

How to connect freight logistics, persons mobility, and spatial planning in and between urban regions? Perspectives from different European urban nodes on TEN-T corridors

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Abstract: European urban nodes are vital for the effectiveness of the European core transport network (TEN-T), for passengers and freight transport. Yet, this role also comes with challenges regarding liveability, a battle for space with other functions in densely populated and growing urban nodes. Effective solutions should be designed at the level of the *functional urban area* of freight and logistics which exist at a different spatial scale from a passenger transport perspective, as examples of Vienna and Rotterdam illustrate. Urban nodes that are stimulating multi-modality ambitions and solutions should include freight and logistics. Regional opportunities for transit oriented development (TOD) could be combined with potential freight hubs, logistics oriented development (LOD). Initiatives can be taken within the urban nodes as well as on the corridor between the urban nodes, as is illustrated by several examples (Venlo (NL) and Lauterbourg (FR)) that relieve spatial and transport pressure in Rotterdam respectively Strasbourg. European tools and funding exist that could support urban nodes in dealing with these complex challenges and investment needs, both from transport and regional policy. An analysis of the STRAT-Board database shows that ESI funds are used by the majority of urban nodes for investments in mobility and infrastructure..

Keywords: Integrated planning and governance; TEN-T corridors and urban nodes; freight transport and logistics; functional urban areas

1. Introduction

European urban nodes are vital for the effectiveness of the European core transport network (TEN-T), as they are the origin and/or destination of most long-distance transport flows, for both passengers and freight. They host major multimodal transport hubs, and are crucial regarding the interface of long distance and last-mile delivery. At the same time, urban nodes play a major role in the transition of Europe's transport system as expressed in the European Commission's Transport White Paper (COM, 2011) aiming at limiting transport emissions and improving accessibility and liveability in cities. European urban nodes are the major arenas where public and private parties and society should join forces to cope with several trends and challenges. Stimulating electric mobility and zero emission transport and other innovative technical solutions will not be enough to deal with the challenges described above.

In order to further explore the role and challenges of urban nodes that are part of the TEN-T network, the European Commission launched a call under Horizon 2020. This paper builds on the mid-term results of a project that was set up under this call: the project *Vital Nodes* (<https://vitalnodes.eu>).

Main objectives of the Vital Nodes project are:

- a) Delivering validated recommendations for a more effective and sustainable integration of all 88 urban nodes into the TEN-T corridors focusing on freight and logistics;
- b) Establishing a long-lasting European expert network for safeguarding long-term continuity in knowledge and implementation (Vital Nodes Consortium, 2017). *Vital Nodes* has brought existing networks together and has been working on ensuring long-term engagement and recommendations for research and funding needs as well as input to TEN-T and CEF guidelines (EC 1315, 2013).

Vital Nodes combines bottom-up knowledge and experience through personalised city workshops with data gathering and policy analysis. This has given the project a unique view on the challenges urban nodes face linked to their position in the TEN-T network.

This paper will explore these challenges, deepen two aspects of these challenges – *functional urban area* (FUA) and European instruments – illustrated by two urban nodes cases and conclude with some lessons learned.

2. Trends and challenges of urban nodes

The Vital Nodes project conducted numerous workshops throughout Europe in 2018 and 2019, in which local, regional and national professionals in spatial and transport came together. Several (local) trends and challenges in the field of (freight) transport and logistics have been identified (Linden, van der, and Linssen, 2018):

- Growing urbanization and densification in many European cities and urban regions, e.g. in Vienna, Budapest, Rotterdam and Strasbourg.
- An increasing number of cities is aiming for low-emission transport policies and stimulating sustainable transport modes, expressed in a local or regional sustainable urban mobility plan (SUMP). Inspiring example is Vienna's STEP 2025 (Vienna City Administration, 2014).
- Development of micro and midi hubs for last-mile freight deliveries in urban regions (e.g. in Vienna, Mannheim and Strasbourg).
- Conflicting transport flows between freight and logistics and person transport, mainly on ring roads and river crossings in e.g. Vienna and Mannheim.
- Risk of 'logistics sprawl' by ad-hoc planning of XXL warehouses in urban regions and along corridors.
- Growing demand of flexibility in freight transport and logistics.

Aggregating the above mentioned challenges a few elements come back as crucial for success. First, the awareness that transport and logistics chains are much larger than the administrative border of the city and have very different stakeholders in comparison with passenger transport. Second, at the level of the urban node transport interests often conflict with environmental and spatial planning interests, leading to more and more complicated, expensive and time-consuming decision-making processes. As

a consequence, public actors need a different type of governance at a different scale, looking beyond administrative (city) boundaries. Good examples and funding opportunities exist but could be better exploited.

3. Exploring the *functional urban area*: definitions, urban nodes typology and examples

When focusing on the spatial and network implications for freight flows, stakeholders need to look at a different spatial scale, beyond administrative boundaries: the *functional urban area* (FUA). This is deviating from the *Daily Urban System* (DUS) level, based on labour market and persons transport flows, which is common practice among most urban regions. So far freight and logistics have been quite underexposed among urban and regional planners. Investments in freight logistics are mainly privately driven whereas investments in persons transport (roads, public transport, bicycle routes, etc.) are public. Within urban areas people and freight often share the same road and rail infrastructure, often resulting in bottlenecks e.g. at river crossings and urban ring roads.

Defining the functional urban area is complex. A few examples illustrate this complexity:

3.1 OECD and EC definition

The Organisation for Economic Co-operation and Development (OECD) and the European Commission (EC) have jointly developed a methodology to define *functional urban areas* (FUAs) in a consistent way across countries. Using population density and travel-to-work flows as key information, a FUA consists of a densely inhabited city and of a surrounding area (commuting zone) whose labour market is highly integrated with the city (OECD 2013). The ultimate aim of the OECD-EC approach to FUAs is to create a harmonised definition of cities and their areas of influence for international comparisons as well as for policy analysis on topics related to urban development. According to the OECD “the definition of urban areas in OECD countries uses population density to identify urban cores and travel-to-work flows to identify the hinterlands whose labour market is highly integrated with the cores” (<http://www.oecd.org/cfe/regional-policy/Definition-of-Functional-Urban-Areas-for-the-OECD-metropolitan-database.pdf>).

3.2 Outside Europe

Further exploration of the FUA outside Europe – for example the case of Ecuador – can be found in: http://www.ub.edu/irea/working_papers/2017/201705.pdf. Concluding: There is a large diversity of names for such urban areas (Metropolitan areas, functional regions, urban zones, conurbations, urban regions, large urban areas, metropolis, etc.) which illustrates the complexity of the phenomenon.

The Florida Department of Administration states as the core: “Functional Classification is the assignment of roadways into systems according to the character of service they provide in relation to the total roadway network” (<https://www.fdot.gov/statistics/hwysys/cubfc.shtm>).

3.3 Definition in TEN-T guidelines

Urban Nodes are a constitutive element of the Trans-European Transport Network (TEN-T) and foster the integration of the network into urban circumstances like spatial structure, economy and regional development.

According to regulation 1315/2013 of the EU, article 3 (p), "urban node means an **urban area** where the transport infrastructure of the trans-European transport network, such as ports including passenger terminals, airports, railway stations, logistic platforms and freight terminals located in and around an urban area, is connected with other parts of that infrastructure and with the infrastructure for regional and local traffic" (EC 1315, 2013).

3.4 Typology of urban nodes

Vital Nodes has formulated a typology to identify and to cluster challenges and potential solutions in dialogue with urban nodes more effectively and efficiently. This typology helps to define the function of an area for TEN-T (and vice versa: how does TEN-T influence the functional area?).

Criteria have been described as follows:

- Cross border function. In case of a cross border node, is it multi-modal or uni-modal?
- Sea port: In case of a sea port node, is it a gateway or a regional hub?
- Inland function. In case of an inland node, is it a small or a big node (threshold is 1 million inhabitants or more)?
- Relation of the node (logistics FUA) and the Corridor: Urban (inbound focused on local consumption) versus Transit (outbound focused on production and transit of goods).
- Is the urban node located in a developed or in a cohesion region?
- Is the urban node centric or poly-centric? In other words, does the node serve multiple urban areas or only one urban area?

3.5 Examples of Rotterdam and Vienna

To illustrate the way how this typology could work out in practice, two examples will be discussed: Rotterdam and Vienna. Table 1 shows the different characteristics of these urban nodes in their functionality of an urban node. Rotterdam as a gateway sea port mainly dealing with outbound-oriented production and transit to the hinterland. Vienna as a big (more than 1 million inhabitants in the metropolitan area) multi-modal inland and cross-border node.

Table 1: Urban nodes typology, examples of Rotterdam and Vienna. Source: Poppeliers *et al.* 2018

	Cross – border: multi or unimodal	Sea: Gateway / regional hub	inland: size: small / big (1 mln inhabitants or more)	Relation of the node (logistics FUA) and the Corridor: inbound / consumption versus outbound / production and transit	Developed or cohesion region	Centric or polycentric
Vienna	Multi-modal		Inland, big	Inbound/consumption	Developed	Centric
Rotterdam		Gateway		Outbound/production and transit	Developed	Polycentric

The (indicative) functional areas for the urban nodes Rotterdam and Vienna illustrate the potential emerging spatiality when focusing on a freight and logistics perspective.

Example Rotterdam



Figure 1: the indicative functional urban area of Rotterdam

The functional urban area of Rotterdam (NL) extends along the multi-modal corridor towards the German Rhein/Ruhr area, passing smaller towns and cities (figure 1). Venlo, on the Dutch-German

border, is one of these towns playing an important function for the corridor. Venlo's inland tri-modal terminal (along the river Meuse, railway and highway) functions as an inland terminal for Rotterdam, thereby having a place in the functional area from a freight perspective. From a point of view from network and spatial dimensions the location of freight / distribution centers influences the impact in a functional area. Therefore the regional authorities (within the functional area) as well as the TEN-T (EC and national authority) all have a role and responsibility in realizing objectives including sustainability and energy transition, liveability (safety, noise, clean air), accessibility and connectivity. A sustainable logistics plan on the level of a functional area should include objectives and governance models to realize those objectives.

Example Vienna



Figure 2: the indicative functional urban area of Vienna

Example of a centric, inland an inbound-oriented urban node is the Austrian capital Vienna. At this moment the city has approximately 1.75 million inhabitants and in the coming years Vienna's population is growing fast, with 40,000 inhabitants per year. The number of inhabitants is expected to increase to 2 million citizens in 2030, while the metropolitan region is expected to be home and workplace for over 3 million people (Vienna City Administration, 2014). Vienna's functional urban area extends to the Slovakian capital of Bratislava, 60 km to the east (figure 2).

On basis of both examples we can conclude that both poly-centric and monocentric urban regions are dealing with growing population, urbanization and increasing transport flows of persons and freight/logistics, resulting in a real challenge of space. There is need for mixed land uses and attention for socio-economic relations to maintain a liveable city. This relates to both central city and peri-urban areas, urging for multi-level governance and integrated planning at the level of both DUS (persons transport) and FUA (freight flows). There is need for a combination of TEN-T related goals and SUMP objectives, as promoted by the Commission in the 2013 Urban Mobility Package (UMP). These joint goals open the perspective for forward-looking practices and integrated approaches, which both enhance transport solutions and stimulate synergies with other urban functions (Balázs *et al.*,

2016). Regarding the complexity of the challenges, there is no ‘silver bullet’ (CEDR *et al.*, 2018; Broesi *et al.*, 2018).

3.6 Towards logistics oriented development

Urban regions that are stimulating multi-modality ambitions and solutions should include freight and logistics. Too often SUMP’s are limited to passenger transport solutions, so this scope should be widened to include freight solutions beyond the last-mile as well. Regional opportunities for transit oriented development (TOD) could be combined with potential freight hubs, logistic oriented development (LOD). This regional strategy will only work when municipalities are not mutually competing and when stakeholders do not only focus on the local (city) level, but include the regional (DUS) and corridor (FUA) levels as well. E.g. by researching and monitoring the impact of freight transport flows in the urban node by developments on the corridor and by developing and deploying integrated measures on corridor level and local/regional level.

The Rastatt tunnel accident in August 2017 illustrated the need for widening the scope of the TEN-T corridor and emphasizing the joint FUA of Strasbourg (FR) and Mannheim (DE). Lowering of railway tracks during tunnel construction works led to closing down all passengers and freight railway traffic between Karlsruhe (DE) and Basel (CH) for almost two months (Interregional Alliance for the Rhine-Alpine Corridor, 2018). Investing in upgrading an alternative railroad on the (French) west bank of the Rhine will contribute to overall network resilience on the broader Rhine Alpine corridor.

Besides, these investments could relieve the city of Strasbourg from bottlenecks and allow liveability improvement solutions as diverting the A35 highway, now situated in the central city. After this diversion the current urban highway will be downgraded and integrated into the urban fabric. Besides the *Port Autonome de Strasbourg* opened a new tri-modal container terminal near the town of Lauterbourg on the river Rhine, 60 kilometers north of Strasbourg, last year. This terminal will relieve the city of Strasbourg from many freight trucks that no longer have to cross the city. Zooming in and out from city level to FUA level helps to identify (potential) solutions for urban bottlenecks at the wider scale of the TEN-T corridor including the comprehensive network, not only ‘on’ TEN-T core corridors and within urban nodes. Strasbourg is a good example of an inspiring multi-level and multi-actor approach in a dynamic cross-border region. In several other urban nodes (potential) bottlenecks occur at road and railway river bridges where local, regional and international transport for passengers and freight transport meet. For example in Vienna, Budapest, Mannheim and Hamburg. In case of renovation or renewal of these river crossings – an enormous challenge in the coming decades – specific attention must be paid to a broader regional approach on the impact of bridge closures and the impact on transport, also in socio-economic terms.

Initiatives between urban nodes, elsewhere on the multi-modal corridor are at least as much important as investments within the core urban nodes. Especially in poly-nuclear urban regions as the Randstad, Flanders, Rhein/Ruhr and Rhein/Neckar regions initiatives may take place outside the ‘official’ core urban nodes. Investments in inland terminals and tri-modal terminals can be found in Venlo, Nijmegen and Duisburg, all on the Rhine Alpine corridor but in between the official urban nodes of Rotterdam, Antwerp, Düsseldorf and Cologne.

4. Potential European tools

In this complex world of urban and regional development (housing, working, leisure and liveability), multimodal infrastructure and multi-level governance there is no ‘silver bullet’ by means of a ‘one size fits all solution’. Neither will existing European instruments (funding and non-funding) be fully equipped to stimulate a better relation between urban nodes and the TEN-T network, between urban nodes and their wider FUA. However, several tools and programmes exist that can be used by urban nodes to fund projects and improve their policy towards dealing with being an urban node on the TEN-T network.

In table 2 several European tools that already could be used have been summarized. Besides a funding programme specifically designed for infrastructure investments (Connecting Europe Facility (CEF)) and knowledge exchange programmes for European cities as CIVITAS to support better mobility planning several other European instruments exist within the policy field of regional development that could play a role in tackling the interrelated challenges the urban nodes face. These instruments are rarely mentioned in European transport policy documents at first sight.

Table 2: Overview of (potential) instruments for urban nodes

<p>Connecting Europe Facility (CEF)</p>	<p>The Connecting Europe Facility (CEF) for Transport is the funding instrument to realize European transport infrastructure policy. It aims at supporting investments in building new transport infrastructure in Europe or rehabilitating and upgrading the existing one. CEF Transport focuses on cross-border projects and projects aiming at removing bottlenecks or bridging missing links in various sections of the Core Network and on the Comprehensive Network (http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/maps_upload/tent_modes/EU_A0Landscape2019_freight.png), as well as for horizontal priorities such as traffic management systems.</p>
<p>Cohesion Fund</p>	<p>The Cohesion Fund is aimed at Member States whose Gross National Income (GNI) per inhabitant is less than 90% of the EU average. It aims to reduce economic and social disparities and to promote sustainable development. Infrastructure and green infrastructure can be financed by this fund.</p>
<p>European Regional Development Fund (ERDF)</p>	<p>The ERDF aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. The ERDF focuses its investments on several key priority areas. The four main priorities are Innovation and research, The digital agenda, Support for small and medium-sized enterprises (SMEs), The low-carbon economy. Investments in sustainable urban mobility fall into this fourth topic. In this fund 5% should be spent on sustainable urban development.</p>

Sustainable urban mobility plan (SUMP)	A SUMP is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles.
Integrated Territorial Investments (ITI)	This tool has been created by the Common Provisions Regulations to facilitate cities (and other authorities) to combine different European funding programmes (e.g. ERDF and Cohesion fund) to implement one integrated strategy. Often this is used to implement an Integrated Sustainable Urban Development Strategy.
Urbact network	A European Programme, funded by the EDRF, that brings cities together in action networks. Through joint projects and exchanges they learn from each other and find the best way forward to implement Integrated sustainable urban development.
Urban Innovative actions (UIA)	A European programme that funds highly innovative urban projects which would be too risky for regular ERDF funding.
Urban Development Network (UDN)	A network led by the Commission to exchange knowledge with and between European cities about the use of European funds for the implementation of <i>Integrated sustainable urban development (ISUD)</i> strategies.
TAIEX-REGIO PEER 2PEER	TAIEX-REGIO PEER 2 PEER is designed to share expertise between bodies that manage funding under the European Regional Development Fund (ERDF) and the Cohesion Fund. It helps public officials involved in the management of these funds to exchange knowledge, good practice and practical solutions to concrete problems thus improving their administrative capacity and ensuring better results for the EU investments.

This overview does not pretend to be complete but gives an idea of the possibilities for urban nodes to use European (funding) instruments for addressing their particular challenges. For a selection of these funding opportunities and instruments we have used available databases to check whether urban nodes already make use of these possibilities. We have used the STRAT-Board database (EC, 2019) to check which of the 88 urban nodes that have an integrated sustainable urban development strategy use *European Structural and Investment Funds* (ESIF) funding for transport related investments. STRAT-Board lists all sub-regional ESIF funded strategies in Europe, although the detail of information per strategy can vary. It typically includes the territorial focus of the strategy, the population covered, the funds used, the total ESIF contribution, the thematic objectives included and the type of implementation mechanism (priority axis, *Integrated Territorial Investments* (ITI) or programme). Investments in infrastructure were to be programmed under thematic objective 7, while investments in

urban mobility were part of thematic object 4: low-carbon economy. If an urban node has a strategy which uses investments from either thematic objective 4 or thematic objective 7, or both, we have considered that the strategy includes investments in transport. Even though this might be a slight overestimation since investments in thematic objective 4 not necessarily include investments in urban mobility.

The findings are that 65 of the 88 urban nodes have an *Integrated sustainable urban development* (ISUD) strategy. 58 of these strategies include investments in transport. Almost all of these 58 urban nodes invest in urban mobility, except two. These two, both in the Czech Republic, only invest in infrastructure. Nine urban nodes both include urban mobility and infrastructure investments. With the exception of Naples, they are all situated in the Eastern Member States. Some urban nodes that only received funding for urban mobility were nevertheless part of a larger programme that did include investments in infrastructure. Here, we touch again on the issue of functional territories. Speaking of which, 23 urban nodes designed their strategies at FUA level, 18 at city level, 14 at neighborhood level and 3 as city-network. Concerning the implementation mechanism chosen, more than half (36) of the urban nodes which invest in urban mobility and transport use ITI, 16 use a priority axis and 5 are part of a dedicated operational programme. In addition to regular ERDF funding, urban nodes could also apply for Urban Innovative Actions in the field of mobility. Of the 88 urban nodes only Toulouse was one of the winners of the UIA call on sustainable mobility.

To get an indication whether urban nodes use European programmes to exchange knowledge on mobility and infrastructure we checked the Urbact website for participants in the Urbact networks on urban mobility and transport. Twelve out of the 88 urban nodes have participated in such networks.

Even though discussions on transport and mobility are often framed around the use of CEF funding or the implementation of a SUMP, when we look at available data, three-quarters of the urban nodes also have an ISUD strategy in place for which they receive European regional funding. And the vast majority of these nodes invest in sustainable urban mobility and/or infrastructure. Mixed sources of funding is a reality for urban nodes that should be better taken into account in the policy discourse at European level and could be further facilitated.

5. Conclusions

Freight and logistics are the ‘new kid on the block’ for urban regions’ challenge on how to coordinate spatial and transport planning. This means additional complexity to urban development, regional planning practice and multimodal corridor development. Ignoring this complexity may result in a longer-lasting lack of linkages between urban nodes and the TEN-T network. Until now, most European initiatives concerning integrating professionals in spatial planning and mobility planning focused on passenger transport and last-mile freight delivery at local and metropolitan level (*daily urban system*). A focus on the *daily urban system* does not fully match with current relations and transport flows in freight and logistics. Outcomes of the Vital Nodes project show that – from a freight and logistics point of view – the *functional urban area* of several urban nodes extends the commuter hinterland thereby connecting neighboring urban nodes (Strasbourg-Mannheim, Vienna-Bratislava) or reaching out to important non-urban nodes, such as Venlo for the urban node Rotterdam.

Attention for the corridor from a spatial point of view has been very limited so far and stakeholders from different silos – corridor development, freight/logistics, and spatial/urban planning – do rarely meet nor speak a common language. Bringing in the freight and logistics perspective on urban and regional development – as has been done in the Vital Nodes project – has made clear the *functional urban area* is a new emerging spatiality that needs to be further explored.

A careful mix of interventions – regarding network, spatial and institutional dimensions, keeping in mind the typology of the urban node – seems to be the way forward to strengthen the relation between the urban node (local and regional level) and the TEN-T corridor level. Regarding the use of European funding instruments, many urban nodes already use regional funding for mobility and infrastructure investments as part of an integrated urban development strategy. More than a quarter of the urban nodes have designed their ISUD strategies at FUA level. Further exchanging experiences about coordinated planning approaches across Europe is indispensable to mutually achieve added value for an efficient and sustainable transport system and vital urban regions.

That's why we should rethink our planning and elaborate on an integrated approach that connects the worlds of infrastructure, mobility, freight and logistics with the world of urban and regional spatial development. An approach in which there is attention for 'soft' measures and innovations, addressing the multiplicity of the challenges by integrating different spatial scales, sectors, modalities and stakeholders. Multi-level governance is key.

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