and measures to ensure an acceptable level of mobility to disabled persons.

Rules and best practises are normally applied to the station and limited to its boundary but it is quite evident that in the context of a mini-hub, where the railway station and the neighbouring areas are in hold and reciprocal connection, the same criteria concerning security and PRM (Passenger with Reduced Mobility) facilities could be extended to the mini-hub area. Of course, it should be at different scale and specifically adapted to the physical context.

To ensure good mobility and to provide equal opportunity for all travellers in utilising railway transport some interventions are necessary, both inside and around the railway station.

The European Regulation 1371 “Rail passengers’ rights and obligations” (EU, 2007) dedicates chapter 5 to disabled and reduced mobility persons, fixing the basic principle of a non-discriminatory access, in particular stating the compliance of the infrastructures to so-called PRM TSI - Technical Specifications for Interoperability relating to accessibility of the Union's rail system for persons with disabilities and persons with reduced mobility.

The Guide for the application of the PRM TSI (European Railway Agency, 2015) enters more in detail, considering a list of infrastructures like parking facilities, obstacle free routes, vertical circulation, route identification, doors and entrances, ticketing & information desks, and visual information, etc., giving for each of them relevant indications for an optimal usability by PMR users. These indications should be at the base of the design of the mini-hub area.

Referring to security aspects, some measures adopted inside the stations can also be extended to mini-hub surrounding area: typically video-surveillance, which can be well integrated with additional features of automatic image processing, like crowd analysis, abandoned luggage detection and abnormal behaviours.

The application to the mini-hub area of additional security measures like access control by detectors and barriers is evidently more difficult, due to the different characteristics of the two areas: the station is, or at least can be, a “closed” area, while external mini-hub area is an “open” area where free access is mandatory.

A crucial element to improve efficiency of station management deriving from the security measures relates to the operational coordination among the different stakeholders responsible for the areas management: the station operators, public transport operators, private operators, and overall police authority. To optimise such coordination, the best solution consists in the creation of a security supervision room controlling both inside the station and outside all the mini-hub area.

1.4 Housing and business development around the mini-hub

Stations and surrounding configuration have been subject to different approaches in the last years.

In USA in the 1990’s the concept of TOD was developed, defined as ‘a mixed-use community that encourages people to live near transit services, like stations, and to decrease their dependence on driving’. (Calthorpe,1993). TOD promotes the necessity to increase the human presence in areas

around the stations through high quality and diversified functional interventions, such as new commercial activities, new constructions, and specific initiatives to support private investments.

A further term connected with TOD is Transit Joint Development (TJD), that points out a specific real estate development and forms of Public-Private Partnership (PPP).

In USA TOD is related to particular interventions of transformation, not always contextualised in a more general urban regulatory framework.

In Europe, given the historical development of cities and the conception of urban planning, the general context is quite different from USA, but it is interesting anyhow to analyse those aspects.

The European response to TOD was proposed, in Great Britain, with the publication of a preliminary study on the Transport Development Areas (TDA), (RICS, 2000). TDA represents a new integrated and synergic approach between all actors involved in mobility and urban transformation, having most relevant applications in public transport nodes and more generally in strategic places characterised by high accessibility needs; starting from this approach, important projects involving railway station renovation and renaissance have been developed.

As a consequence of these new approaches, railway stations have increased both their functions, becoming a fundamental passengers interchange node for an integrated multimodal transport system, and they have been becoming a new central place within the urban centres.

Mini-hubs offer opportunities for the development of diversified commercial activities, both inside the station and in neighbouring area, and the customers are both the citizens living in the TDA and the travellers using the transport hub.

It should be very useful to develop an integrated vision involving both the station and the neighbouring area, by planning which services and commercial activities to be promoted and their physical location, in a strategic vision of increasing global attractiveness of the mini-hub. Such a process, quite similar in airport hubs, is not easy, due to two correlated factors: the station area and the neighbouring area are normally managed by different stakeholders (typically railway operator and municipality), and the planning must take into account the real interest of business groups, as most of the initiatives have a “private” character.

1.5 Expected impacts

The evaluation of the benefits deriving from a set of “mini” interventions in an interchange urban node is a complex problem, which has been already addressed in many projects and initiatives at European level.

In particular, the European policy addressing the subject within TEN-T Programme “Union Guidelines for the development of the Trans-European Transport Network” (E.U, 2013a) and “Connecting Europe Facility” (E.U, 2013b) are focusing on the strategic rule of urban nodes within the general strategy of the European transport development.

An effort in the direction of assessing interventions and benefits has been found within the initiative LINK (the European forum on intermodal passenger travel 2007-2013), funded by E.U. – DG MOVE, providing general recommendations concerning the strategic lines of intervention.

More recently, NODES project, developed within FP7 programme and concluded in 2015, entered more in detail, developing a package named “Toolbox” (NODES D.3.1.2, 2015): from one side the definition of a wide spread of interventions on an interchange node, from the other side a list of indicators to evaluate and measure these interventions. The result is a sort of matrix, which seems interesting, in which most of the interventions previously described by other research projects can

be found. The results proposed by the Toolbox are only qualitative, but they can be very useful in a first step of evaluation.

The topics identified within the Toolbox to cover the key functions of interchange nodes are:

- strategies for integrated land use planning with urban passenger integrated planning;
- innovative approaches relating to the design of new or upgraded efficient transport interchanges;
- intermodal operations and information provision;
- management and business models: the interchange as business case for the local economy;
- energy efficient and environmental friendly interchanges.

The following table (Figure 9) summarises some results derived from NODES Toolbox, which seem more relevant as applied to mini-hub context.

	Intermodal Transport Control System	Multimodal journey planner	Passenger info-service	Smart ticketing system	Static/dynamic multimodal map	Park & Ride facilities	Urban space for interchange	Pedestrian information & navigation	Exploitation of commercial services
Enhance accessibility and integration	++	++	++	++	++	++	++	+	+
Enhance intermodality	++	++	++	++	++	++	++	+	0
Enhance liveability	++	0	+	++	++	+	++	++	++
Increase safety and security conditions	++	0	+	++	++	+	++	0	+
Increase economic viability and costs efficiency	++	++	0	++	0	+	+	0	++
Stimulate local economy	0	++	0	++	0	+	+	+	++
Increase environmental efficiency	0	0	0	0	0	+	0	0	0
Increase energy efficiency	0	0	0	0	0	+	0	0	0

Figure 9. Application of some NODES benchmark criteria to mini-hub context

Source: IIC, 2017 (derived from NODES 2015)

2 The Genoa case: next steps and developments

Due to its specific orographic configuration between sea and hills the lack of space has always been one of the most relevant problems of Genoa. The presence of the biggest historical centre in Europe exacerbates a situation already difficult.

Significant infrastructural interventions that are necessary to improve modal interchange facilities are strictly conditioned by constrains determined by the existing urban environment especially when stations are located in historical urban centres, designed and built in historical periods characterised by completely different needs. In spite of this adverse condition, the Genoa Municipality developed the “Mini-hub concept”, focused on a strategic transport development connecting the two main stations of Principe and Brignole to their neighbourhood.

A set of specific interventions are planned by the Municipality of Genoa in the near future, addressing some of the topics described in the previous paragraphs:

- bike sharing service located near Principe metro station will be improved with an additional parking in Piazza Acquaverde, closer to the main entrance of the station;
- in Brignole station the existing bike parking will be expanded with new racks; furthermore, bike sharing parking space will be located closer to the main entrance of the station and in Piazza Raggi, very close the station;
- a new car sharing parking (3 lots) will be located closer to station Brignole;
- new information panels are going to be located near to both the stations;
- charging columns for electric vehicles will be located near to the Brignole station and in the interchange parking space.

Moreover, the tender for the realisation of the regional integrated ticketing for public transport is in progress: the system is expected to be in operation within a couple of years and will support all technological developments in terms of integrated ticketing.

In addition to these already planned interventions, the Municipality will identify other interventions to improve the connections between the station and the city, contributing to better develop the mini-hub concept within RAISE-IT, and capitalising the project results by including additional aspect in the future mobility planning.

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4 List of Abbreviations

AFCS	Automatic Fare Collection Systems
B+R	Bike and Ride
LINK	The European forum on intermodal passenger travel
K+R	Kiss & Ride
NFC	Near Field Communication
PPP	Public Private Partnership
P+R	Park and Ride
PRM	Passenger with Reduced Mobility
SUMP	Sustainable Urban Mobility Plan
TDA	Transport Development Areas
TJD	Transit Joint Development
TOD	Transit Oriented Development