TANGENT

MULTI-ACTOR CO-CREATION STRATEGIES FOR EACH CASE STUDY

D1.1

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Executive summary

This document aims at defining the multi-actor co-creation process within the TANGENT project which will guide the effective engagement of local stakeholders and ensure coordination of inputs across the project. Such active collaboration among local actors will enable TANGENT to tailor its outputs to the specific challenges and conditions of each Case Study and find practical solutions for effective multi-actor cooperation.

First, this deliverable defines the aim of using a co-creation process in the TANGENT project. Chapter 2 identifies key references, concepts and methodologies to guide co-creation processes with multiple stakeholders toward innovative Network and Traffic Management (NTM) solutions. Chapter 3 describes clear strategies for the co-creation activities under the different stages of the process. Chapter 4 provides a first description of each Case Studies, identifying the actors involved, objectives and scenarios, and other relevant factors to be considered. Finally, Chapter 4 defines a concrete timeline for the co-creation process.

Key words

Co-creation, multi-actor cooperation, stakeholder engagement, stakeholder mapping, systemic analysis, OSTO System-model

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List of abbreviations and acronyms

Acronym	Meaning
ASAP	As Soon As Possible
B2B	Business-to-business
B2C	Business-to-Consumer
CCAM	Cooperative Connected and Automated Mobility
C-ITS	Cooperative Intelligent Transport Systems
EC	European Commission
GA	Grant Agreement
KoM	Kick-off Meeting
KPI	Key Performance Indicator
MaaS	Mobility as a Service
NTM	Network and Traffic Management
ODD	Operational Design Domains
OSTO	Open, Social, Technological and Economic (based on German terminology “Ökonomisch)
RAIM	Architectures of Intelligent Mobility Services (translated from German)
RAIM	Architectures of Intelligent Mobility Services (translated from German)
SUMP	Sustainable Urban Mobility Plans
UVAR	Urban Vehicle Access Regulations
WP	Work Package

1 Introduction

1.1 Attainment of the objectives and explanation of deviations

The objective of this document aims at defining the co-creation process within the TANGENT project to guide the effective engagement of local stakeholders and ensure coordination of inputs across the project. To define the co-creation process within the project, it was also necessary to provide a first description of the Case Studies on the status of their vision, objectives, stakeholders involved and scenarios.

The deliverable has been delayed by 5 weeks due to the need to further refine the case studies description and identify the type of stakeholders involved. Further discussion and agreements were needed regarding the co-creation methodology for the Virtual Case Study of Athens, as there is fewer needs for stakeholder engagement and approval. This delay was in part linked to changes in the Case Studies descriptions from the proposal stage which needed further agreement and rounds of discussions. Finally, this delay in the definition of the Case Studies led to a delay in the review process to still ensure a high quality review from project partners.

1.2 Intended audience

This deliverable is mainly intended to project partners, to the project officers and to the public interested in co-creation processes with stakeholders

1.3 Structure of the deliverable and links with other work packages/deliverables

First, this deliverable defines the aim of using a co-creation process in the TANGENT project. Chapter 2 identifies key references, concepts and methodologies to guide co-creation processes with multiple stakeholders towards innovative Network and Traffic Management (NTM) solutions. Chapter 3 describes clear strategies for the co-creation activities under the different stages of the process. Chapter 4 provide a first description of each Case Studies, identifying the actors involved, objectives and scenarios, and other relevant factors to be considered. Finally, Chapter 4 defines a concrete timeline for the co-creation process.

This deliverable is mainly linked to most of work packages as it describes the co-creation process that will be implemented to define key aspects of the project such as network and traffic management systems, multi-actor cooperation models and Case Studies validation and lessons learned. This deliverable is still particularly linked to Work Package 7 and D7.1 “Definition of the Case Studies, testing methodology and stakeholders’ & users’ engagement campaign”.

2 The aim of the co-creation - a coordination of inputs across the project

This document aims at defining the co-creation process within the TANGENT project to guide the effective engagement of local stakeholders and ensure coordination of inputs across the project. Such active collaboration among local actors will enable TANGENT to tailor it's outputs to the specific challenges and conditions of each Case Study and find practical solutions for effective multi-actor cooperation.

2.1 How it aligns with TANGENT objectives

TANGENT aims to support more efficient traffic management in terms of congestion reduction, environmental effects mitigation through CO2 reduction, safety increase and economic advantage. Specifically, TANGENT pursues nine main objectives to deliver the mechanisms for Network and Traffic Management (NTM) of the future:

Objective	Definition
Ob1	To orchestrate the multiple agents in the overall transport both public & private, for the different transport modes, aiming to collectively identify their roles, responsibilities and needs; identify new ways of cooperation among the agents, including the design of new arbitration models that balance individual versus collective needs; and to define the specifications for the TANGENT tool architecture and functionalities.
Ob2	To identify, collect and harmonise & fuse the relevant data to feed the system, considering different data sources, e.g., multimodal travel and traffic data from transport operators, traveller data and open data.
Ob3	To understand and model the transport users' behaviour and motivations in a multimodal and automated landscape: their individual needs, preferences and sentiments, as well as their effect on the transport system.
Ob4	To develop a state-of-the-art framework to monitor and forecast the traffic flow & traffic conditions, as well as transport demand & supply under various circumstances (e.g. large/sport events, roadworks, accidents, …).
Ob5	To optimise traffic management according to different performance targets both off-line and on-line by means of Artificial Intelligence techniques and to calibrate the designed arbitration models for regular and disruptive traffic situations.
Ob6	To integrate the overall solution and set up the necessary infrastructure for building up the decision-making support tool for traffic operations. To empower transport managers and decision makers with clean graphical user interfaces with automatic functionalities.
Ob7	To test, validate and assess the impact of the delivered decision-making tool and services in the multimodal network through simulation in four scenarios: Rennes (Fr), Lisbon (PT), Greater Manchester (UK) and a virtual case in Athens (HE) building-up Case Studies addressing multimodal transport, CAVs, events, changing traffic flows, safety aspects, etc.

Objective	Definition
Ob8	To disseminate results, training for transport operators and policy makers to pave the way of future mobility in Europe.
Ob9	To deliver new business models based on transport agents' cooperation.

Table 1: TANGENT's objectives

As stated in Objective 1, multi-actor cooperation constitutes an essential factor for achieving TANGENT's strategic goals, reaching collective solutions to balance the needs and priorities of the various actors, and enabling optimal management of the network's resources. The testing and validation of TANGENT's tools also requires the coordinated involvement of key stakeholders, allowing its practical implementation and adaptation to a local context.

To achieve these objectives, TANGENT needs to work cooperatively with all the stakeholders that will take part in the Case Studies' implementation.

To this end, the multi-actor engagement methodology described in this deliverable aims to coordinate cooperative discussions around all aspects of NTM and the Case Studies' implementation, which are the focus of other WPs and Tasks in TANGENT.

2.2 Challenges that come with cooperation locally

Stakeholders identified in each Case Studies have various roles within the local transport ecosystem, which also means they have different goals and interests in taking part in the project. Developing a co-creation process using specific methodologies to ensure continuous and targeted engagement of local stakeholders is therefore necessary to better understand stakeholders' different goals and interests. In implementing a structured stakeholder engagement process, it will support the development and implementation of each Case Study by accounting for varying opinions and interests.

2.3 Ensure coordination with other WPs

The goal of using multi-actor co-creation processes is to ensure coordination with stakeholders and other WPs towards developing tools tailored to local needs. Engagement with key stakeholders and cooperative definition of the Case Studies' needs and challenges with the support of WPs will contribute to a more accurate definition of the Case Study and a more targeted TANGENT solution. In addition, such a process will further contribute to a direct collaboration among all WPs, allowing for knowledge steering and sharing, as well as coordination among the project's different research dimensions and their application in the Case Studies.

3 Key references and methodological background

3.1 Framework for innovative and intelligent mobility: RAIM

RAIM, a German framework for Architectures of Intelligent Mobility Services (translated from German), provides a guide for design planning, as well as the functional, technical, and economic implementation of intelligent mobility solutions. The latter are data-based applications in the field of transport and mobility that can be used by users. On a contractual, organisational and technical level, RAIM supports smooth communication between the actors involved. The RAIM framework could be used, for example, to subsequently structure existing services in the transport sector or to enable cooperation between private and public actors in the creation of intelligent mobility services (or enable integrated management), while highlighting the importance of promoting dialogue and consensus between stakeholders in the case of new services (mobility services). It is primarily intended to address mobility service providers, public transport companies, navigation service providers, app operators, regulators, authorities, and urban actors.

Rupprecht Consult, as partner of the RAIM project (funded by the Feredal Highway Research Institute – BASt) and co-author of the RAIM guidelines for implementation, will build on this experience to enrich the multi-actor co-creation and cooperation processes in TANGENT.

For the purposes of TANGENT's multi-actor co-creation processes, the RAIM framework provides a useful model to guide the engagement efforts and to address key topics and questions in a structured manner, as well as handling typical uncertainties and challenges of such cooperative processes, in particular with multiple numbers of actors in a data-based and highly innovative field.

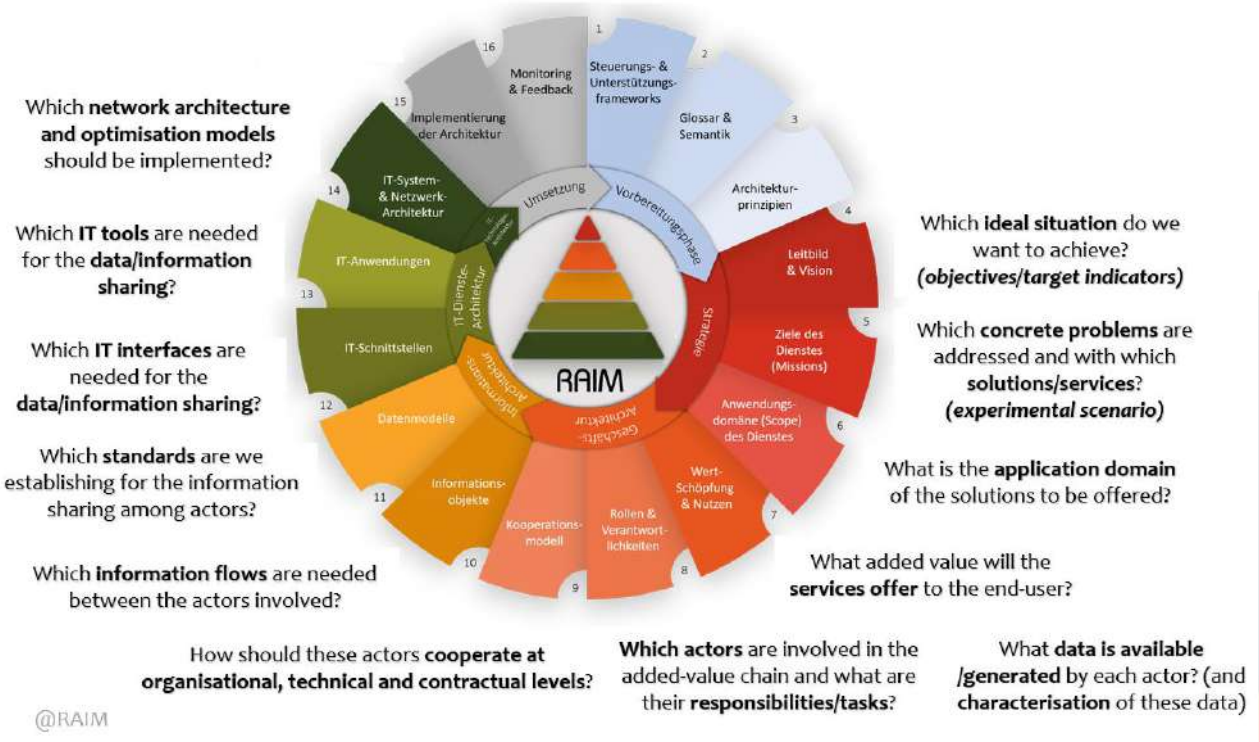


Figure 1: Adaptation of the RAIM process to TANGENT

The RAIM model is divided into sequential modules, guiding through the preparation, planning and implementation of innovative solutions and service architectures. The methodology brings key actors together to achieve reliable compromises and design optimal cooperation models. This is achieved through general building blocks which can be adapted to the specific objectives of each Case Study and tools to address data-based services (incl. data exchange between actors) in the mobility sector. The planning process begins with the common vision and the goals pursued, continues through the definition of the individual processes, data exchanges and agreements to the selection of the used hardware, software, data sharing, as well as cooperation models, optimisation measures and network architecture.

3.2 Stakeholder engagement processes through SUMP and guidance to participatory processes

A transition towards sustainable mobility requires active support from stakeholders and the wider public. It is essential to involve all relevant stakeholders throughout sustainable urban mobility planning processes and, thus, address their specific requirements.

The Guidelines for developing and implementing a Sustainable Urban Mobility Plan – SUMP (Rupprecht Consult, 2019), promoted by the European Commission as a cornerstone for the implementation of sustainable urban mobility in Europe, have detailed recommendations when it comes to stakeholder engagement and participatory processes. A dedicated strategy is needed for the involvement of stakeholders, drawing on different formats and techniques when dealing with authorities, private businesses, civil society organisations, or all of them together.

Different involvement tools and methods for SUMP development exist (see Figure 2), some of which can be relevant in the context of TANGENT, especially for the implementation of the TANGENT tools in the Case Study cities. Establishing involvement activities as part of standard planning practices and identifying the participation methods suitable for stakeholders is essential for the implementation of TANGENT.

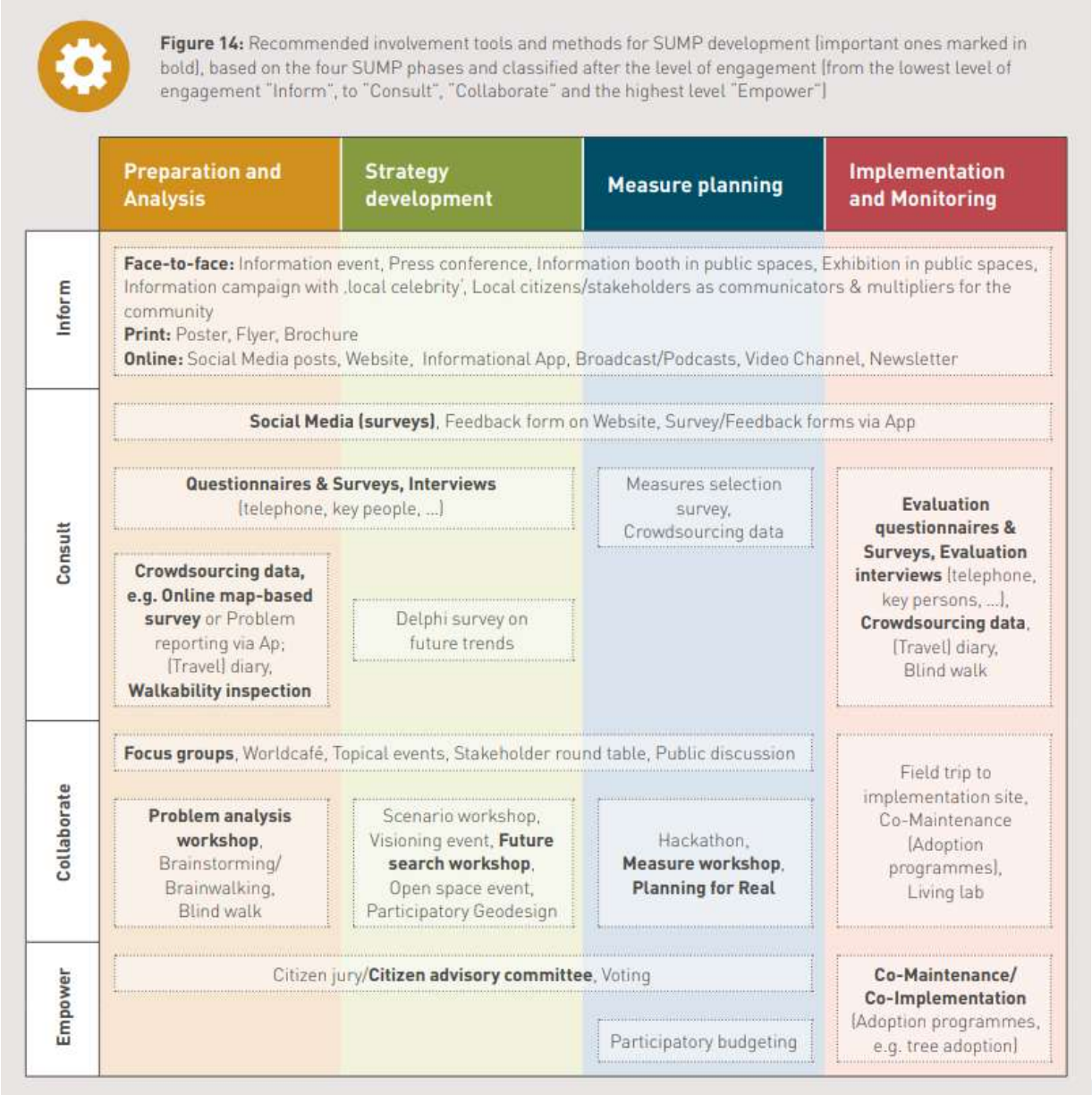


Figure 2: SUMP involvement tools and methods (Source: Rupprecht Consult, 2019)

The activities and types of engagement described in Figure 2, respond to different levels of collaboration with stakeholders. Deciding which engagement to pursue with each stakeholder, requires a strategic analysis of the level of interest, capacities, and relevance of the involved actors in the planning process.

The next section focuses on the stakeholder mapping and characterisation process, and its importance to building effective cooperation processes in mobility planning and implementation efforts.

3.3 Stakeholder identification and analysis

All relevant stakeholders should be identified prior to attempting their engagement. The preliminary list of stakeholders for TANGENT can be found for each Case Study in Section 4. The list will be expected

to be amended and modified based on the evolution of the project, the identification of new stakeholders or changes in the levels of interest and influences from stakeholders in the project.

To identify the key stakeholders, WP1 has asked each Case Study to fill in an excel document, partial results of which can be found in Section 4. The following questions were asked:

- What is the name of the stakeholder?
- What is their type?
- What do they do?
- What is their level of interest in TANGENT?
- What is their level of influence on the outcomes of the project?
- What are their interests and concerns regarding TANGENT?
- How would they engage with the project?
- How to communicate with them?
- Who in TANGENT would communicate the information?
- How do we get information from the stakeholder (i.e., who to contact and how)?
- What information would they need at some point of the project?
- How often would they need information?
- When would they need information?

Together with the identification, project partners should profile the stakeholders in order to properly engage with them. The most common criteria relevant for stakeholder engagement is their level of interest, their level of influence on the outcomes of the project and how they would engage with the project.

Mapping stakeholders at the beginning of the co-creation process is essential to identify each stakeholder's role in the process, which stakeholders will be the most useful to engage with and define what is expected from them at different stages of the project. Mapping allows the TANGENT project partners to evaluate stakeholders using specific criteria and to visualise the interplay of relationships. In the mapping process, we used and adapted Mendelow's power-interest matrix.

	Low Influence	High Influence
Low Stake	least priority stakeholder group	useful for decision and opinion formulation, brokering
High Stake	important stakeholder group perhaps in needs of empowerment	most critical stakeholder group

Figure 3: Influence-Interest Matrix (Source: Rupprecht Consult, 2019 - based on UN-Habitat, 2001.

Figure 4: Tools to Support Urban Decision Making, Nairobi, p. 24) used to identify stakeholders with differing levels of interest and influence over TANGENT (adaptation from Mendelow's power-interest matrix)

There are five forms of engagement possible based on the power of these stakeholders:

1. Pull communication: one-way communication with stakeholders by sharing information on the project, through brochures and posters for example (lowest power).

2. Push communication: one-way communication to targeted stakeholders and groups through emails, targeted posts, etc.

3. Consultation: two-way engagement by sending out information to specific stakeholders on the project, gathering feedback from them and taking into account their knowledge and opinion.

4. Participation: two-way engagement through the distribution of tasks and responsibilities to specific stakeholders (still limited power) .

5. Partnership: two-way engagement by sharing accountability in decision-making procedures and allocating actions to specific stakeholders (highest power).

In the case of TANGENT, we have identified three forms of engagement possible:

1. Communication (lowest power): stakeholders receive information on the project activities and result through different communication means (e.g., e-mails, social media, brochures, targeted posters, etc).

2. Consultation (limited power): stakeholders participating in project activities to a limited extent (e.g., they may attend a few meetings, workshops, site visits, provide access to necessary information, etc.).

3. Partnership (highest power): stakeholders are integrated into the project activities, may share accountability in decision-taking and contribute to certain actions.

The result of the stakeholder mapping and analysis should contribute to defining an adapted and integrated stakeholder engagement plan towards ensuring the successful implementation of the TANGENT tools in the Case Studies.

3.4 Systemic analysis of the Network & Traffic Management model

To guide the analysis of multimodal transport systems and traffic management solutions for each Case Study, the TANGENT co-creation process will apply the OSTO System Model approach, which stands for Open, Social, Technological and Economic (based on German terminology “Ökonomisch) aspects in a holistic perspective.

This methodology has recently been implemented and validated by Rupprecht Consult in the InterregCE Dynaxibility4CE project to support planning for innovative mobility solutions (CCAM, MaaS and UVAR) in seven European Functional Urban Areas. The Dynaxibility4CE experience demonstrated that the application of this system-model approach allows for a structured and comprehensive analysis of the local context and conditions. This is of particular importance when addressing innovative mobility solutions, given the level of uncertainty and complexity involved. A system-model perspective ensures that all relevant elements are considered in the analysis and supports a holistic planning process.

This approach will support the TANGENT processes, both the Case Study implementations and the development of NTM solutions, by guiding the cooperative analysis of local conditions, needs (operational and non-operational) and NTM measures.

The participative discussion in TANGENT co-creation workshops will follow the structural version of the model, focusing on design elements and (system) behaviour. To deal with the complexities of the mobility innovations addressed and their integration in urban transport systems, a structured analysis of the system’s components is proposed, thus, considering the systems core processes at organisational, social, and individual levels (see Figure 5):

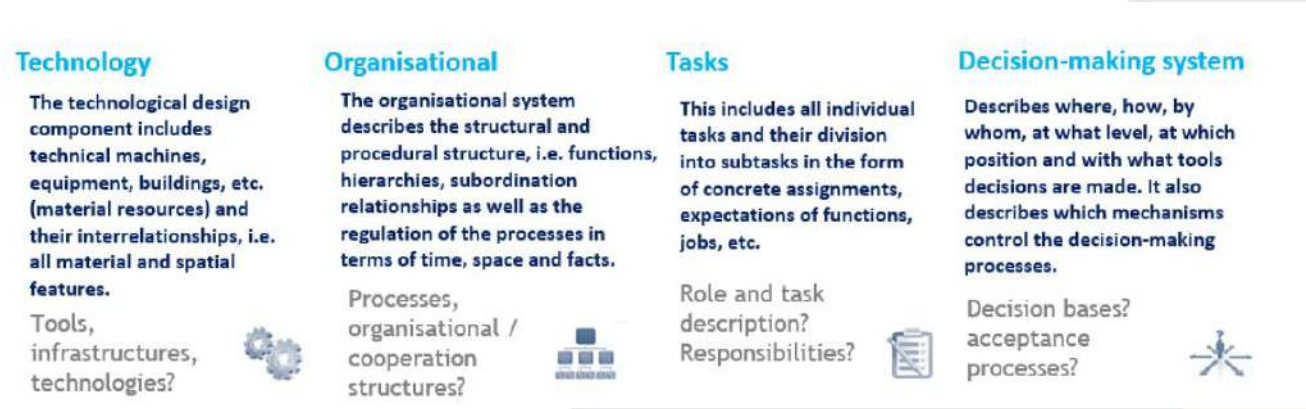


Figure 5: System-design elements (OSTO model)

4 TANGENT co-creation process

Following the SUMP planning principles and concept, TANGENT has designed a stage-wise approach for its multi-actor co-creation processes. Each stage addresses key aspects of TANGENT's multi-actor cooperation towards optimal Network and Traffic Management:

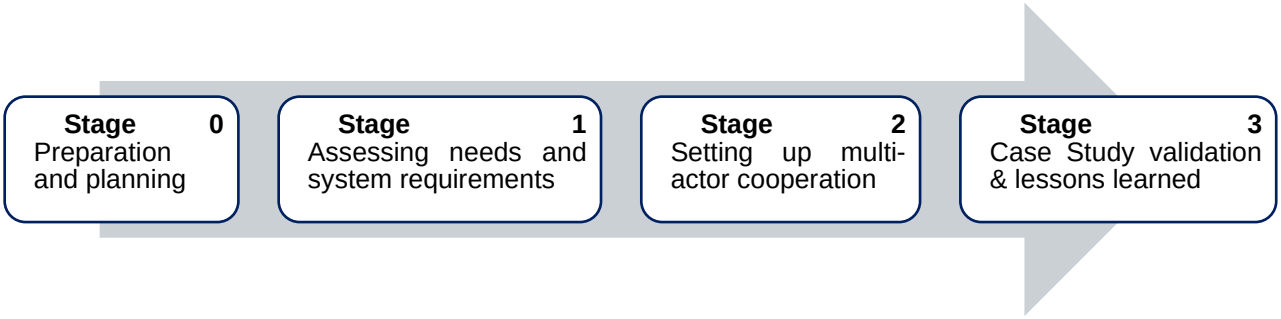


Figure 6: Process of the multi-actor co-creation strategies for Case Studies

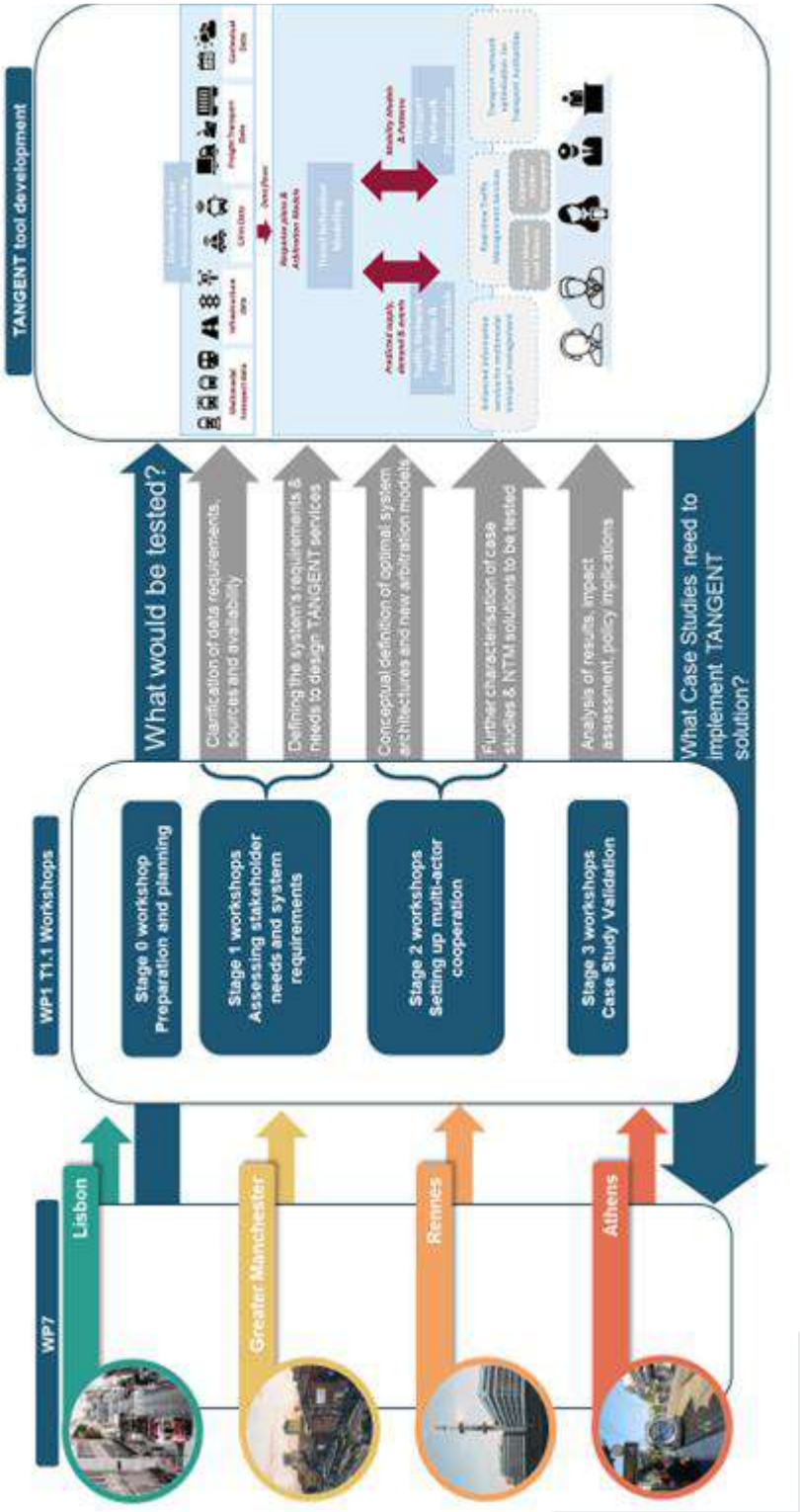


Figure 7: Integration of the multi-actor co-creation process, including workshops, within the development of the TANGENT tool and case studies

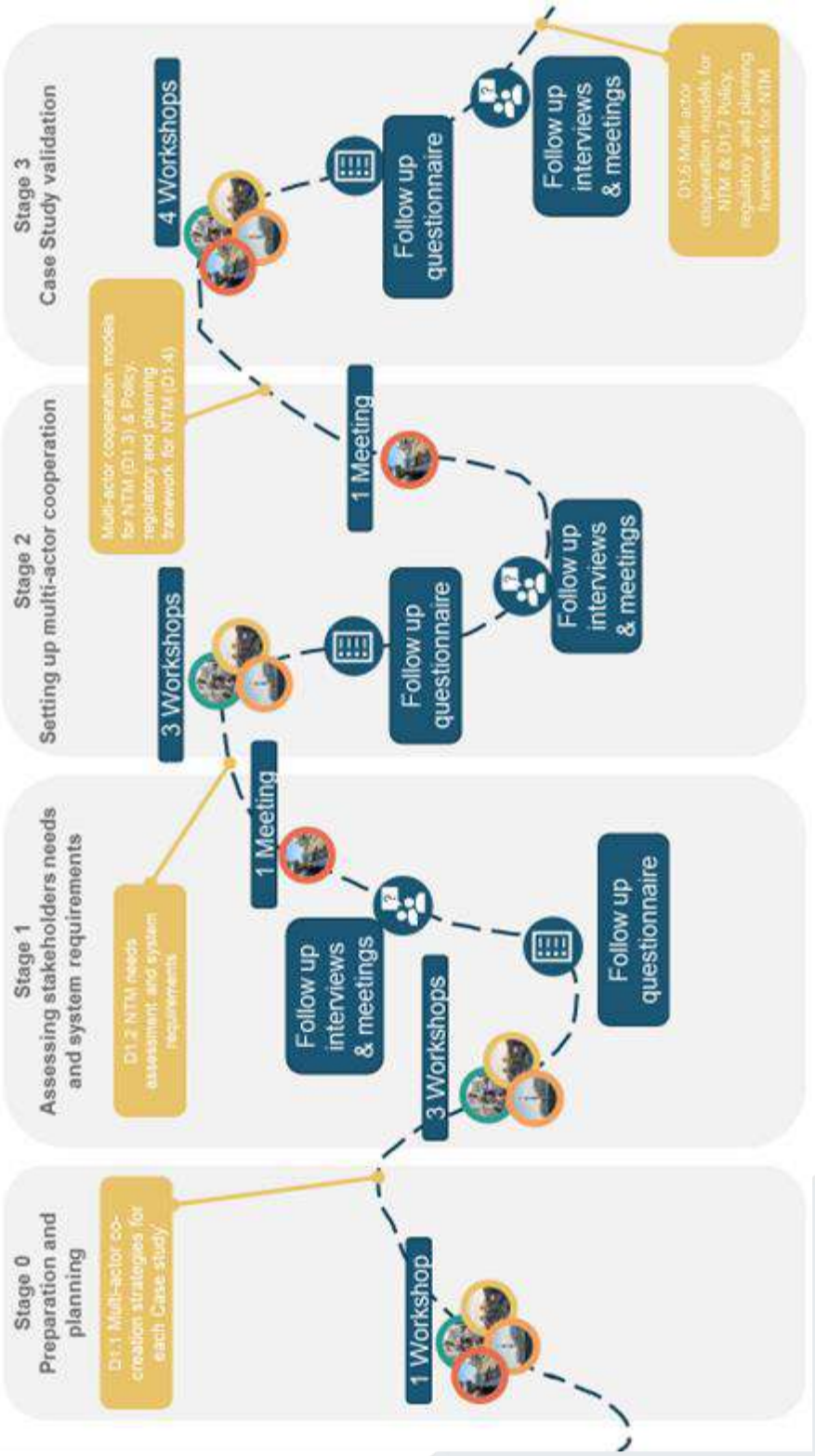


Figure 8: Stage process including workshops, complementary engagement channels and tools

A series of workshops, supported by complementary engagement channels and tools (such as questionnaires, interviews, and online conference meetings), will allow the project to establish seamless cooperation with local actors and among project Work Packages (WP).

Such co-creation instances will provide an opportunity for partners to present project progress and results and, in turn, receive feedback and consult the perspectives of local stakeholders, build agreements towards each Case Study's implementation plans, and collect key input for the development of TANGENT's NTM solutions.

Moreover, the analysis of the mobility ecosystem at each Case Study site, and identification of interests and priorities of the stakeholders involved, allow the project to adapt the proposed methodology to the specific local context and engage effectively with key actors.

The conceptual design of each stage's scope, format and topics to be addressed has been developed through the adaptation of the RAIM methodology, identifying key questions and engagement formats to feed the TANGENT co-creation processes.

Similarly, the OSTO system-model described in Chapter 2 will be used to structure the interactive discussions in each Stage's workshops, ensuring the analysis of core processes for the NTM solution at organisational, technical, social, and individual levels.

The eight elements of the System-Model have been grouped and adapted to fit TANGENT's needs. As shown in Figure 5, TANGENT's co-creation workshops will discuss:

- The functional and technological design of the NTM solutions, including data harmonisation and management, sharing strategies for the required information flows, traffic management solutions and innovative mobility services at the technical level.

- The organisational structure for each local mobility network, the roles and needs of the different stakeholders (including trade-offs) towards the definition of optimal decision-making systems (arbitration models for the NTM solution), monitoring and control systems.

- The tasks required for the TANGENT solution implementation, the people, skills, capacities and resources involved will be addressed, considering the importance of an innovation management strategy and continuous capacity development.

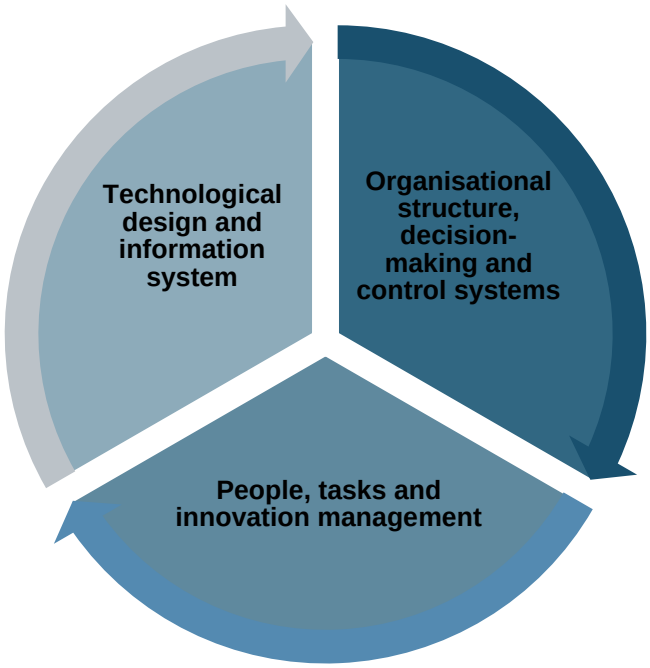


Figure 9: TANGENT's key elements for the NTM systemic analysis

The following sections describe each stage of the TANGENT co-creation process in detail, including its objectives, key topics addressed, involved partners and local stakeholders and planned activities.

4.1 Stage 0: Preparation and Planning

The Stage 0 of the co-creation processes aimed at the preparation and planning of initiative activities at each Case Study city/region, aiming to reach a common understanding of current mobility and planning conditions and to support the development of concrete implementation plans for each Case Study. This stage was run in close cooperation with Task 7.1, which set the context for the technical implementation of the Case Studies in WP7.

Objectives	Definition of baseline conditions for the Case Study implementation: • legal and supporting framework • planning and policy background • characterisation of the transport network (modes, data sources and governance) • Stakeholder mapping (incl. roles, needs and priorities) Establish a work plan for the co-creation process: • schedule of workshops • responsibilities for involved partners Support T.7.1.1 Specification of test scenarios and implementation protocols • discuss vision and objectives for each Case Study,

	• analysis of test scenarios (incl. transport modes involved/ Operational Design Domains (ODDs) / infrastructure)
Key aspects addressed	Baseline conditions • Which policy, legal frameworks and supporting frameworks are relevant? (e.g., mobility plans, vision for innovative solutions, regulations, etc.) • How can the transport network (services and management functionalities) be described briefly and concisely?
	Objectives & scenario • What are the qualitative and quantitative objectives of the Case Study? • What are the expected impacts and benefits of the TANGENT solution implementation? • What are the scenarios to be evaluated? How do they respond to the identified objectives?
	Stakeholder mapping • Which roles must be filled for the NTM solution to work? • And which capacities and resources are required for each role? • Which roles must exchange which data with each other? • Which local actors need to be involved? Do they address all identified roles)?
	Workplan • When should the next workshops take place? • Which project partners need to be involved in each stage and what are their roles/responsibilities? • Define scope, format and agenda for upcoming workshops

Table 2: Stage 0 overview

The stage 0 workshop took place on the 4th of November 2021 (online) with most of the consortium partners and each Case Study being present. During this workshop, WP1 Leader, Rupprecht Consult, presented an example of the RAIM methodology and how it could be adapted to the TANGENT project.

The specific objectives, test scenarios, involved actors and local context for each Case Study were briefly discussed, and follow-up conference meetings have been set up to further define the baseline for each Case Study's implementation. These virtual meetings with each Case Study took place between December 2021 and February 2022.

The main output/outcome of this stage is this deliverable (D1.1 Multi-actor co-creation strategies for each Case Study).

4.2 Stage 1: Assessing needs and system requirements

The goal of stage 1 is to validate and complete the developed Case Study implementation plans that have been previously defined under WP7 and assess key priorities and needs of the different actors involved. The assessment of user preferences and needs will consider the results from the stated preference surveys conducted in T3.2.

The goal is for the discussion to lead to the characterisation of the transport and traffic management systems in each Case Study, categorising functional and non-functional requirements, and evaluating data availability. The four workshops will constitute key inputs for Task 2.1, providing an instance for cooperative assessment with local stakeholders to support the research performed in WP2.

Timeline	March - May 2022
Objectives	• Development of implementation plans & co-creation process with local stakeholders • Agree on objectives of the Case Study, target indicators and test scenarios (incl. services, Further characterisation of the scenario: services/solutions, operational requirements, roles involved) • Common understanding of current transport and traffic management systems • Stakeholder roles and needs: assess key priorities, roles and needs of the different actors involved • Identification of functional and non-functional requirements of the transport network and traffic management system • Data analysis and harmonisation: discuss gaps and alternative sources, data governance and sharing strategies, which information flow are needed between actors.
Key questions	Implementation Plan and co-creation process • Validate the objectives and scenarios to be tested, • Identification of indicators to measure these objectives and establish targets • Agree on the work plan and roles of each party. • Reach a common understanding on the elements of the transport and traffic management system to be considered Needs and requirements • Further discussion and characterisation of the local transport network (under each scenario): services/solutions, operational requirements, roles involved, traffic management solutions. • Local policy goals and user needs: principles for arbitration models and action planning Stakeholder roles and needs • What are the responsibilities and tasks of each stakeholder? • What role do they fulfil in the system?

	• Map their key interests and needs. • How do they relate to each other (dependencies, established cooperation, etc.) -> at organisational, technical, operational and contractual levels. Data • Which information flows are needed between actors? • What data gaps have been identified? And how can they be filled (new sources)? • Discuss data governance and potential sharing strategies/ principles

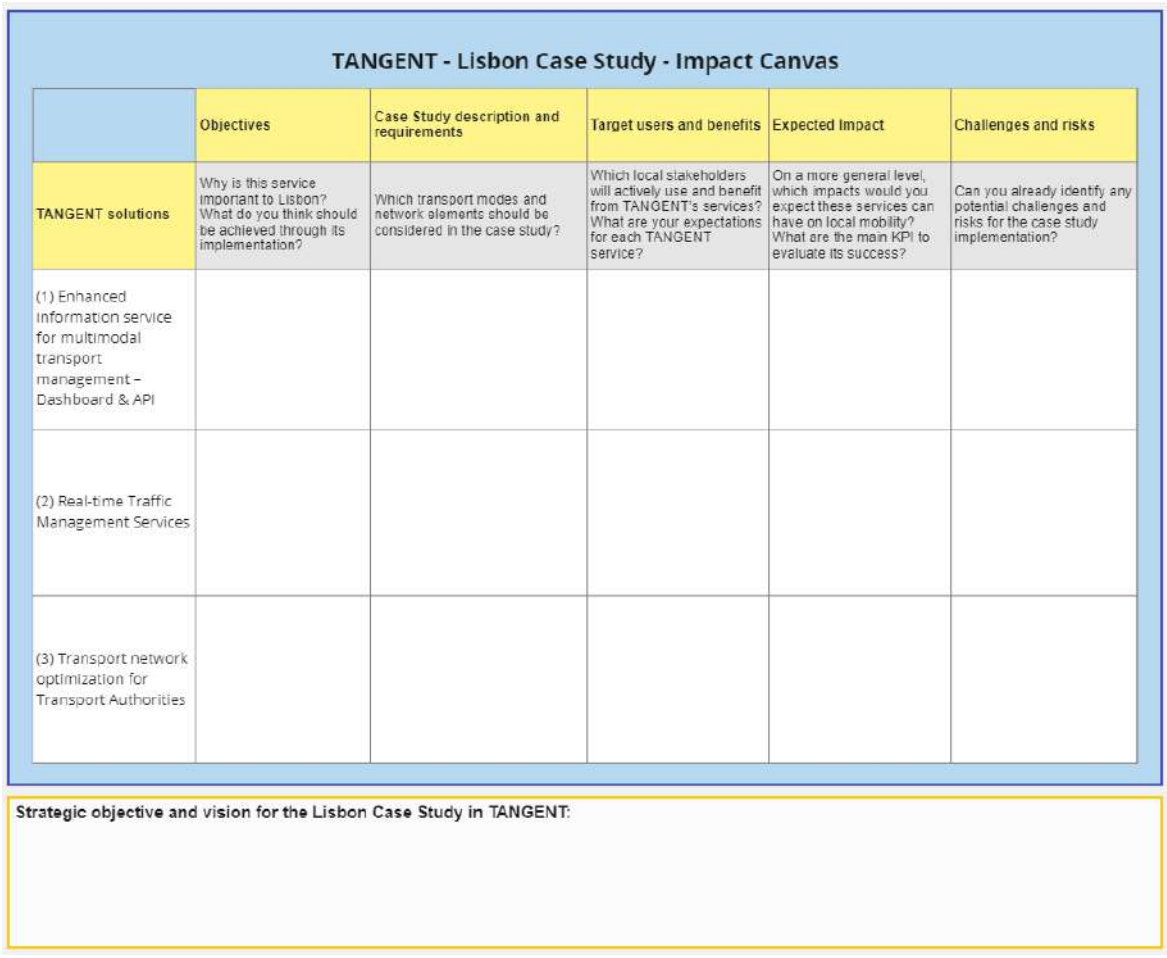
Table 3: Stage 1 overview

4.3 Stage 1 Workshop

During the first part of the Stage 1 workshop, TANGENT partners will present the project, the Case Study implementation plan and the stakeholder engagement plan to the stakeholders. The goal of this part of the workshop is to highlight the necessity and opportunities for both the stakeholders and the TANGENT project to have stakeholders engaged and contribute throughout the project.

During the second part of the workshop, Rupprecht Consult will moderate an interactive session where stakeholders will contribute to creating an impact canvas (Figure 5) and completing a systemic analysis using the OSTO approach defined under Section 2 (Figure 6).

The main output/outcome of this stage contributes to the deliverable D1.2 “Network and Traffic Management needs assessment and system requirements”.



TANGENT - Lisbon Case Study - Impact Canvas

	Objectives	Case Study description and requirements	Target users and benefits	Expected Impact	Challenges and risks
TANGENT solutions	Why is this service important to Lisbon? What do you think should be achieved through its implementation?	Which transport modes and network elements should be considered in the case study?	Which local stakeholders will actively use and benefit from TANGENT's services? What are your expectations for each TANGENT service?	On a more general level, which impacts would you expect these services can have on local mobility? What are the main KPI to evaluate its success?	Can you already identify any potential challenges and risks for the case study implementation?
(1) Enhanced information service for multimodal transport management – Dashboard & API					
(2) Real-time Traffic Management Services					
(3) Transport network optimization for Transport Authorities					

Strategic objective and vision for the Lisbon Case Study in TANGENT:

Figure 10: Example of TANGENT Impact Canvas

Technology and Information Systems	Organisational structure, governance, and decision-making	Tasks, people, knowledge and innovation management
Based on the presented 'data catalogue' and the TANGENT services, is there any missing data source or tools that should be considered? Which challenges (and solutions) can you identify for the utilisation/integration of these data? (data sharing strategies and principles) (if time allows) Besides the operational data of the transportation system, what	Are there any missing stakeholders that should be involved in the case study? How are traffic management decisions made for the Rennes transport network? How are they implemented? Do they involve coordinated action from different modes and stakeholders? Which existent cooperation structures/groups are there for Rennes' mobility planning and	Where do you see your responsibilities and tasks for the implementation of each TANGENT solution? Where do you see a need for capacity building for the skills and competences needed to effectively implement each TANGENT service (e.g., C-ITS, CCAM, data management, etc.)?

Technology and Information Systems	Organisational structure, governance, and decision-making	Tasks, people, knowledge and innovation management
other sources of data about the mobility situation and user perception?	traffic management efforts? Which multi-actor cooperation experiences would you highlight?	

Table 4: TANGENT – Stage 1 - systemic analysis of the Case Studies

4.3.1 Follow up activities

To complement the discussions advanced in Stage 1's workshops, TANGENT will prepare questionnaires for each Case Study, allowing the project to collect vital inputs to understand the operational and non-operational requirements, role, priorities and concerns of each stakeholder.

Such contribution will not only inform the development of TANGENT's tools in WP2-6, but allow WP7 to establish clear cooperation agreements for each Case Study site, addressing the perspectives of each stakeholder and foreseeing potential risks and conflicts for the Case Study implementation.

4.4 Stage 2: Setting multi-actor cooperation

The goal of Stage 2 is to set up multi-actor cooperation, where partners will work with local stakeholders to cooperatively analyse the organisational, governance and operational structures of its transport networks.

During each workshop with the partner city/region, we will assess with stakeholders the multimodal network development and operation, its integration of new mobility services, considering the smart infrastructure classification index defined in Task 6.5. Cooperation and business models will be discussed towards the optimal system architectures and new arbitration models (T1.2).

Stage 2 provides a valuable instance of discussion with key local actors, to complement and support the analysis conducted in Task 1.2.

Timeline	From June 2022 to September 2022
Objectives	Discuss multi-actor cooperation for innovative Network Traffic Management for each scenario, including: • Organisational level: jointly analyse the organisational, governance and operational structures, decision-making, skills and resources. • Service model and multimodal integration: discuss multimodal service models and impacts of the scenarios considered, towards the definition of optimal system architectures and traffic management solutions. • Operational and technical levels: assess functional, operational and technical requirements of the multi-modal network management, including infrastructure (physical and digital), expected impacts on each scenario and potential solutions.

	• Information and technology architecture: further define information flows and data-sharing requirements for the described scenarios and NTM models.
Participants	Local workshop with each Case Study (incl. key stakeholders) DEUSTO & A-to-Be to actively participate
Key questions	Organisational structure • Analysis of the organisational, governance and operational structures, • Decision-making systems and principles • Resources available/needed (incl. skills, tools, cooperation structures)
	Service model and multimodal integration • Assessment of multimodal service models (incl. innovative mobility solutions) • Consequences/parameters for the scenarios considered • Discuss optimal system architectures and traffic management solutions
	Operational and technical requirements • Discuss functional, operational and technical requirements of the multi-modal network management • Infrastructure (physical and digital) and operational requirements for each scenario/solution considered • Technical requirements/architecture for the NTM
	• Information and technology architecture • further define information flows and relation to multi-actor cooperation models • data-sharing requirements for the described scenarios and for NTM solutions

Table 5: Stage 2 Overview

The main output/outcome of this stage contributes to the deliverables D1.3 “Multi-actor cooperation models for NTM” and D1.4 “Policy, regulatory and planning framework for NTM”.

4.5 Stage 3: Case Study validation and lessons learned

The goal of Stage 3 is to analyse results from the Case Study implementation and impact assessment (T7.4) with local stakeholders and experts during the workshops held in each partner city/region.

Timeline	Last year of the project
Objectives	• Analyse results from the Case Study implementation and impact assessment, and its policy implications, with local stakeholders and experts, • Evaluation and revision of the multi-actor cooperation according to experiences with Case Study implementation • Identify/validate lessons learned, recommendations and key success factors for transferability and exploitation
Participants	Local workshop with each Case Study (incl. key stakeholders) WP7 – Local partners, ID4CAR & PANTEIA – to present the project's findings and outputs, validate the NTM approach and tools developed, and analysing its policy implications
Key questions	• Analysis of Case Study results • Discuss the assessed impacts for each scenario • What are the key achievements/issues identified? • What benefits are expected through enhanced NTM?
	• Multi-actor cooperation • How did the multi-actor cooperation work? • What challenges came up? • What can be improved?
	Policy implications and mobility planning outlook • What relevant conclusions and implications can be identified to guide local mobility policy and action planning?
	Lessons learned and recommendations • What are the main lessons learned and recommendations for the implementation of innovative Network Traffic Management solutions in the future? • What key success factors can be identified? • How can the project results be taken up and exploited by other cities?

Table 6: Stage 3 Overview

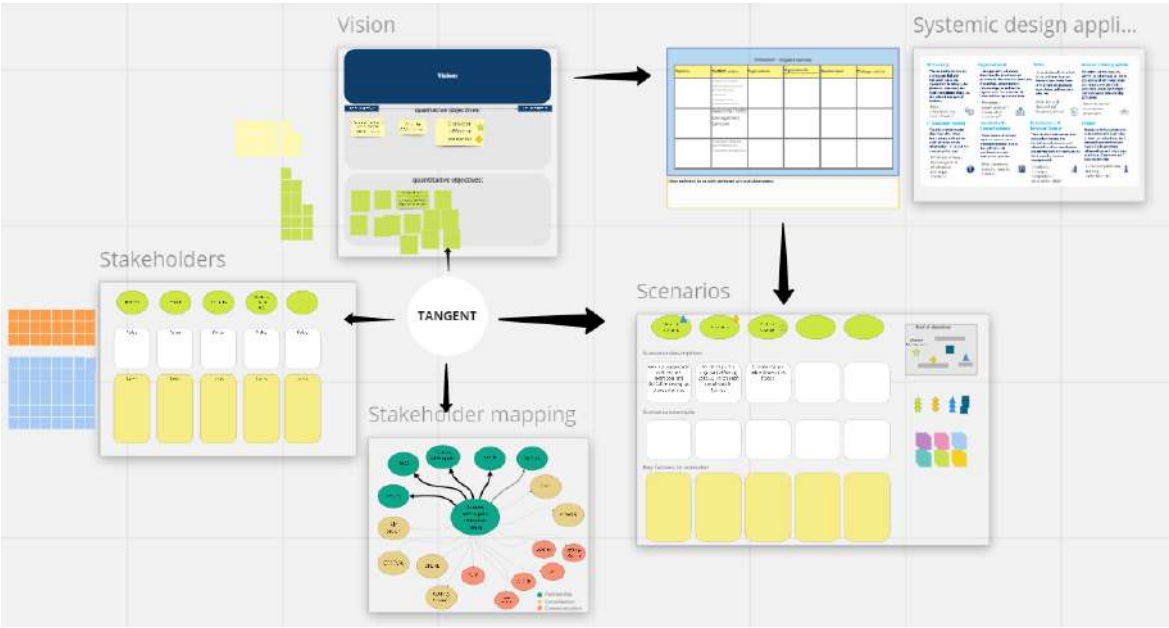
The main output/outcome of this stage contributes mainly to T7.4 "Results & Impact Assessment" of the Case Studies but also to the deliverables D1.6 "Multi-actor cooperation models for NTM" and D1.7 "Policy, regulatory and planning framework for NTM".

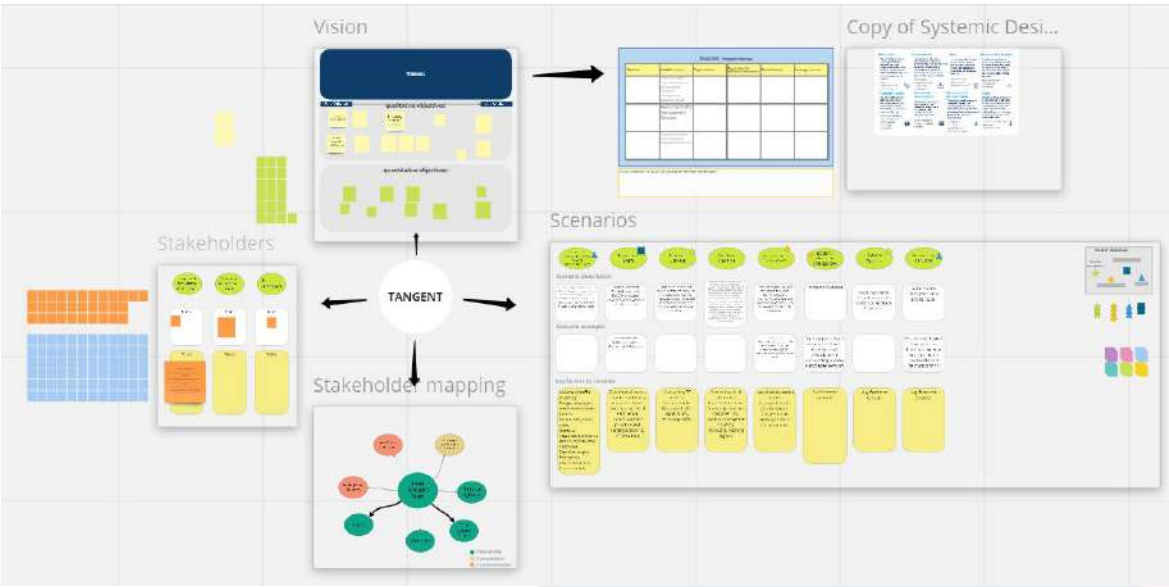
4.5.1 Workshops support

Throughout the co-creation process we will use a Miro board that is aimed to be a working document evolving throughout the workshops with the content provided by Case Studies, WPs leaders and stakeholders during workshops.

It has been structured following the TANGENT methodology, inspired by the RAIM Miro board. It has been presented at the Stage 0 workshop and during monthly meetings with the Consortium. Each Case Study has their own space on the Miro board to gather information such as stakeholder mapping, stakeholder role in the project, vision and objectives, scenarios, an impact canvas and an OSTO systemic analysis.

All questionnaires and invitations forms will be developed using Google form.





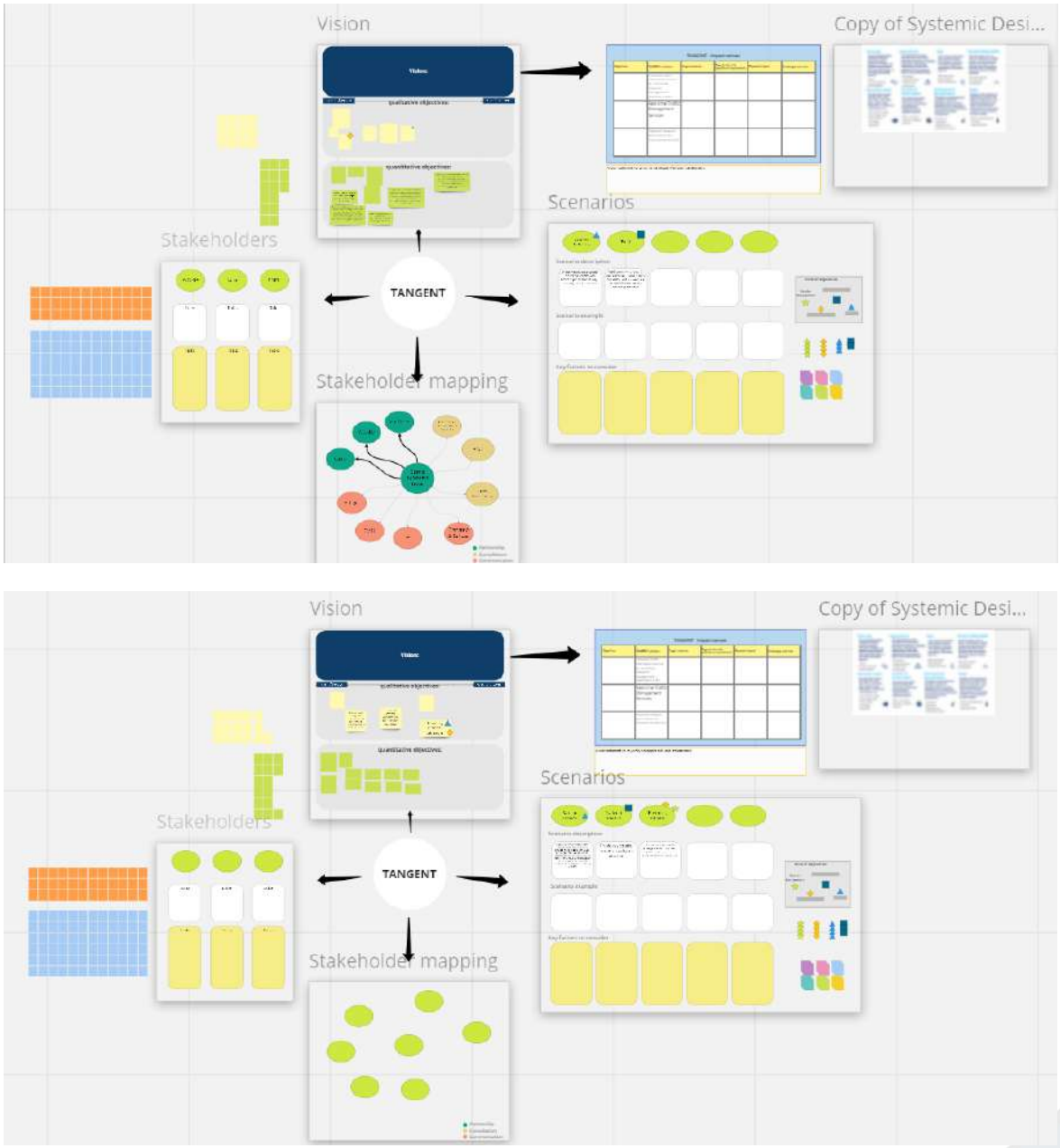


Figure 11: Extracts from the Miro board under its current shape for example.

5 TANGENT Case Studies

During the initial preparatory phase, TANGENT has focused on the analysis of local baseline conditions and NTM goals in each case study. In a joint effort from WP1, WP2 and WP7 have worked collaboratively with the Case Study leaders to advance in the characterisation of the transport network, data sources and governance and strategic objectives for each of the Case Study's implementation.

This chapter presents TANGENT case studies' preliminary description, the results of the stakeholder mapping and engagement analysis, as well as the planned TANGENT solutions to be implemented and test scenarios. The conditions, NTM measures and scenarios will be further discussed and validated with local stakeholders during upcoming workshops (Stage 1), and thus will be subjected to modifications. Moreover, the designed co-creation process will enable the effective coordination across Work Packages, aligning TANGENT's tool development with the identified needs and goals of the case studies (and vice versa).

5.1 Rennes

5.1.1 Local context

Rennes Métropole is the Métropole, an intercommunal structure, centred on the city of Rennes. It is located in the *Ille-et-Vilaine* department, in the Brittany region, western France. It was created in January 2015, replacing the previous *Communauté d'agglomération de Rennes*, which had itself succeeded in 2000 to the previous district created in 1970 with less powers than the current metropolis. Its population was 444,723 in 2014, of which 219,370 in Rennes itself. Rennes Métropole, the mobility organising authority, defines the overall transport strategy in its territory through its Urban Transport Plan (PDU[1]) and, in this context, organises the public transport policy in its 43 municipalities. To promote sustainable mobility throughout the territory, the metropolis is implementing a set of solutions favouring public transport and developing complementarity between the different modes of transport, with a clear choice for innovation and experimentation. Rennes Metropole developed from 2017 to 2021 the inOut initiative around new mobility to support demonstration and experimentation on its territory. inOut brought together everyone who wants to invent and explore tomorrow's mobility by acting as an information hub, experimentation platform, network of key stakeholders and professionals and as an area for all citizens to learn and experience new mobility solutions with the free event every year.

5.1.2 Characterisation of the transport network in terms of modes, data sources and governance

Modes	Sources
Metro, bikes	Rennes Metropole Portal
Buses	Keolis Star Data Explore

[1] Plan de déplacement urbain

Modes	Sources
Air quality	Air Breizh / IRISA
Traffic	Autoroutes Traffic

Table 7: Overview of modes and data sources present in Rennes

5.1.3 Stakeholder mapping

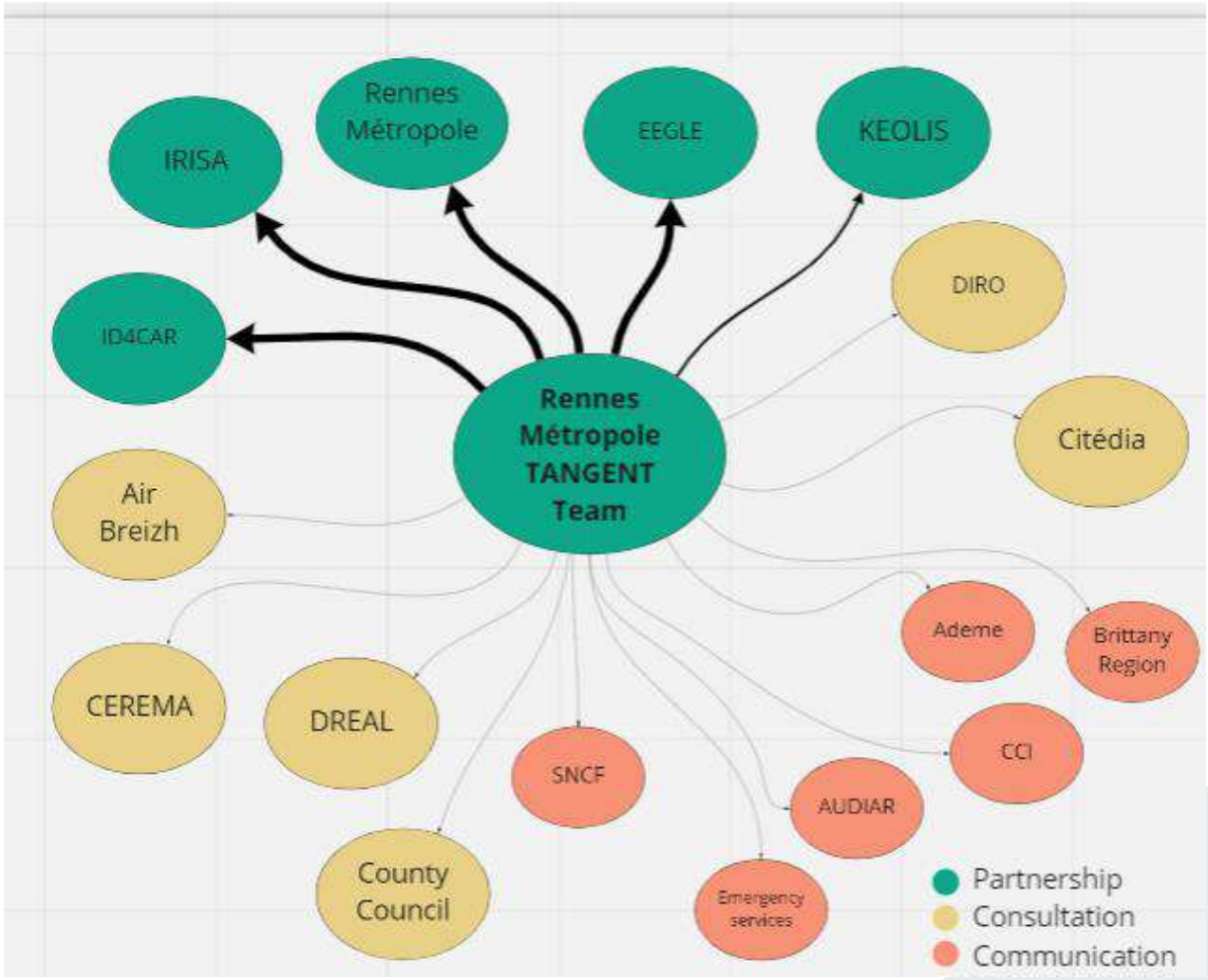


Figure 12: Overview of Rennes' stakeholder mapping (Miro board)

5.1.3.1 Stakeholders to create partnerships with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
EEGLE	SME working on technical basis for the development of digital services based on cartographic and analytical data visualization, user rights management and mass processing capabilities.	Expert on data management supporting ID4Car and interest in feeding their own development.
ID4CAR	Cluster	To make sure the consortium runs smoothly to achieve Rennes goals.
KEOLIS Rennes (operating Rennes Metropole "STAR" transport network)	PTO Public transport operator	Interested in the assessment of the effectiveness of the actions and in the interface with the hyper vision system and with the overall transport system management.
IRISA	Academic lab - working on data and mobility projects - including RUDI	Interested in the assessment of the effectiveness of the actions and in the interface with their own projects (monitoring air quality)
Rennes Métropole	Local Authority - PTA - different services involved (Road/infrastructure management, transport and mobility management, Innovation, etc.)	Improving internal expertise on traffic management, in particular through the capacity to integrate large datasets and thanks to exchange of good practices with other European cities. TANGENT to contribute to achieving the goals of the 2030 Urban Travel Plan (PDU) Feeding Rennes Métropole Public Data Service with a Case Study on mobility.

Table 8: Overview of stakeholders to create partnerships within Rennes

5.1.3.2 Stakeholders to consult with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
Air Breizh	Association working on air quality	
CEREMA	National research centre with a lab on mobility	

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
DIRO	Manage the national road network	Road infrastructure managers involved in the area chosen for Rennes Case Study
Citédia	Urban Services Operator for Rennes Métropole (car & cycle parks, performance halls, leisure facilities, company offices...)	Mainly links between mobility and management of car & cycle parks
County council (Département d'Ille-et-Vilaine)	County council PTA (management of county roads)	Impact of TANGENT on the overall local mobility system
DREAL Service infra, sécurité et transport et unité mobilité	Regional representative of the national Ministry of environment, planning and housing	Impact of TANGENT on environment and planning at the regional level. NB: A global study of the west access (area of Case Study) of Rennes Métropole is conducted by Rennes Métropole and the DREAL. In this study, some aspects have already been validated: A west – east tram bus by 2030; Park and ride installation by 2030

Table 9: Overview of stakeholders to consult with in Rennes

5.1.3.3 Stakeholders to communicate with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
SNCF	Manage the rail national service	Impact of TANGENT outcomes on the development of intermodal mobility hubs
Brittany region	Regional PTA (management of regional infrastructure, trains, interurban coaches...)	Impact of TANGENT on the overall regional mobility system
AUDIAR	Rennes Métropole agency (studies and consultancy on urban planning)	Impact of tangent on planning policies, behaviours and infrastructure
CCI	Chamber of commerce and industry	Impact of TANGENT on the companies installed on the Case Study area (which is a mainly an industrial activity area)
Emergency services	Police, Fire, ambulance	Congestion and operating services with reliable journey times. Able to attend incidents in timely manner

Table 10: Overview of Stakeholders to communicate with in Rennes

5.1.4 Objectives

- Reduce congestion
- Reduce pollution
- Increase public transport, cycling and walking
- Decrease single-occupant trips

5.1.5 TANGENT solutions and test scenarios[2]

(1) **Enhanced traffic information service for multimodal transport management – Dashboard & API (Testing environment: Real scenario):** Rennes has a particular interest in promoting the data sharing and cooperation between public and private actors around a "win-win" economic model that benefits users. To this end, this module will gather and process data from different stakeholders (public and private) and provide various schemes for data-sharing among them based on current standards (e.g. NeTEx, DATEXII) and extensions of them for guaranteeing interoperability and improving intermodality. Furthermore, TANGENT will provide traffic dynamics in real-time from various modes, it will identify delays on the transport network, arising events and will predict the future status of the network, identifying congestion and bottlenecks.

(2) **Real-time Traffic Management Services (Testing environment: Virtual and real scenarios):** Rennes aims a behavioural change of their transport users for reducing congestion and bottlenecks. For this, the use of cars will be limited, and the shared modes will be promoted by giving incentives. Apart from this, Rennes is engaged in reducing noise, pollution and congestion in its streets and roads, and the freight delivery issue is central to this strategy, especially in the city centre. TANGENT will contribute to this through the "Smart Network Load Balance" functionality by suggesting certain routes and modes of transport to appropriate stakeholders (e.g. users, service providers, transport operators, freight fleet operators, etc.), by the coordination/synchronisation of on-demand and transit modes and freight delivery. The Cooperative Incident Management service will be also tested for unplanned events and disaster management as indicated below.

(3) **Transport network optimization for Transport Authorities (Testing environment: Virtual scenarios):** Rennes is continuously implementing innovative measures for improving operations on the transport network towards a more sustainable city. TANGENT will support their decision-making for simulating possible scenarios related to intermodality, shared mobility, urban freight transport and CAVS, such as What-If the capacity of the Demand Responsive Transport supply is increased in the city? What-If priority is given to vehicles with 2-3 passengers (car-pooling) by lanes management? What-If this new arbitration model is applied to prioritise the use of soft modes?

[2] These draft NTM solutions for the case study site and respective test scenarios continue to be discussed and validated with local stakeholder and TANGENT project partners, and thus are subject to further modifications.

5.1.5.1 Scenarios

The case study in Rennes will focus on a specific area which is particularly congested and which offers the opportunity to test a lot of situations taking place in other areas of the Métropole and even in other cities (replicability). The “route de Lorient” is actually a penetrating road towards an industrial area (freight) but also the way to access (from the West) the football stadium, the Hospital, the city centre and it is located near the exhibition centre and the airport. The scenario will tackle the questions raised above, making the most of information on traffic dynamics in real-time (for both traffic managers and users), providing incentives for car sharing, encouraging the use of soft modes and public transport, planning lanes dedicated to public transport, testing the control of access to the ring road…

5.2 Lisbon

5.2.1 Local context

Lisbon is the capital and the largest city of Portugal, with an estimated population of 0.5 M and an administrative area of ~100 km². Its Metropolitan Area covers 18 municipalities in Great Lisbon and Setúbal Peninsula, with a total population of 2.8 M in a total area of ~3,000 km². CARRIS is the main surface transport operator of the city of Lisbon, moving more than 140 million passengers per year in its bus and tram network. It has a network with more than 2000 stops and operates roughly 700 buses and 50 trams. CARRIS has a team devoted to analysing data about its passengers’ movements which supports the activities associated with network management and development. Within this team, there are increasingly relevant transport modelling capabilities, which will be used to provide input to the project activities. CARRIS has extensive experience in planning the deployment of new bus and tram routes, studying passenger flows and estimating demand. In addition, has developed numerous activities of planning special services, devoted to providing extra offers to events in its operating area, and has a team that addresses changes in the network due to foreseen (e.g. works) and unforeseen events (e.g. flooding, accidents).

5.2.2 Characterisation of the transport network in terms of modes, data sources and governance

Modes	Sources
C-ITS	Brisa – A-to-Be
Car	ViaVerde
Tram, Bus	Carris

Table 11: Overview of modes and data sources present in Lisbon

5.2.3 Stakeholder mapping

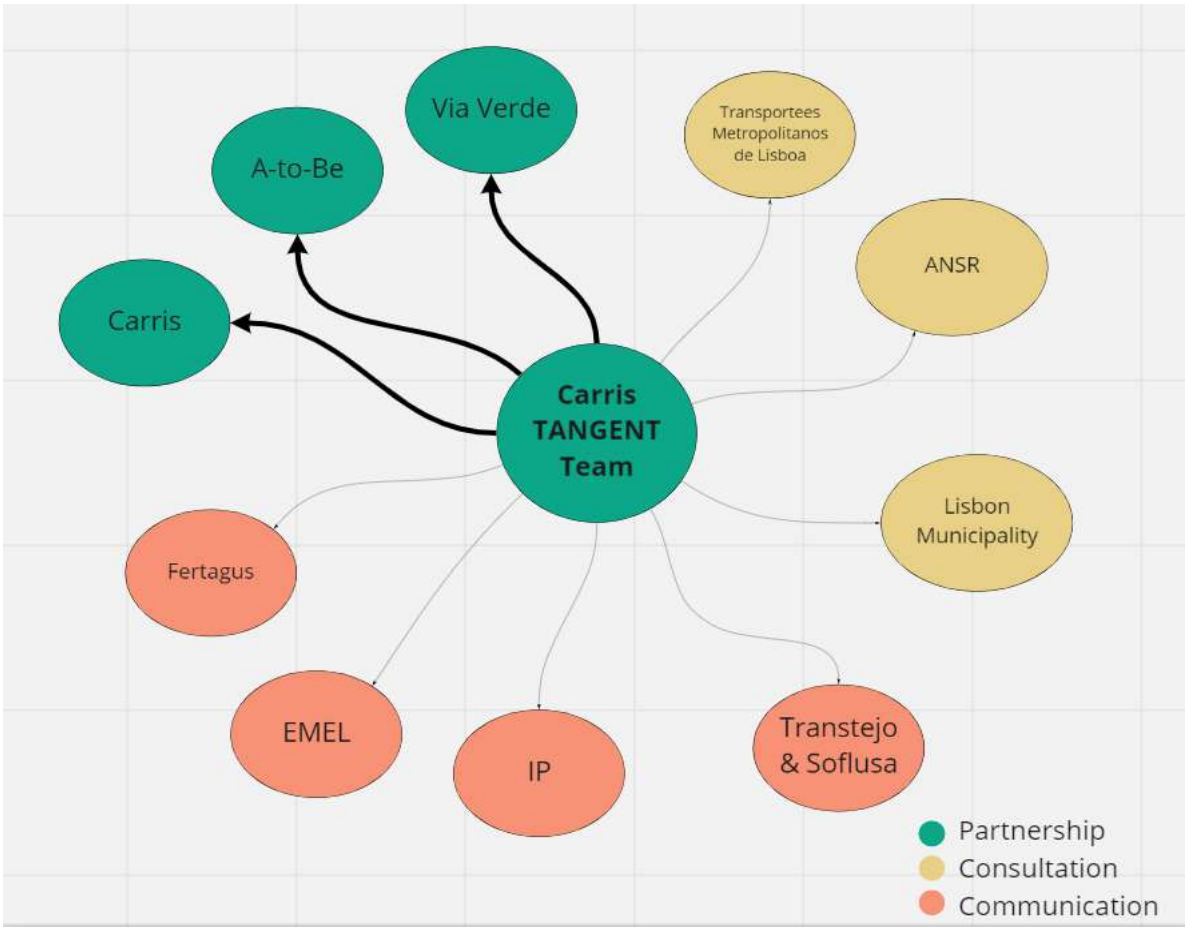


Figure 13: Overview of Lisbon's stakeholder mapping (Miro board)

5.2.3.1 Stakeholders to create partnerships with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
Carris	Public transport operator in the City of Lisbon; operates bus and trams	Congestion and operating uninterrupted transport services with reliable journey times for customers
A-to-Be	ITS technology supplier	
Via Verde	Mobility services provider; offers payment solutions for road tolls, off-street parking, on-street parking and is piloting a solution for public transport/MaaS	

Table 12: Overview of stakeholders to create partnerships with in Lisbon

5.2.3.2 Stakeholders to consult with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
Lisbon Municipality	Local authority and public transport authority in the City of Lisbon. Responsible for road management in Lisbon.	Promotion of resilient networks; insights for traffic planning and management
Transportes Metropolitanos de Lisboa	Public Transport Authority for the metropolitan area. Manager of suburban bus public service contracts. Management of the multimodal public transport ticketing system.	Congestion and operating uninterrupted transport services with reliable journey times for customers
ANSR	Responsible for road safety	Response to emergencies

Table 13: Overview of stakeholders to consult with in Lisbon

5.2.3.3 Stakeholders to communicate with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
Fertagus	Public transport operator - suburban rail and feeder buses	Congestion and operating uninterrupted transport services with reliable journey times for customers
Transtejo & Soflusa	Public transport operator - Ferries	Congestion and operating uninterrupted transport services with reliable journey times for customers
EMEL	Mobility and Parking Company of Lisbon. Management of on-street and off-street parking, shared bikes and traffic signals in the city of Lisbon	Promotion of resilient networks; insights for traffic planning and management
IP	Management of transport infrastructure, including national roads, rail network and stations.	Promotion of resilient networks; insights for traffic planning and management

Table 14: Overview of stakeholders to communicate with in Lisbon

5.2.4 Objectives

The objectives of Lisbon are as follows:

- Increase sustainable transport

- Reduce congestion
- Reduce pollution
- Better planning of response to events,
- Reduced car mileage while searching for parking areas
- Increase of public transport use

5.2.5 TANGENT solutions and test scenarios[3]

(1) **Enhanced traffic information service for multimodal transport management – Dashboard & API (Testing environment: Real scenario).** In recent years, Lisbon is working in a mobility catalogue to include new service providers and supply real-time information that go beyond General Transit Feed Specification (GTFS) feeds (cycling lanes, parking spaces, public transport locations). Besides, harmonisation of the data sources is a priority for improving mobility information systems for connected vehicles and connected transport users. TANGENT will contribute to achieve these objectives and to improve the cooperation of urban and inter-urban traffic by integrating data sources from multiple stakeholders, processing it and disseminate current and future status of the network, incidents as well as speed, route and Park & Ride recommendations to users through different channels, including C-ITS infrastructure and Variable Messages Panels.

(2) **Real-time Traffic Management Services (Testing environment: real and virtual scenarios in traffic simulator).** The "Smart Network Balance Service" will contribute to a better integration of urban and interurban traffic management in the Metropolitan area of Lisbon by 1) optimising interurban flows in highways by speed and route recommendations through C-ITS for connected vehicles and through VMS for conventional vehicles; 2) directing vehicles to unoccupied off-street and on-street parking places and by adjusting prices to balance demand and promote Park & Ride, and 3) improving the synchronisation of urban public transport with incoming inter-urban traffic flows from highways. Cooperative incident management will be tested on planned and unplanned events. In fact, some of the activities in this area have been accelerated in recent months through the creation of 'pop-up cycle lanes' and reallocation of public space to non-transport activities (e.g. terraces for restaurants or cafes), as part of the response to the COVID-19 pandemic.

(3) **Transport network optimization for Transport Authorities (Testing environment: virtual scenarios in traffic simulator)** Lisbon is continuously innovating in their transport network for a more sustainable city, focused on a citizen-centric approach by promoting public transport and soft modes of transport (cycling, walking…). TANGENT will support their decision making for simulating possible scenarios such as: What if variable parking pricing is implemented to promote Park & Ride in Lisbon? What is the best tolling pricing policy to optimise flows on highways? What if C-ITS Day 1 and Day 1.5 services are implemented on some highways? What if buses and ferries schedules are better synchronised? What if the capacity and

[3] These draft NTM solutions for the case study site and respective test scenarios continue to be discussed and validated with local stakeholders and TANGENT project partners, and thus are subject to further modifications.

frequency of ferries are increased? What if public transport from/to the airport is complemented with on-demand mobility services?

5.2.5.1 Scenarios

- Baseline scenario: Handling conventional and connected vehicles with different penetration of day 1 and Day 1.5 C-ITS Services
- Event Scenario: Web Summit which lasts for approximately 1 week in early November and attracts close to 100.000 people to the eastern part of town.

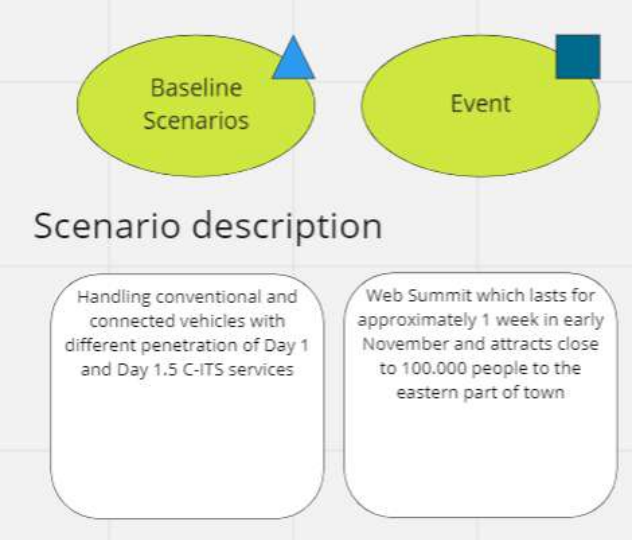


Figure 14: Miro board of Lisbon's Scenarios

5.3 Greater Manchester

5.3.1 Local context

Greater Manchester (GM) is a large polycentric city region of 2.73 million residents across 1,276 square kilometres in the North West of England. GM is the UK's first combined authority (GMCA), representing 10 local authorities and their leaders, working together to address strategic challenges, chaired by a directly elected mayor, Andy Burnham. Over 2.1 billion journeys are generated every year, 268 million of which are made by public transport modes. The high use and dependency on private motorised vehicles for journeys as short as 1km results in congested urban centres and key route networks. This contributes to the deterioration of air quality which in turn costs businesses in GM £1.3 billion.

In addition, TfGM is a transport operator; it owns Greater Manchester's tram system (Metro-link) which entails over 57 miles of track (with new lines being added and further extensions in development) and 92 stops. TfGM also provides Metro Shuttle services (a free bus service operating in 4 districts). TfGM subsidises local rail services and helps funds station improvements across Greater Manchester. For Bus TfGM maintains bus shelters, subsidised fares on certain services and implements the System One travelcards with plans for smart ticketing apps in development. For Highway, TfGM has been responsible for the maintenance of traffic signals, road management and safety since 2009.

5.3.2 Characterisation of the transport network in terms of modes, data sources and governance

Modes	Sources
Buses	TfGM, Bus Open Data Service (tbd), Online Map
Trams	TfGM
Railways	National rail data portal
Car	Google maps access, GMUTC Traffic Signal Database of Manchester, TFGM developer portal, Transport Research Laboratory, Traffic England
Metro	
Bike Share	
Demand Responsive	
Air Quality	Clean Air Greater Manchester
Pedestrian	
Other data	Road safety data gov, CSTV

Table 15: Overview of modes and data sources present in Greater Manchester

5.3.3 Stakeholder mapping

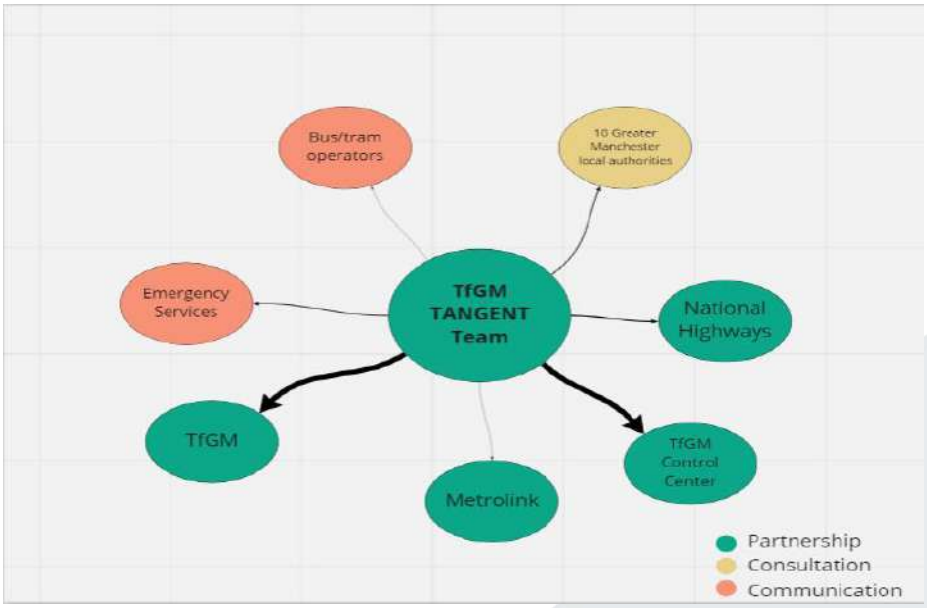


Figure 15: Overview of Greater Manchester's stakeholder mapping (Miro board)

5.3.3.1 Stakeholders to create partnerships with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
Metrolink	TfGM operated tram	Congestion and operating uninterrupted transport services with reliable journey times for customers
National Highways	Manage the motorway network in England	Incidents and disruption on the motorway network impact the Greater Manchester transport network
TfGM Control Centre	Manage the transport network from the central control centre. Communicate with bus, tram, and customers	Managing events/incidents on the transport network. Ensuring assets and traffic management tools are operational and providing customer information

Table 16. Overview of stakeholders to create partnerships within Greater Manchester

5.3.3.2 Stakeholders to consult with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
TFGM	ITS and Urban Traffic Control teams	Efficient transport network for all road users. Reducing congestion, improving air quality, modal shift
10 local authorities	Local government agency providing local services in each of the ten Greater Manchester districts	Efficient transport network for all road users. Reducing congestion, improving air quality, modal shift

Table 17: Overview of stakeholders to consult with in Greater Manchester

5.3.3.3 Stakeholders to communicate with

Stakeholder name	Type of stakeholder	Interest and concerns regarding TANGENT?
Emergency services	Police, Fire, ambulance	Congestion and operating services with reliable journey times. Able to attend incidents in timely manner
Bus operators	Public transport operator. Various operators within Greater Manchester. would prioritise which best	Congestion and operating uninterrupted transport services with reliable journey times for customers

Table 18: Overview of stakeholders to communicate within Greater Manchester

5.3.4 Objectives

The objectives for Greater Manchester include:

- Transport optimization
- Multimodal assistance mobility
- Increase sustainable transport uptake
- Align with Next Generation traffic management system procurement
- Better use of open-source data
- Reduce accidents
- Reducing pollution
- Improve customer experience
- Reducing congestion
- Increase in bus/metrolink patronage
- Improving journey time reliability
- Improving journey times across modes

5.3.5 TANGENT solution and test scenarios[4]

(1) **Enhanced traffic information service for multimodal transport management – Dashboard & API (Testing environment: Real scenario).** TANGENT will provide a general view on all the transport network for all the means of transport to improve transport flows both in rural and urban zones in Greater Manchester. It will map multi-modal traffic flow and assess congestion cause analysis mapping and congestion monitoring to identify 'pinch points' in the network and the cause. For this, it will take advantage of the predictive capabilities delivered by TANGENT. Furthermore, the comprehensive multimodal mobility information, traffic predictions and route recommendations delivered to users and transport operators by this service, will contribute to improve travel choices and assist in providing customer journey information and encourage sustainable modes.

(2) **Real-time Traffic Management Services (Testing environment: real and virtual scenarios in traffic simulator).** Through the "Smart Network Load Balance" service, TANGENT will

[4] These draft NTM solutions for the case study site and respective test scenarios continue to be discussed and validated with local stakeholder and TANGENT project partners, and thus are subject to further modifications.

contribute to optimising transport both in urban areas and rural/semi-rural regions from Greater Manchester by balancing demand and supply across different modes by suggesting different strategies and measures to transport authorities and transport operators (e.g. alternative traffic signal timings variable speed limits, re-routing, pricing, incentives, etc.) with a particular interest on promoting sustainable modes. The Cooperative Incident Management service will be tested for planned events and disaster management.

(3) **Transport network optimization for Transport Authorities (Testing environment: Virtual scenarios in traffic simulator)** Greater Manchester is continuously implementing innovative measures for improving transport network operations and meeting the objectives related to sustainability and decarbonization agenda. TANGENT will support their decision-making for simulating possible scenarios such as: What-If the Demand Responsive Transport is implemented to better connect rural and urban areas? What-If CAVs are available? What-If the usage of automated shuttles is extended to other areas (i.e. business parks, hospitals)? What-If more affordable fares in bus services are established based on demand and offer for vulnerable groups (elderly, disabled people…)? What if on-demand transport is synchronised with public transit modes to improve the connectivity of rural/semi-rural areas with the airport?

Scenario	Description	Example	Key factors to consider
Conventional vehicles & different levels of penetrations of CAVs	Conventional vehicles and different levels of penetration of CAVs; and impacts with Shuttle service (autonomous) operating in dedicated lanes or with the rest of the traffic.		
Large sport events	Large sport event (Football match with 50k-75k attendees) considering conventional vehicles and CAVs	Manchester city Manchester United Concerts at MEN Arena.	• Date/time of event - can clash with busy commuter times. • Location specific at each venue. • Communication prior to event. • Parking availability. • PT provision. • DfT / AVL bus data. • Planned road closures post event. • Traffic signal strategies. • Traffic management e.g., VMS.

Scenario	Description	Example	Key factors to consider
Pandemic outbreak	Pandemic outbreak (e.g. covid-19) restricting mobility of people and causing a huge gap between offer and demand and considering both conventional vehicles and CAVs.		• Maintaining PT services. • Customer info • Managing traffic signal faults. • Rerouting traffic. • W&C provision • Data gathering/reporting • Safety • CCTV for crowded areas
Additional scenarios	What-If the Demand Responsive Transport is implemented to better connect rural and urban areas? What-If CAVs are available? What-If the usage of automated shuttles is extended to other areas (i.e. business parks, hospitals)? - What-If more affordable fares in bus services are established based on demand and offer for vulnerable groups (elderly, disabled people...)? What if on-demand transport is synchronised with public transit modes to improve the connectivity of rural/semi-rural areas with the airport?		• Size and scale of disruption • Expected duration. • Communication and customer info. • Tools to manage the situation. • Rerouting, retiming signals
Disruption on Public Transport Network	Tram line failure. How will this impact the whole highway network? Alternative use of buses and impact on congestion. How do we get information to customers	Disruption on Metrolink(tram), bus or rail and impact on the whole transport network. For example, the closure of Metrolink line.	• Use of tickets across modes. • Increase in traffic due to closure. • Congestion on the highway network. • Customer info. • Smart ticket data availability • Patronage across modes • Journey times across network • Bus priority measures

Scenario	Description	Example	Key factors to consider
Incident/ closure on strategic road	Impact of incident	Closure of lane of a section of the strategic road network on the surrounding Greater Manchester Network	• Volume of traffic diverting. • Freight diversions - emissions/suitable routes. • National Highways data. • Speed of response/communication with National Highways.. • Signal strategies. • Emergency Diversion routes. • Customer info
Severe Weather	Flood/ high winds. Widespread Amber weather warnings for Rain and Wind across GM, flood alerts in force for majority of catchments. Multiple road closures across GM, majority of rail lines in/out of GM closed due to flooding. Do not travel message issued.		• Size and scale of disruption • Expected duration. • Communication and customer info. • Tools to manage the situation. • Rerouting, retiming signals • Modal shift to car due to rail lines closed. • Journey time data. • Road closure data (Waze). • Met Office data. • Flood forecasting centre data. • Safety considerations.
Smaller-scale disruption	More routine disruption on a smaller scale.	For example broken down vehicles blocking a highway lane, unplanned roadworks and demonstrations.	• Size and scale of disruption • Expected duration. • Communication and customer info. • Tools to manage the situation. • Rerouting, retiming signals

Table 19: Overview of test scenarios in Greater Manchester

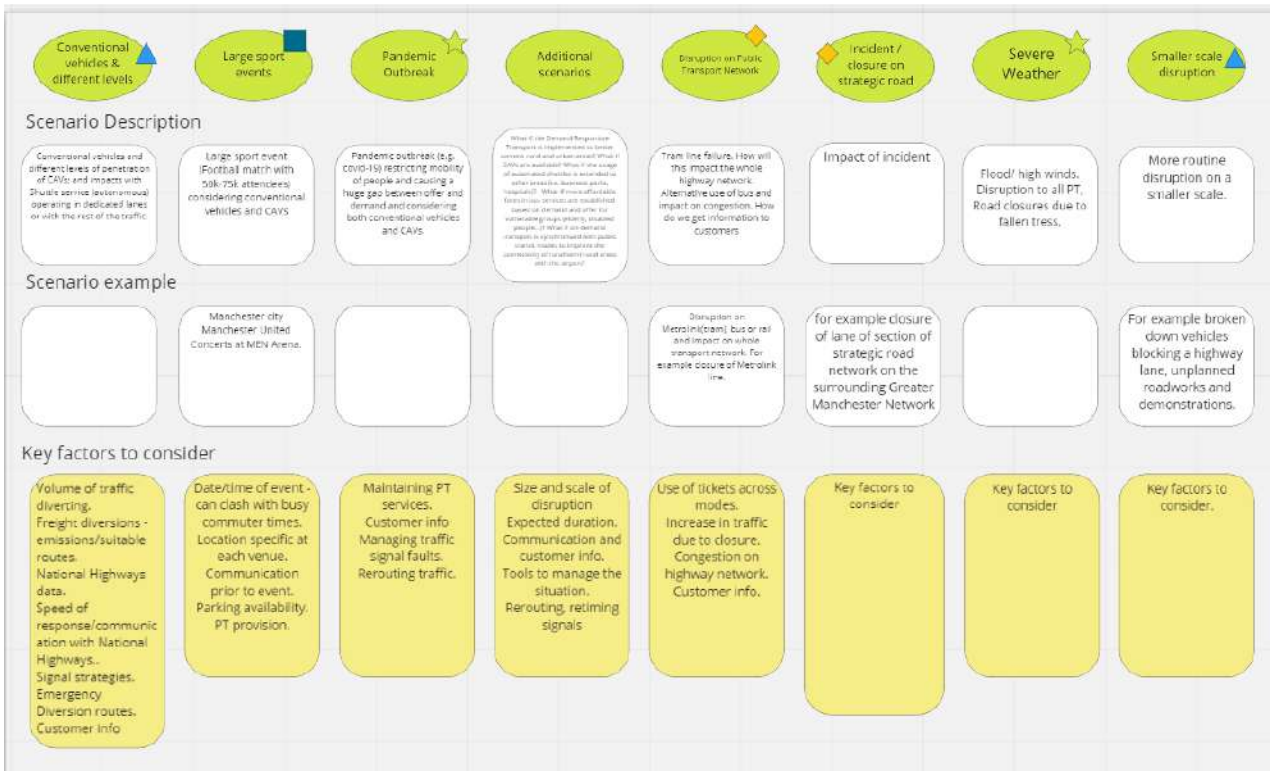


Figure 16: Overview of the Miro board of Greater Manchester's scenarios

5.4 Athens

5.4.1 Local context

Athens, Greece is one of the largest economic hubs in Southern Europe, with more than 3 million residents across ~39 sq.km. Athens faces severe congestion problems due to the rising demand for car trips and the lack of coordination between modes. Recently, the “Grand Walk” project was implemented in order to relieve the city centre from increased levels of car traffic and make room for alternative and more sustainable means of transport. The “Grand Walk” will free up 50,000 sq.m. of space for pedestrians and soft modes, create 2,000 motorcycle parking spots and 12 taxi stands, and facilitate bus services.

The main priorities of the Athens Case Study are to:

1. Improve network connectivity and operation
2. Reduce congestion (by 2030-2050)
3. Reduce pollution levels
4. Improve safety (reduce accidents)
5. Support the effort started by the large urban regeneration project “The Grand Walk” for rendering urban space to pedestrians, soft transport modes and facilitating and promoting Public Transport.

5.4.2 Characterisation of the transport network

The transport network of Athens is characterised by 170 public transport lines, 95 bus lines, 14 trolley lines, 4 metro lines, 2 tram lines, 5 suburban lines, 50 intercity bus lines, 1.030 public transport stations, as well as cars, motorcycles, and freight vehicles.

Athens being a virtual Case Study, NTUA has currently access to all the data needed for the implementation of the virtual Case Study. This data includes traffic data from cameras and loop detectors for calibration. In the simulation environment, the inner-ring urban transportation network of Athens, Greece is used. The network consists of 1293 nodes/intersections and 2572 edges/links. Concerning the demand of the network, approximately 83000 vehicles are inserted in the network, which corresponds to the demand of the morning peak hour.

5.4.3 Stakeholder involvement

TANGENT's case study in Athens will involve a virtual implementation of Network and Traffic Management solutions, led by NTUA, in a unilateral simulation environment. In this way, no coordination of measures and operations among local stakeholders is required and a different approach is needed for the case study's co-creation process.

Considering the nature of the case study, the cooperative process proposed will rather focus on ensuring an effective communication across project partners and work packages, to exploit the advantages and learn from the results of Athens' case study. A virtual case study allows for more flexibility and agility in the definition of network optimisation and traffic management measures and will allow TANGENT to evaluate and demonstrate the benefits of the tested solutions, without the potential constraints and conflict resolution of multi-actor cooperation. This testbed for TANGENT's NTM solutions will also serve as a guide for other case studies, with a practical showcase of the implemented solutions and its expected impacts.

To achieve these goals, a structured and well-coordinated communication within project activities, involving technical partners and other case study leaders, is required for the analysis of Athens' case study. A series of online workshops and regular conference calls will be coordinated by WP1 to guide discussions and follow up on the progress of the case study.

Although NTUA counts with a wide spectrum of mobility data and tools for the case study's implementation, local stakeholders will be contacted during the preparatory phase, to explore additional data sources.

5.4.4 Objectives

The objectives of the Athens Case Study are as follows:

- Multimodal transport handling
- Real-time Traffic Management Services (testing environment: a virtual scenario in traffic simulator)
- Reducing Congestion
- Transport network optimization for Transport Authorities
- Reducing Pollution

- Handling different critical situations (both planned and unplanned)
- Changes in travel behaviour

5.4.5 TANGENT solutions and test scenarios[5]

(1) **Enhanced traffic information service for multimodal transport management – Dashboard & API.** The significant changes to Athens' road infrastructure due to the interventions of the "Grand Walk" form a new traffic "reality" for the citizens, with a strong multimodal character, which in turn requires more advanced management strategies for the demand to be served efficiently. TANGENT will provide strategies to improve network connectivity and operation through a better information system that connects all modes with a special focus on the synchronisation of traffic and public transport.

(2) **Real-time Traffic Management Services (Testing environment: a virtual scenario in traffic simulator)** TANGENT will aim to significantly reduce congestion levels through the balance of the demand and supply in real-time scenarios. The effectiveness of TANGENT strategies will be tested for various future mobility scenarios, including on-demand services, ride-sharing services, and C-ITS applications. In addition, the effectiveness of the Cooperative Incident Management system developed within the framework of TANGENT will be tested in the case of occurring accidents, critical load events, and unplanned disruptive conditions.

(3) **Transport network optimization for Transport Authorities (Testing environment: a virtual scenario in traffic simulator)** TANGENT will support authorities in the identification and implementation of strategies to optimise the transport services and traffic throughout the city's network. This will include innovative solutions, such as on-demand and ride-sharing services, exploiting cooperative strategies to enable synchronisation with public transport to minimise total travel time and provide optimal alternatives to end-users. Also, different dynamic pricing schemes (or combinations) will be tested to optimise network-wide flow across multiple modes, and transit assignment and signalisation will be dynamically optimised, to maximise the system's socioeconomic benefits.

The Athens' Road Network serves as a testbed for the TANGENT project where different NTM solutions developed within the framework of the project can be implemented and evaluated. An overview of the scenarios that can potentially be implemented in the Athens Case Study are presented in the table below.

Scenario	Description	Example	Key factors to consider
Future baseline scenarios	Testing smart optimisation strategies and innovative mobility solutions, incl. on-demand and ride-sharing services, dynamic pricing	First /last mile on-demand service for the connection with Public Transport Dynamic pricing schemes	• Future Demand prediction • Short-term predictions

[5] These draft NTM solutions for the case study site and respective test scenarios continue to be discussed and validated with local stakeholders and TANGENT project partners, and thus are subject to further modifications.

Scenario	Description	Example	Key factors to consider
	schemes, and dynamic synchronisation of transit services and traffic conditions exploiting C-ITS functionalities of connected and cooperative mobility (e.g., CCAM).	Synchronisation of Public Transport and traffic	• Travel behaviour shifts • User acceptance • Automation
Planned events	Roadworks, large public events, etc.	On-demand fleet re-allocation due to the occurrence of a specific event	• On-demand service specifications • Demand prediction • Specific event's information
Unplanned events	System malfunctions or adverse weather conditions	1. Synchronisation of Public Transport and traffic with priorities based on demand	• Changes in mobility patterns • Weather conditions

Table 20: Overview of Athens Scenarios

6 Workshops planning

6.1 Time frame of the workshops

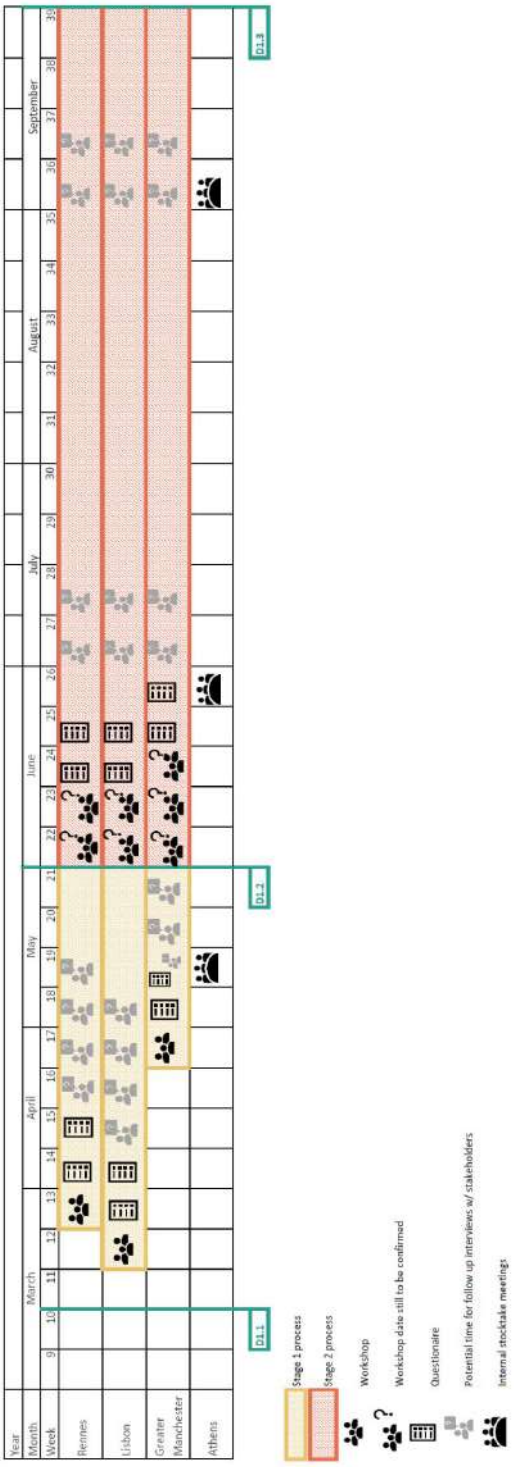


Figure 17: Workshops time frame overview for stage 1 and stage 3

Stage 3 workshops will take place in the third year of the project. Therefore we will plan the workshops accordingly in due time and depending on the implementation plan developed by the Case Studies.

7 Conclusions

This document aimed at defining the co-creation process within the TANGENT project which will guide the effective engagement of local stakeholders and ensure coordination of inputs across the project. Such active collaboration among local actors will enable TANGENT to tailor it's outputs to the specific challenges and conditions of each Case Study and find practical solutions for effective multi-actor cooperation.

First, this deliverable defined the aim of using a co-creation process in the TANGENT project. Chapter 2 identified key references, concepts and methodologies to guide co-creation processes with multiple stakeholders towards innovative Network and Traffic Management (NTM) solutions. Chapter 3 described clear strategies for the co-creation activities under the different stages of the process. Chapter 4 provided a first description of each Case Studies, identifying the actors involved, objectives and scenarios, and other relevant factors to be considered. Finally, Chapter 4 defined a concrete timeline for the co-creation process.

8 References

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