

FEHRL







Transport Infrastructure Integrated with Land-Use Planning





The development of TILUP will be centred around three representative European

Area of research: zone Rotterdam-Cologne

Transport Infrastructure Integrated with Land-Use Planning (TIILUP) is a research programme initiated by Rijkswatestaat in light of the launch of the EU Framework Programme for Research and Innovation Horizon 2020, under the umbrella of the Forever Open Road (FOR) programme of the Forum of European Highway Research Laboratories (FEHRL). The FOR programme works towards a next generation of advanced and affordable infrastructure that can be adopted both for maintaining the existing network and building new infrastructure. This will enable operators to adopt emerging innovations, whilst overcoming the increasing constraints on capacity, sustainability, reliability and integration and societal challenges.



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1 Summary

What is TIILUP?

TIILUP is a planning method that integrates the planning of Transport Infrastructure and Land-Use in a practical way.

Why is there a need for TIILUP?

In today's European context, transport infrastructure and land-use planning face challenges such as uncertainty concerning the future development of mobility, environmental issues, societal demand for sustainable solutions, limited financial budgets, etc. These issues cannot be met with traditional (technical solution driven) planning methods. A new broad scope strategic planning approach is needed in order to deal with these issues in an efficient manner: Transport Infrastructure Integrated with Land-Use Planning – TIILUP.



What are TIILUP key success elements?

The combination between a multimodal network approach, inclusive spatial design, stakeholder commitment and multi-level scale (EU corridor, region and local) synergy are the key ingredients for TIILUP.

What results can be expected when TIILUP is applied?

Best practice experience shows that a TIILUP approach leads to considerable synergy. The return can be achieved in several fields such as improved investment climate, mobility network resilience, stakeholder involvement, environmental quality, etc.

Why is research needed?

Knowledge concerning TIILUP is still fragmented. There is a need to integrate available knowledge and to transform this into a practical set of consistent guidelines: the TIILUP approach.

How will TIILUP be developed?

The development of TIILUP will be practice driven. A set of best-practices, prologue studies and pilots will form the basis of the approach. The focus lies on the implementation and the improvement of future investments.

The six dimensions of the strategy driven approach of the TIILUP basic framework. The three relevant scale levels of the TIILUP planning approach.



Three relevant scales

TIILUP: working on all (geographic) scale levels and connecting those scale levels in an iterative matter is crucial for a successful approach.

- The scale of European Corridors: Traffic within the European corridors creates much pressure on transport infrastructure within regions. At the same time, it can result in positive spin-off effects on a local scale. Crossings points of international infrastructure offer chances for logistic and service nodes. The challenge is to embed this programmatic spin off within the existing urban fabric.
- 2. The scale of Daily Urban System with different infrastructure networks and a variety of multimodal nodes: The highest amount of multimodal mobility takes place within the regions or so called Daily Urban Systems. On the main infrastructure lines in the region, these daily urban system flows of traffic coincide with the traffic that moves on the level of the European corridors. The regional scale is crucial to manage strategically different modalities, different infrastructure scales and the land use around the multimodal nodes in regional systems.
- 3. The scale of specific locations: On this scale, spatial embedding can prevent the negative effects of large infrastructure on the environment and enlarge local spatial and environmental quality for residents, businesses etc.



Example of integrating highway and urban development at the Nordtangente in Basel.

2 Reading guide

This report contains the results of the TIILUP Prologue, a mix of a theory and a practice based approach for the integration of infrastructure planning and land-use planning. The first three chapters (3 to 5) contain information about the theoretical background of TIILUP. The position of TIILUP in the triangle Infrastructure - Land-Use - Mobility is to be found in chapter 3. This is being followed by explaining the urgency of this approach in chapter 4. The different dimensions that form together the TIILUP Basic Framework are being described in chapter 5. The following chapters are practice based. Chapter 6 introduces the three workshops that were being held in the Rotterdam - to - Rhein / Ruhr zone. It shows three relevant scales and the importance of interaction between these scales is being stressed. For each dimension of the TIILUP basic framework suggestions for approvement have been made. Chapter 7 shows the opportunities and challenges for an integral approach of infrastructure planning and land-use planning in the Rotterdam - to - Rhein / Ruhr zone that with recommendations for further research (chapter 8).

An example of integrating a highway with shopping facilities and good quality public space on street level.



E-Holsterhausen -Altendorf 300 m

An example of integrating a highway with a regional mass transit system.

3 Transport Infrastructure Integrated with Land-Use Planning

TIILUP (Transport Infrastructure Integrated with Land-Use Planning) is an integrated approach which aims at a shift in paradigm from current practice of a small scope, ad hoc, technical solution driven planning approach towards a new practice that considers a broad, network scope, strategy driven, adaptive planning approach. TIILUP is a planning approach, which strives for an adaptable, sustainable and robust transport network, offering users an optimal mobility chain, with good connections between the various networks via multimodal hubs, and close coordination of infrastructure and spatial development.

This can lead to more efficient planning in terms of investment costs, a planning process that leads to higher social/economic revenues, as well as reliability of the transport system and livability/sustainability in the regions involved. Regarding the enhancement of sustainable transport and land-use planning different perspectives are relevant. Transportation regards both the 'hardware' of infrastructure provision and the use of this infrastructure – mobility. Land-use planning regards all spatial functions of housing, working, recreation, nature, water, mining, transportation, etc.



TIILUP focuses on the synergy between transport infrastructure and land-use planning. In this approach, first of all the link between infrastructure and land-use will be investigated, since there is little knowledge available. In subsequent steps, full integration with all aspects (mobility, infrastructure and land-use) will be considered.

4

The urgency of an integral approach of infrastructure planning and land-use planning

The TIILUP research programme focuses on an integral approach of infrastructure and land-use planning. Many authorities across Europe are facing ever tougher challenges to cope with the need to accommodate increased traffic demand, while minimising congestion and maintaining services in the face of increasing climate change effects, as well as deliver on environmental and societal objectives. Individual mobility and freight transport will continue to grow over the coming decades and our mobility behaviour is rapidly changing. We are becoming more flexible and mobile and there is a growing spatial and economic differentiation. Successful urban regions will continue to grow, while others will soon face the impact of a declining population. Climate change is increasing the frequency of extreme weather events and hazards our biodiversity and natural habitats. A series of international expert reviews stressed the following dominant urgencies for a TIILUP approach:

> Strong growth

- Research forecasts a strong growth of the mobility of people and road traffic will remain dominant. However, there will be a wider spread across different modes.
- There will also be a strong growth in freight traffic. For example in the Rhein-Ruhr corridor the growth of freight traffic will mainly result in a growth of traffic of trucks. The pressure on the existing highways will increase.
- At the moment the vulnerability of the infrastructure system is often caused by the last 8 10% of traffic on the highways.



The diagram shows the expected growth in mobility, especially air traffic and freight traffic will increase considerably.

> High investments in infrastructure in the near future

In the coming decades there will still be high investments in infrastructure (see map Investment Agenda, p.24-25) in order to:

- 1. Facilitate the growth in mobility;
- 2. Integrate across the modes;
- 3. Comply with the EU environmental regulations.

> Urban regions as focus points

Especially the urban regions are the hotspots for an integral approach of traffic and land-use planning (see map Regional Development, p.22-23). This has to do both with the investments in infrastructure, the restructuring of the urbanized areas and the possible interaction between these two developments:

- Important parts of the forthcoming investments in infrastructure are embedded in urban regions;
- In the coming decades, huge parts of the existing cities are going to be transformed and renewed to meet new demands;
- Infrastructural improvements and adjustments in the existing urban areas have by far the largest macro-economic effects.





> The result of an integral approach

An integral approach of infrastructure planning and land-use planning will result in:

- an optimal value out of the investments in infrastructure and land-use developments;
- a more efficient planning process;
- a broad support for new infrastructure projects;
- a better living environment.

5 TIILUP basic framework

On basis of group discussions with international experts, the basic framework of TIILUP has been developed and checked. Six dimensions have been distinguished: spatial, temporal, network, value, institutional and implementation dimension. Although many other groupings are possible, we consider these six dimensions being characteristic of land-use and infrastructure planning. It might be clear that these six dimensions are very closely related; the value of the basic framework is the synergetic integration of these elements.

1. Spatial dimension: Spatial concepts with synergetic effects on accessibility

For this dimension critical aspects are the ability to deal with scale issues, the role of transport analysis and spatial design as a strategic and operational tool. This is achieved by examining integrative spatial agglomeration and transport concepts. Well-known examples of such integrative concepts are Transit-Oriented Development (TOD), Multimodal corridors, Nodal development, Area-oriented approach.

2. Network dimension: Multimodal network optimization at various spatial scales

This dimension aims at establishing the main parameters of specific transport systems (multimodal, land-use transport integration, LUTI) in relation to spatial functions and spatial density. Different levels of spatial scales are relevant: corridors at (inter)national, daily urban systems at metropolitan level and landscaping at local level.

3. Time dimension: Time linkages and shift to strategy driven planning

This dimension aims at linking the stages in a full life-cycle of places (this also relates to renewal, redevelopment, circular economy/cradle-to-cradle (C2C) and asset management), examining paradigms and temporal changes associated with changing lifestyles and linkages to mobility and accessibility. It also consists of an analysis and review of time linkages for strategy development – regarding the analysis of development of transport infrastructure systems, transitions to multi-modality.

4. Value dimension: Combined value creation and capturing

This dimension gives an overview of state of art of models and approaches to assess value (e.g. Cost-Benefit Analysis; Life-Cycle Assessment; Environmental Impact Assessment), to create value (including accessibility) and capture value in combined infrastructure and spatial development (projects).

5. Institutional dimension: Organisational empowerment for integrated planning

This dimension comprises of examining and analysing existing organisational and institutional frameworks which leads to an overview of governance approaches at all levels for the implementation toolbox. This relates to a broad array of concepts regarding institutional embedding, issues of institutional capacity, culture and setting, governance models at all institutional levels. It also entails development of governance approaches for different situations (transport-land-use combinations, at different scales) related to partnerships: inter-governmental cooperation (public-public partnerships), market involvement (public-private partnerships), stakeholder engagement (citizens, interest groups), and governance of organisational networks.

6. Implementation dimension: Implementation drivers for integrated planning

Finally, a critical aspect in innovation is the deployment and the implementation. Therefore in the TIILUP program explicit attention is paid to the implementation of the framework developed. This dimension includes making an inventory of implementation issues and drivers in order to tackle implementation barriers.

Strategy driven approach of the TIILUP basic framework:



6 TIILUP Prologue

6.1 Introduction

TIILUP wants to enhance the integration of infrastructure planning and land-use planning. The TIILUP prologue was started in order to investigate the potential of this integration in practice. The core of this prologue consisted of three expert meetings in the Rotterdam - to Rhein /Ruhr zone (R2R), namely: the Rotterdam region, the Arnhem region and the Rhein-Ruhr area. The three meetings were intended to test and sharpen the TIILUP framework on the one hand and to make a quick scan of the specific opportunities the integration of infrastructure and land-use planning offers in the regions on the other hand. The participants in the meetings were a mix of experts in the field of finance, governance, design and planning, project management as well as local experts.

Each meeting started with a presentation by an expert. Professor Luuk Boelens (University of Gent) focused in his presentation on the governance aspect and the challenge of how to reach an optimal use of existing infrastructure. Project manager Huub van Zwam gave an insight into the key success factors of two major harbor projects (Rotterdam Maasvlakte II and the Schelde delta). The former State Advisor for Infrastructure, Ton Venhoeven, showed the importance of spatial design in the integral approaches that were applied on three highway projects around Utrecht. The presentations were the kick off for a discussion about the different fields of the TIILUP framework and the practitioner experience of the participants with an integral approach. In the second round of discussion the specific chances and challenges of an integral approach in the region were being discussed. On basis of the meetings in the Netherlands two financial spatial experts (Professor Pieter Tordoir - Amsterdam University - professor Erwin van der Krabben - Radboud University Nijmegen) have each written an essay on the financial spatial aspects of an integral approach of infrastructure planning and land-use planning.

This chapter contains the conclusions of the three meetings. First, the input from the meetings for the TIILUP framework will be described. After that, the suggestions for specific opportunities as discussed in the three meetings will be summarized. Both the sharpened content of the TIILUP framework and the specific opportunities in the three regions result in recommendations for the TIILUP / Horizon 2020 research programme.



Discussion by participants in one of the Prologue expert meetings.

Expert meeting Rotterdam - 27th of August 2013

Martin Aarts - City of Rotterdam Jos Arts - University of Groningen / Ministry of Infrastructure & Environment Sebastian van Berkel - Must urbanism Ada Blijleven - Ministry of Infrastructure & Environment Luuk Boelens - University of Ghent Marielle van Dijk - Port of Rotterdam Tertius Hanekamp - TEMAH / Ministry of Infrastructure & Environment Inez 't Hart - Ministry of Infrastructure & Environment Laurens van Tiel - Ministry of Infrastructure & Environment Pieter Tordoir - University of Amsterdam Wouter Veldhuis - Must urbanism Mark Verheijen - Rotterdam University of Applied Science

Expert meeting Arnhem - 2nd of October 2013

Paul van den Anker - City of Nijmegen Jos Arts - University of Groningen / Ministry of Infrastructure & Environment Sebastian van Berkel - Must urbanism Robert Broesi - Must urbanism Anko Grootveld (Anko Grootveld Coaching, Province of Gelderland) Tertius Hanekamp - TEMAH / Ministry of Infrastructure & Environment Inez 't Hart - Ministry of Infrastructure & Environment Erwin van der Krabben (Radboud University Nijmegen) Ingmar van Meerkerk (Erasmus University Rotterdam) Huub van Zwam (Executive manager for e.g. Maasvlakte 2)

Expert meeting Düsseldorf - 16th of October 2013

Jos Arts - University of Groningen / Ministry of Infrastructure & Environment Sebastian van Berkel - Must urbanism Robert Broesi - Must urbanism Tertius Hanekamp - TEMAH / Ministry of Infrastructure & Environment Michael Heinze - Ministerium für Bauen und Verkehr des Landes Nordrhein-Westfalen Tim Lehmann - TID-EC Engineering Center - Deutsche Bahn International GmbH Arne Lorz - Stadt Duisburg Dirk Neumann - Must urbanism Thomas Pott - Regionalverband Ruhr Henrik Sander - orange edge Charlotte Selter - Planungsamt Düsseldorf Ton Venhoeven - former Chief Government Advisor on Infrastructure, VenhoevenCS Jeannette Wagner - Bundesstadt Bonn Thomas Wehmeier (Bundesinstitut für Bau-, Stat- und Raumforschung)

6.2 Three relevant scales

TIILUP states that working on all (geographic) scale levels and connecting those scale levels in an iterative matter is crucial for a successful approach. In the meetings, three major levels of scale could be distinguished for which the experts stressed that especially the interaction between the three scales has to be taken into account:

1. The scale of the European corridors: The traffic within the European corridors puts a lot of pressure on the infrastructure within the regions. At the same time it can result in positive spin-off effects on a local scale. The crossings points of international infrastructure, offer chances for logistic and service nodes. The challenge is to embed this programmatic spin off within the existing urban fabric. Duisburg is an example of such an international node within the northwestern European network. In the R2R Prologue study for example we can see that the Rotterdam Harbour is a crucial entry point for the "Blue Banana". At the same time EU environmental regulations are becoming more strict and implemented. This asks for solutions to be sought in the Daily Urban System and the local level.

2. The scale of the daily urban system with all the different infrastructure networks and the variety of multimodal nodes: The highest amount of multimodal mobility takes place within the regions or so called Daily Urban Systems. On the main infrastructure lines in the region, these daily urban system flows of traffic coincide with the traffic that moves on the level of the European corridors. The regional scale is crucial to manage strategically different modalities, different infrastructure scales and the land-use around the multimodal nodes. For example, the case Rotterdam (ring road) and Luxembourg (Plateau de Kirchberg) show that the congestion on the main infrastructure can be reduced by interventions on infrastructures on a lower scale and by enhancing other modalities elsewhere in the regional system.

3. The scale of the specific location: On this scale, spatial embedding can prevent the negative effects of large infrastructure on the environment. Best practices in for example Marseille (Cité de la Méditerranée), Basel (Nordtangente), Groningen (ring road) and Utrecht (A2 - Leidsche Rijn) show that this can result in a higher value, a better environment and an effective land-use.



The traffic jam: a mix of corridor, regional and local traffic



6.3 Outcomes for different dimensions of the TIILUP framework

TIILUP states that a key factor for a successful integral approach, is: "Combining the systems engineering approach of infrastructure and traffic planners with the typological approach of architects and spatial planners (into a scenario driven approach, testing different models)." The TIILUP approach is of interest because it will lead to:

- Cost savings
- Time savings
- Appreciation of the end result

The expert meetings resulted in recommendations for sharpening the focus of six dimensions of the TILLUP approach, as described below.

1. Spatial dimension

The role of design is an important key factor, not in an aesthetic manner but in developing creative integral solutions, bringing involved parties together, informing participants and showing the consequences of policy choices.

- Spatial design is an important tool to show the spatial + functional opportunities of an integrated approach;
- Spatial design as a research tool can accelerate the planning process;
- Integrative spatial planning can optimise the financial benefits;
- Spatial planning / design is crucial on three levels: location, daily urban system (region) and European corridor;
- Spatial planning/design is crucial to create a broad support for future projects;
- Regional agendas ('Gebiedsagenda') appear to be a powerful instrument to stimulate an integrative approach.

Professor dr. Pieter Tordoir (University of Amsterdam) concludes on the basis of different researches that multimodal nodes have the highest potential for capturing value around infrastructure. Option Value is the most important asset of the multimodal accessible locations. Not so much the option to transfer but especially the flexibility creates added value of multimodal access. Besides the option value, the value of a location is also dependent on the spatial program, the accessibility and spatial distribution of other locations in the network. Professor Tordoir stresses the importance of the Daily Urban System* when considering the value effects on a system level. He concludes that the value effect of multimodal nodes on a system level is highly underestimated. This is ground for further research. In particular, the 'smart control' by design, regulatory and incentive environment and governance, which synchronously is arrested at the site level, city level and transregional level, is a very promising subject for knowledge creation and innovation in the context of the TIILUP programme.

 \star The Daily Urban System is the area in which daily commuting occurs.



2. Multimodal networks optimization at various spatial scales

Working on all (geographic) scale levels and connecting those scale levels in an iterative matter is crucial for a successful integrative approach. Aspects that were being added to this field are:

- A multi-scalar approach is necessary in order to optimise the investments in the network and the land-use, resulting in a robust and sustainable system;
- Investments in infrastructure will be mainly about optimising the existing network (hardly adding new infrastructure lines);
- The Daily Urban System is the most relevant scale for an integrative approach;
- To meet the future challenges (growth of mobility, uncertain modalities and environmental regulations) a mix of expansion of infrastructure, a multimodal connectivity and a optimal land-use is needed.



3. Time dimension

A key factor in the TIILUP approach is linking stages in a full life-cycle of places. This also relates to renewal, redevelopment, circular economy / cradle to cradle and asset management. In the research on this dimension, the following has to be taken into account:

- Infrastructure is usually very problem driven with a short time horizon. Incorporating the long term functioning of the Network and Land-use can add future value;
- The way infrastructure and project / land-use development are being financed is extremely different;
- Infrastructure: once the decision is taken to start a project, the financial resources are ensured in amount and time by the state;
- Land-use / project developments: the financial resources are extremely unsure in amount and time because of the kind (private) and quantity of different investors;
- The difference in finance makes it extremely difficult to synchronize infrastructure and land-use planning.

Professor Erwin van der Krabbe (Radboud University Nijmegen) asks, among others, special attention for value capturing instruments. Based on his research he concludes that around the world a large variety of value capturing instruments is used to capture (part of) the plus value of land and property that is the result of the implementation of transport infrastructure. Based on his participation in international research with respect to this topic (EU COST ACTION TU0602 'Land Management for Urban Dynamics'; Tira et al., 2011), literature review and discussions with international colleagues, he concludes that many European cities are still searching for innovations in value capturing tools and strategies, in order to improve the financial basis for public infrastructure development. The need for effective tools has further become urgent by the shift that is taking place in many European cities from greenfield development to urban transformation and brownfield redevelopment (re-development of existing build-up areas) – the latter often being much more complex, due to for instance fragmented land and property ownership.



4. Value dimension

The challenge for integrative planning is combined value creation, value capturing and value assessment. For the latter good forecasts of traffic development and spatial-economic development are important as well as good Cost Benefit Analysis. In the value dimension, three aspects are worth to take into consideration.

A. Infrastructure generates value

- Markets for land development and real estate are being driven by the value of locations and the value of the nodes;
- The value of a node is determined as well by the spatial program, the accessibility and the spread of other locations in the network;
- System effects (the fact that the location is part of a network) are heavily underestimated by financial experts and the calculation models they use.

B. Capturing value

Currently, to capture the value generated by infrastructure is extremely difficult. In general, infrastructure has to be considered as a collective good that cannot be realized by a free market. This implies that the costs and benefits of infrastructure cannot be captured and optimised. One rare example is the instrument of Umlegung (urban re-allotment) in Germany.

• There is a need to develop more tools for capturing spatial value in situations of restructuring urban areas (the main challenge for the future).

C. System value

Simple rules and incentives on the scale of a location ("acupuncture strategy") can produce relatively large over-all effects in the whole regional system. This way of stirring / influencing the system in order to optimise the spatial value of infrastructure is until now an underestimated instrument.

There is a need to develop tools to calculate the economic overall- effects of acupunctural interventions on the level of the system.



5. Institutional dimension

The existing planning structures in the Netherlands and Germany provide enough possibilities for an integral approach of infrastructure and land-use planning. The main challenge is to create a situation where the different parties involved (both governmental and non- governmental) work together. An independent mediator seems to be a key success factor in this process.

• There is a need for good examples of independent mediators in bringing parties together in complex projects with a variety of actors.



6. Implementation

In order to achieve a better integration of infrastructure and spatial planning, especially the interaction between the different fields of the framework is important. This can be stimulated by pilot projects that implement promising institutional arrangements that have been found in the TIILUP Prologue, including: the State Advisor for Infrastructure, Quality Teams for spatial quality in development projects; regional development agendas in which different levels of government indicate their investment plans; integrated programming of spatial and infrastructural investments.

7 Opportunities and challenges

In the coming decades, there are clear opportunities in the Rotterdam - Rhein-Ruhr corridor to deploy a TIILUP approach. The map of the regional development agenda (p.22-23) shows that there is a great number of developments and ambitions in different sectors such as economy, urbanization, mobility, water, energy and nature. The map of the investment agenda (p.24-25) shows that in the near future, a broad series of projects in the field of infrastructure has been planned. The combination of the regional developments with the foreseen investments in infrastructure is an opportunity not to be missed. It will offer three chances:

- **European level:** a good connection between the European corridors and the regional urban system can give a strong impetus to the regional economy.
- **Regional level:** a multimodal network strategy in relation to urban developments (growth, shrinkage, restructuring) will provide the best chances to get the highest value out of the interaction between land-use and infrastructure.
- **Local level:** multimodal nodes have the highest potential to get the most value out of integral planning.

The confrontation of these chances with specific, regional or local situations results in five types of spatial - programmatic challenges in the Rotterdam - Rhein Ruhr corridor. The scheme on page 18-19 shows these five types of challenges. The specific regional challenges and chances for the areas Rotterdam, Arnhem-Nijmegen and NRW were discussed in the three TIILUP prologue workshops. The outcome of these workshops is to be found on the pages 26 – 33. On basis of these results, the TIILUP core group made a quick scan of similar chances and challenges across Europe. The map Quick scan European potential shows a first glimpse of the relevance of an integration of land-use planning and infrastructure planning in different European regions.





Five types of challenges





International (freight)traffic and local traffic are competing for the same space and capacity on the infrastructure. Ingredients for this theme are:

- Multimodal network optimization can be realised by means of coordinated interaction between infrastructure on all levels and (regional) land-use potential.
- The peak percentage on corridor mobility leads to congestion;
- A tension between infrastructure corridor development, environmental regulations and living environment.



The growth of (freight) transport offers the possibility of international Hub development on the crossings of international, multimodal corridors. Giving space to hub development can lead to local environmental issues, spatial barriers and negatively impact living qualities. Ingredients for this theme are:

- Opportunities for value capturing on specific spots in the network;
- Opportunities for local multimodal connectivity optimization;
- Spatial acupuncture for merging expanding infrastructure in the urban fabric.



The concurrent growth of the region and the infrastructure corridor often leads to tension. Especially when the infrastructure growth can not be harmonised with the available space and current spatial form (barrier). In order to create synergy effects, codevelopment of infrastructure measures and urban (re)development is required. Ingredients for this theme are:

- Spatial synergy is the only option to facilitate competing spatial growth (infra and land-use);
- Spatial design should be utilised in order to expand the infrastructure capacity and to minimise the impact on the urban fabric.



In some areas, spatial (re)development focuses on the existing urban area. Additional spatial development combined with corridor development can lead to cannibalisation of the (re)development potential of the existing city. This asks for a consolidation of the corridor in order to maximise spatial quality potential. Ingredients for this theme are:

- Cohesive corridor landscaping;
- Firm regional governance;
- Regional value capturing.



A declining population in formerly booming areas can lead to the situation that the infrastructure lay-out does not fit the land-use anymore. A transformation of parts of the existing, but out of use, infrastructure is needed to generate the context needed for a vital regional future. Ingredients for this theme are:

- Transformation of the infrastructure on a systems level in order to generate a new positive context for a vital region;
- Maintenance of the current system is a key asset towards strategic transformation of the system.



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National / state interest

auonari state interest					
	Top Economic Sectors				
	High Tech systems and materials				
2	Energy				

- 0 Creative Industry
- 4 Agro-Food
- O Horticulture and propagating stock
- Life-sciences and health
- ¥. Chemical Industry
- 8 Logistics
- ٠ Water Technology
- ۲ Schiphol Mainport
- 0 Rotterdam Mainport
- 0 Southeast Netherlands Brainport
- ۲ Greenport
- Other airport of national impor-0 tance
- Other airport of national impor-tance + military airfield 0
- ۲ Military airfield
- 0 Seaport of national importance
- ۲ Inland port of national importance
- Logistic multimodal hub of interna-tional importance ø
- 0 Centre for knowledge / R&D

Regional interest

- 80 High Tech systems and materials
- 2 Energy

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Δ

- Maintenance
- Agro & Food
- Horticulture and propagating stock
- Life-sciences and health
- Chemical Industry
- Logistics
- Maritime industry
- ٥ Water
- Leisure
 - Agricultural landscape for production
- ۲ Greenport
- Seaport of regional importance military co-use 0
- Logistic multimodal hub of regional importance 0
- Integral spatial development of regional importance O
- ø Centre for knowledge / R&D

- National / state interest
- Urban expansion Urban renewal and ٦
- transformation
- ۵ Urban extensification (shrinkage)
- Regional interest
- Urban expansion ۵.
- Urban renewal and ۵ transformation

MOBILITY

- Bottleneck main motorway
- -
- Bottleneck border crossing rail 00
- traffic
- Bottleneck waterway
- 念 Bottleneck locks

- Interconnected mass transit syst
- 0 Public transport hub
- ۵ Integral multimodal development
- International corridor

Regional interest

HON!

- Main road
- Bottleneck main road
- New link main road (indication)
- Bottleneck bridge
- =0V Interconnected mass transit syst.

LANDSCAPE & HERITAGE

- National / state interest Natura 2000
 - National Park
 - Regional Park
 - Cultural heritage on world herit-age list (or nominated)
- Object or ensemble on world heritage list (or nominated) Ø

Regional interest

Structural landscape development or Metropolitan Landscape

- National / state interest
 - Main motorway

 - New link main motorway (indication)
 - Main railway

 - New link main railway (indication)

 - Main waterway

 - Bottleneck bridge

- Bottleneck main railway

Quick scan opportunities: Regional development agenda

R2R-corridor combined with the Dutch Regional Development Agendas (GA) of the Multi-year Infrastucture, Spatial Planning and Transport Programme (MIRT) + a quick scan of similar German issues

WATER

- National / state interest Primary flood defence - insufficient (3rd Safety Assessment) Primary flood defence - further investigation needed (3rd Safety Assessment)
- Primary flood defence sufficient (3rd Safety Assessment)
- E Discharge (peak) water levels
- Flexible water level management
- Discharge partitioning
- Discharge capacity
- Flood defence gates
- Sand replenishment coast
- Peak level / fresh water storage (area of research)
- Coalition Natural Buffer for Climate Adaptation
- o (Improve) ecological quality
- Area for attention fresh water supply due to subsidence
- Area for attention fresh water supply due to salinisation
- Drought sensitive area: no fresh water supply from main water system
- Salinisation and drought sensitive area

Salinisation fresh water access point

fresh water storage

KR.

 Water related integral spatial development

Flexible water level management.

ENERGY

- National / state interest
- (Possible) location power station capacity > 500MW
- (Possible) location nuclear power station
- 1 Wind farm
- Potential area for wind farm (Strategic Environmental Assessment) () Tidal power plant
- Geothermal power plant
- Energy supply network >220kV
- New link energy supply network
 380kV (indication)
 Pipeline

07



- M32 Renewal bridge Rheinbrücke Düsseldorf Flehe
- M33 Renewal bridge A57 Dormagen Nievenheim
- M34 Renewal bridge Rheinbücke Leverkusen
- Renewal bridge Bonn Nordbrücke M35
- M36 Renewal bridge Bonn Kennedy Brücke
- M37 Renewal bridge Bonn Südbrücke

Upgrade ICE-route Emmerich-Oberhausen

R19

R20

R21

R22

R23

R24*

- Regional transit system Rhein-Ruhr Express (RRX) Upgrade ICE-route Köln-Aachen
- Station (area) redevelopment Duisburg Haubtbahnhof
- Station (area) redevelopment Essen Haubtbahnhof
- Station (area) redevelopment Dortmund Haubtbahnhof
- Not on the map: Modernization of 108 railway stations in Nordrhein-Westfalen

Quick scan opportunities: Investment agenda

R2R-corridor combined with the Dutch Project Scheme 2013 of the Multi-year Infrastucture, Spatial Planning and Transport Programme (MIRT) + a quick scan of similar German projects



Opportunities Rotterdam-The Hague region



European level

Developments

- International corridors: enlargement capacity A12 (Utrecht) and A15 (Port of Rotterdam)
- Port of Rotterdam as European/Global logistic node
- Maasvlakte II deep water port operational

Barriers

- Connecting international infrastructure corridors with multimodal networks
- Strategic planning of international nodes in relation to multi-scale networks



Chances

- Network:
 - strategic planning of multimodal and multi-scale traffic network

 - opportunities for local multimodal connectivity optimization
 - Time: resilliant integrated (land-use, multi-modal) mobilty strategy
 - Value: opportunities for value capturing on specific spots in the network



Regional level Rotterdam-The Hague region

Developments

- Integral approach enlargement capacity ring road Rotterdam (A4-A15-A16-A20)
- New highway links: Extension A4, Tunnel A15-A20, Bypass A13-A16
- High-Frequency Rail Transport Programme (commuter traffic)
- StedenbaanPlus (TOD programme for regional transit system)
- High speed cycle network

Barriers

- Infrastructure: mixed use of highways (local/regional traffic and freight transport)
- Housing: geographic tension between north and south side of the region
- Development around transit nodes: regional cooperation needed
- Competing interest in space: housing, infrastructure and environment

- Network:
 - strategic planning of multimodal + multi-scale network in relation to housing developments
- Time: financial strategy to synchronize infrastructure and land-use planning investments
- Value: optimization value of network + land-use
- Institutional: need for mediators to coordinate collaboration



acki Ble Berkel en Roden Berasch ē1 Rotterda laassluis Vlaardingen **Opportunities Rotterdam-The Hague region European level** Barendrecht Broadening motorways Port development - Cool Port TEN-t corridor **Regional level** Integral approach transit system Integral approach motorway **:==:** New motorway Bicycle highway Local level Urban redevelopment



Local level – Rotterdam (south side)

Developments

- Shrinkage population, devaluation of value houses
- Highway A15 / Maasvlakte (extension harbour area + infrastructure)

Barriers

• Tension increasing freight traffic and industrial areas versus quality of life



Chances

- Spatial: embedding developments harbour in relationship to living quality
- Value: capturing value harbour for the city



Local level – Rotterdam (east side)

Developments

- Expansion university and knowledge based economy
- New housing areas
- Highway A16

Barriers

- Local traffic on highway system
- Need for higher quality of life environment

Chances

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- Spatial: embedding housing & infrastructure in already dense area
- Network: multimodal network strategy

Local level – Rotterdam (Central Business District)

Developments

- Densification of urban area
- Completion of regional public transport network (higher accessibility)
- Improvement of public space

Barriers

- Competition with highway locations
- Image / quality of life

- Value: capturing value in multimodal nodes in centre of the city
 - managing spin off effect on whole urban system
- Implementation: pilot project managing spinn off effect on system level

Opportunities Arnhem-Nijmegen region



European level

- Developments
- International corridors
- Optimization river Waal
- High-Frequency Rail Transport Programme (freight traffic)
- New link A15 (short cut international corridor)

Barriers

- Connecting international infrastructure corridors with multimodal networks
- Strategic planning of international nodes in relation to multi-scale networks



Chances

- Network: strategic planning of multimodal + multi-scale traffic network
 - Value: capturing of value on specific nodes on the international corridor



Regional level

Developments

- Regional Rail Express ('Stadsregiorail')
- Bicycle Highway
- Urbanization: + 25.000 new dwellings
- Regional Park

Barriers

- Tension between new dwellings, existing green space and new infrastructure
- New developments are seen as a threat
- Culture of cooperation: laborious



Chances

- Spatial: embedding new infrastructure in the landscape
- Institutional: strong regional governance to maintain existing qualities of landscape and city

Local level

Developments

- Urban renewal
- How to maintain the existing quality of the cities?

Barriers

• New infrastructure is considered as a threat for the existing cities



- Value:
 capturing value from existing infrastructure

 consolidating value in the existing cities
- Implementation: pilot project consolidation of value in existing cities



Opportunities Rhein-Ruhr region region



European level

Developments

- Optimization ICE network (Köln Brussels; Köln Arnhem)
- Construction Betuwelijn Oberhausen Zevenaar freight rail link
- Duisburg Hafen as European logistic node

Barriers

- Connecting international infrastructure corridors with multimodal networks
- Strategic planning of international nodes in relationship to multi-scale networks

Chances

- Network: strategic planning of multimodal and multi-scale traffic network - opportunities for local multimodal connectivity optimization
- Value: opportunities for value capturing on specific spots in the network



Regional level NRW

Developments

- Broadening highways: A4, A40, A57, A59
- Rein-Ruhr Express (new regional public transport system)
- 700.000 new dwellings are needed until 2030
- 600.000 existing houses will not fit to the demands of the market

Barriers

- Infrastructure: isolated approach
- Housing: geographic tension: growth along Rhein-Sieg corridor, shrinkage in Ruhrgebiet
- Culture of collaboration: hardly nonexistent
- Competing interest in space: housing, infrastructure and environment

Chances

- Network: strategic planning of a regional multimodal network in relation to
 housing developments
 - Time: financial strategy to synchronize infrastructure and land-use planning investments
 - optimization of the value of the existing network & land-use
- Value:Institutional:
- mediators as a new tool to coordinate & stimulate regional collaboration
- Implementation: pilot project new governance tools to stimulate integrative approach on regional level



Local level - Duisburg

Developments

- Expansion of Duisburg Hafen as logistic node
- Shrinkage of population

Barriers

• Tension between space for expansion harbour versus environmental & living quality

- Spatial: embedding developments harbour in relationship to living quality
- Value: capturing value of the harbour for the city





Local level - Düsseldorf

Developments

- Restructuring urban areas
- Redevelopment of locations around new Rhein-Ruhr express

Barriers

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Connecting restructuring developments to infrastructure network strategy



Chances

- Spatial: development of multimodal nodes in relation to renewal locations
 - Value: optimization of value around multimodal nodes
- Implementation: pilot project new governance tool to stimulate integrative approach on
 local level



Local level - Essen

Developments

- Completion of A52
- Construction of high speed bicycle track
- Shrinkage of population

Barriers

- Costs
- Negative effects (noise, pollution) of new highway

Chances

- Spatial: embedding new housing with sound barriers around infrastructure (A52)
 - Network: transformation (re-use) of existing infrastructure
- Value: optimization of value around embedded infrastructure



Local level - Bonn

Developments

• Intensification of areas for housing around main infrastructure (highway + rail)

Barriers

- Tension between noise problem versus environmental & living quality
- Cooperation between different authorities

- Spatial:
 embedding new housing / offices with sound barriers around infrastructure
 - Time: financial strategy to synchronize infrastructure and land-use planning investments
- Value:
- optimization of value around multimodal nodes
- Implementation:
 new governance strategies to improve cooperation between governmental institutions and between private parties and local government

QUICK SCAN EUROPEAN POTENTIAL

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Across Europe, a broad number of regions can be identified where the five types of challenges in the field of land-use planning and infrastructure planning as describes by TIILUP, can be identified. This map of Europe shows the result of a quick scan of these challenges. It is the outcome of the three TIILUP prologue workshops and an assessment that was made by the TIILUP core group. This explains the strong concentration of dots in the Rotterdam to Rhein / Rhur zone. A more profound investigation in Europe will definitely result in a broader scope of regions where the integrative approach has a high potential.

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Potential in Rotterdam-Cologne Corridor Quick scan potential elsewhere* CORRIDOR ROTTERDAM-COLOCNE: multi- modal condor with road, rail and water ROITERDAM: growth of freight traffic (har- bou) on highways has to be combined with local person traffic DUI/SBURG: expansion of the harbour as European freight hub has to be fitted in the harbour for the city Concourter Tellor MM: growth of the harbour as European freight hub has to be fitted in the harbour for the city ROTTERDAM: copansion of the harbour as European freight hub has to be fitted in the harbour for the city ROTTERDAM: copansion of the harbour by realizing initial multimodal nodes with real estate potential = value capturing Concoursence ROTTERDAM: focus on the multimodal nodes with real estate potential = value capturing Southern Ring Road, Groningen (NL) Nordtangente, Basel (CI) Concoursence REPECHT: national, through passing traffic has to be combined with local traffic (pressure + polution in the existing prior adA 20 THEN-SIEG AREA: optimization of the re- gional, multimodal network, combined with es accelerator SHEIN-SIEG AREA: optimization of the re- gional, multimodal network, combined with es accelerator Show in receasing pressure on the highways and railways and at the same time pressure to built housing around these infrastructures conflict of pollution and sound) SESH: missing link AS2 and impact on live ability Main Bypass (EST) Suiding culture on motorways (A) Main Bypass (EST)			
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 Concurrence CONCURRENCE CONCURRENCE CONCURRENCE CARNHEM / NUMMEGEN: construction of new and value again of the restent city CONSULIDATION CONSULID	CORRIDOR	 CORRIDOR ROTTERDAM-COLOGNE: multi- modal corridor with road, rail and water ROTTERDAM: growth of freight traffic (har- bour) on highways has to be combined with local person traffic 	 Rail Baltica (D-PL-LT-LV-EST-FIN) Dublin-Belfast Economic Corridor (IRL) Danube Axis (D-A-SK-H-HR-SRB-BG-RO) Territorial Development Plan Central Limburg (B)
 ROTTERDAM: bypass A13 - A16 in a sensitive area (housing) to diminish pressure + pollution on the existing ring road A20 UTRECHT: national, through passing traffic has to be combined with local traffic (pressure on the ring road) RHEIN-SIEG AREA: optimization of the regional, multimodal network combined with the allocation of up to 600.000 new dwellings until 2030, using the Rhein-Ruhr Express (RRX) as accelerator BONN: increasing pressure on the highways and railways and at the same time pressure to build housing around these infrastructures conflict of pollution and sound) ESSEN: missing link A52 and impact on livability ARNHEM / NIJMEGEN: construction of new national / corridor infrastructure that attracts new developments versus the preservation of the quality of the existent city Mao Bypass (EST) Building culture on motorways (A) 	B HUB DEVELOPMENT	 DUISBURG: expansion of the harbour as European freight hub has to be fitted in the local urban fabric = value capturing from the harbour for the city ROTTERDAM: expansion of the harbour by realizing inland 'hub-harbours' ROTTERDAM: focus on the multimodal nodes with real estate potential = value capturing 	 Copenhagen-Malmö (DK-S) Cité de la Méditerranée, Marseille (F) Lille (F)
 ARNHEM / NIJMEGEN: construction of new national / corridor infrastructure that attracts new developments versus the preservation of the quality of the existent city Mäo Bypass (EST) Building culture on motorways (A) 	CONCURRENCE	 ROTTERDAM: bypass A13 - A16 in a sensitive area (housing) to diminish pressure + pollution on the existing ring road A20 UTRECHT: national, through passing traffic has to be combined with local traffic (pressure on the ring road) RHEIN-SIEG AREA: optimization of the regional, multimodal network combined with the allocation of up to 600.000 new dwellings until 2030, using the Rhein-Ruhr Express (RRX) as accelerator BONN: increasing pressure on the highways and railways and at the same time pressure to build housing around these infrastructures (conflict of pollution and sound) ESSEN: missing link A52 and impact on livability 	 Southern Ring Road, Groningen (NL) Nordtangente, Basel (CH) Aspern Vienna's Urban Lakeside (A) Co-finance ASFING (A) S-Bahn München Center-Airport (D) Brainport Avenue Eindhoven (NL) Manual A40/Ruhr (D) Suur Strait accesibility study (EST) Tallinn Ring Road (EST) Cork N40 Demand Mangement Study (IRL) Metropolitan Coastal Landscape (B-NL) Metropolitan Core Area Flanders (B)
	CONSOLIDATION	• ARNHEM / NIJMEGEN: construction of new national / corridor infrastructure that attracts new developments versus the preservation of the quality of the existent city	 Mäo Bypass (EST) Building culture on motorways (A)
 FURH ZONE: transformation of out of use infrastructure in the framework of a declining population, e.g. construction of high speed bicycle track on the route of former rail tracks RHEIN-RUHR AREA: renovation of 800 bridges as a moment of opportunity to reconsider the lay-out of the system 	E TRANSFORMA- TION	 RURH ZONE: transformation of out of use infrastructure in the framework of a declining population, e.g. construction of high speed bicycle track on the route of former rail tracks RHEIN-RUHR AREA: renovation of 800 bridges as a moment of opportunity to reconsider the lay-out of the system 	 Plateau de Kirchberg Luxembourg (L) Norwegian highway architecture (N) Rotterdam Stadshavens (NL) Liège (B)
*Cases mentioned by TIILUP core group and in TIILUP road map (april 2013)	- the	0	*Cases mentioned by TIILUP core group and in TIILUP road map (april 2013)

8 Recommendations for research

In October the outcomes of the prologue were discussed in an international expert review (core group). The review stressed infrastructure is not only a way to go from A to B but also an instrument that has an impact and influence on its surroundings.

TIILUP will provide answers on how to anticipate and respond with infrastructure planning to large changes in the environment (demographic, climate, politics, landscape, land-use). With respect to the Horizon 2020 programme, the TIILUP core group concludes the following topics are most suited to be researched first:

1. Development of tools to assess the (financial) impact of transport infrastructure development on land and property development

To promote the financial integration of transport infrastructure development and land and property development technical tools should be developed that enable both private and public stakeholders to calculate the potential (financial) impact of transport infrastructure development on land and property values. Such a tool can help to 'optimise' this kind of integrated projects financially and can also support value capture negotiations between public and private stakeholders.

2. Multi modal modelling (See also LUTI road map)

Research is needed to determine and simulate what the effect will be of the choices made based on the TIILUP framework. An important aspect of this research is how to quantify the potential of multimodal transportation solutions on modal shift action from motorway networks to other modalities (especially in urban areas). Are multi-modality solutions for example a way to ensure that the growing demand for freight transport can be handled in existing networks – preferably without additional road - expansion measures?

3. Impact of new technologies

Research should be conducted on the possibilities of new technologies to optimise the use of the existing infrastructure system an the land-use around the nodes. To which extent can innovations like automated driving and improved traffic control technologies provide more road-capacity? And how big is the impact of alternative powered vehicles on transport-systems? What is the time component?

4. Strategic maintenance (from repair to system optimization)

Research is needed not only on the planning of new infrastructure, but also on the upgrading of existing infrastructure. Research should be conducted to look at the possibilities that arise at the moment of the maintenance of old infrastructure, not only to simply replace, but to use the moment as a means to be flexible and adapt to new situations (smart maintenance redesign).

5. Smart value capturing on a (regional, daily urban system) systems level

Around the world a large variety of value capturing instruments is used to finance public infrastructure works from land and property development. Complete overviews of this kind of tools and of their effectiveness do not exist (see also Alterman, 2012). Often European cities stick to traditional 'local' value capturing tools and ignore alternative instruments. Especially the research on an 'acupunctural strategy' across a full scale transport system needs to be addressed. The core of this strategy consists of specific local interventions in different modalities that have an overalleffect on the value of the whole system as well as on the overall efficiency of the corridor. For the acupuntural interventions, a range of tools can be applied, for example spatial design, rules/laws, financial stimulation measures an governance arrangements. The research should focus on the development of tools to value the effects of acupunctural interventions on the level of the system.

6. Spatial intermediation; for example Quality Teams and Chief Government advisor

Especially for larger cities/ metropolitan areas where more complex issues arise and where there is an international link, the national government has an important role to play in linking the different governments and coordination becomes very important. Where there is little such coordination at the moment, a lot of development arises from separate local initiatives. Different communities have different requirements; the challenge is to find the common ground by mediation. It's important to look for the missing levels of organisation, as these are necessary for good communication. Experimental research can help to test, under different conditions, innovations in the governance and finance of TOD projects – including the usefulness of 'foreign' strategies and tools – and their impact on cooperation between public and private stakeholders.

7. Adaptive Regional development (including governance)

In the Netherlands the national government only grants subsidies for investments in different spatial projects like infrastructure or nature projects, when they are part of an integral vision, the so called Gebiedsagenda's (Regional Agendas). This proofs to be a successful instrument in order to stimulate cities and regions to develop integrative spatial strategies. Research should be conducted on the possibilities to implement this kind of instrument in other countries around Europe.

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TIILUP stands for Transport Infrastructure Integrated with Land-Use Planning and is one of the innovation themes of the Forum of European Highway Research Laboratories (FEHRL). The TIILUP Prologue is the pilot of a research program that aims to develop approaches to effectively integrate infrastructure and land-use planning. The development of these approaches is very practice driven and analyses best practices in order to develop a toolbox that enables organizations to plan infrastructure more efficiently. The TIILUP prologue consisted of three expert meetings in the Rotterdam – Ruhr Rhein zone to test and elaborate the different aspects of the TIILUP approach. The TIILUP core group conducted a review on the output of these meetings. The results of the TILUP prologue are to be found in this report.



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