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**Deliverable D32 Core indicators for the interconnection  
between short and long-distance transport networks ;  
projet 7FP CLOSER (Connecting LOng and  
Short-distance networks for Efficient Transport);  
September 2011**

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Connecting LOnG and Short-distance networks for Efficient  
tRansport

## **Deliverable D3.2**

### **Core indicators for the interconnection between short and long-distance transport networks**

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## Index

### LIST OF TABLES

### LIST OF FIGURES

### LIST OF ABBREVIATIONS

### ABSTRACT

<b>1</b>	<b>INTRODUCTION AND BACKGROUND.....</b>	<b>8</b>
1.1	BACKGROUND AND AIM OF DOCUMENT .....	8
1.2	POLICY CONTEXT .....	9
1.3	CONTRIBUTIONS.....	10
1.4	DOCUMENT ORGANISATION .....	11
<b>2</b>	<b>TYOLOGIES FOR INTERFACES BETWEEN LONG AND SHORT- DISTANCE TRANSPORT NETWORKS .....</b>	<b>12</b>
2.1	DEFINITIONS AND INPUTS FROM CLOSER DELIVERABLE 3.1 .....	12
2.2	INPUTS FROM CLOSER WORKSHOP IN LILLE .....	13
2.3	TYOLOGIES AND TYPES .....	14
2.4	TYOLOGIES IN CLOSER .....	17
2.4.1	<i>Freight transport</i> .....	17
2.4.2	<i>Passenger transport</i> .....	19
<b>3</b>	<b>INDICATOR ANALYSIS .....</b>	<b>21</b>
3.1	USE OF INDICATORS IN TRANSPORT .....	21
3.2	PURPOSE OF INDICATORS AND SELECTION CRITERIA.....	21
3.2.1	<i>Purpose and role of indicators</i> .....	21
3.2.2	<i>Indicator selection criteria</i> .....	22
3.3	SUMMARY OF PREVIOUS INDICATOR REVIEW.....	23
3.4	SELECTION PROCESS .....	24
3.5	INDICATOR TESTING FOR CANDIDATE TERMINALS .....	25
3.5.1	<i>Freight transport indicators</i> .....	27
3.5.2	<i>Airport indicators</i> .....	31
3.5.3	<i>Other passenger transport interface indicators</i> .....	36
3.6	INPUTS FROM MEMBERS OF THE CLOSER POLICY ADVISORY GROUP .....	40
3.7	INTERCONNECT INDICATORS .....	42
3.8	GAPS IN THE DATA COLLECTION AND THE ANALYSIS OF THE MATERIAL .....	43
<b>4</b>	<b>CORE INDICATORS FOR LONG/SHORT-DISTANCE INTERFACES.....</b>	<b>44</b>
4.1	POLICY INDICATORS .....	47
4.2	ORGANISATIONAL AND INSTITUTIONAL STRUCTURE .....	48
4.3	SUPPLY-SIDE PERFORMANCE .....	48
4.4	TERMINAL PROPERTIES .....	48



4.5	LEVEL OF SERVICE .....	49
4.6	RELATION TO EC POLICY GOALS .....	51
<b>5</b>	<b>CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>55</b>
	<b>REFERENCES .....</b>	<b>57</b>
	<b>APPENDIX A. TEMPLATES FOR INDICATOR TESTING FOR CANDIDATE TERMINALS.....</b>	<b>59</b>
	FREIGHT TRANSPORT .....	59
	AIRPORTS .....	60
	OTHER PASSENGER TRANSPORT TERMINALS .....	61

## LIST OF TABLES

Table 1. Freight platform types and characteristics.....	14
Table 2. Categories of UK railway stations. Source: Wikipedia. ....	16
Table 3. Freight transport typology. ....	17
Table 4. Passenger transport typology. ....	19
Table 5. Candidate terminals used for indicator testing. ....	26
Table 6. Freight transport indicators tested for candidate terminals. ....	27
Table 7. Airport indicators tested for candidate terminals. ....	31
Table 8. Indicators tested for other passenger transport candidate terminals. ....	36
Table 9. Indicators that have been highlighted by Policy Advisory Group members....	41
Table 10. Suggested core indicators for long/short-distance interfaces. ....	45
Table 11. Coverage of EC transport policy goals by core indicators. ....	51

## LIST OF FIGURES

Figure 1. Indicator selection process. ....	25
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## LIST OF ABBREVIATIONS

DoW	Description of Work
EC	European Commission
EU	European Union
FP	Framework Programme
FP7	Seventh Framework Programme
IST	Information Society Technology
NGO	Non-Governmental Organisation
PAG	Policy Advisory Group
RTD	Research and Technological Development
SME	Small and Medium Enterprise
WP	Work Package
PO	Project Officer

## Abstract

The CLOSER project has been set to analyse the interfaces and interconnections between long distance transport networks and local/regional transport networks of all modes. The project is funded within the Seventh Framework Programme of the European Commission, under the topic TPT-2008.0.0.13 “New mobility/organisational schemes: interconnection between short and long-distance transport networks”.

The goal of WP3 of CLOSER is to establish a set of core indicators that reflect the most crucial issues connected to interfaces between short and long-distance transport networks, both for passenger and freight transport. This includes the creation of a structured representation of these interfaces, determination of core indicators, and the assessment of usability of the core indicators. CLOSER WP3 has produced two deliverables, of which the current document is the second. The first deliverable “Interconnections between short and long-distance transport networks: Structure of interface and existing indicators” (Andersen et al., 2010) contained a review of existing indicators related to interfaces between long and short-distance freight and passenger transport.

The aim of this document is to structure the interconnections between short and long-distance transport networks. This in particular includes:

- Establishment of selection criteria to choose core indicators
- Selection and validation of core indicators and new indicators
- Set of typologies of interfaces

The document also presents the *results of the WP3 workshop* arranged in Lille on May 24, 2011.

Core indicators are the main outcome of CLOSER WP3. In total 30 indicators are defined, covering issues like policy and environment, organisational and institutional aspects, supply-side performance, terminal properties and level of service.

Core indicators for long/short-distance interfaces should facilitate:

- Description of the functioning of interfaces (good/bad)
- Recommendations for improving the interfaces
- Global assessment: prioritisation of actions (what is important to work on)
- Benchmarking of interconnections

Indicators have been selected in a three-level process, including review of indicator selection criteria, test quantification of indicators for a set of specific *candidate* terminals and input from the CLOSER expert panel Policy Advisory Group. In addition, gaps are identified and reduced.

Finally, the ten outlined policy goals of the most recent EC white paper on transport (Commission of the European Communities, 2011) are presented in light of the suggested core indicators for interfaces between long-distance and short-distance transport.



# 1 Introduction and background

## 1.1 Background and aim of document

The CLOSER project has been set to analyse the interfaces and interconnections between long distance transport networks and local/regional transport networks of all modes. The project has been funded within the Seventh Framework Programme of the European Commission, under the topic TPT-2008.0.0.13 “New mobility/organisational schemes: interconnection between short and long-distance transport networks”.

The purpose of CLOSER is to build upon existing research and practice, developing innovative tools for the analysis of interfaces between long and short-distance transport networks, check these tools in a number of case studies, and make specific recommendations to stakeholders in order to get:

- A more systematic approach to the concept of interfaces between long and short-distance transport (from planning to design and operation).
- Specific guidelines for decision makers in order to cope with the challenges of a particular project, and to get the most out of the opportunities that each project offer in the areas of transport, spatial, and economic development.
- A friendlier regulatory environment; fostering cooperation and supporting better integrated interfaces.
- Improved mechanisms for funding those concepts with a higher degree of integration (including EU funding schemes).
- In-depth involvement of stakeholders, particularly transport operators.

The CLOSER project covers both passenger and freight transport, and lasts from 2010 to 2012.

The goal of WP3 of CLOSER is to establish a set of core indicators that reflect the most crucial issues connected to interfaces between short and long-distance transport networks, both for passenger and freight transport. This includes the creation of a structured representation of these interfaces, determination of core indicators, and the assessment of usability of the core indicators. CLOSER WP3 has produced two deliverables, of which the current document is the second. The first deliverable *Interconnections between short and long-distance transport networks: Structure of interface and existing indicators* (Andersen et al., 2010) contained a review of existing indicators related to interfaces between long and short-distance freight and passenger transport.

The aim of this document is to analyse interconnections between short and long-distance transport networks and contribute to structuring such interconnections. This in particular includes:

- Establishment of selection criteria to choose core indicators.
- Selection and validation of core indicators and new indicators.

- Set of typologies of interfaces

The deliverable also presents *results of the WP3 workshop* arranged in Lille on May 24, 2011.

## 1.2 Policy context

CLOSER Deliverable 3.1 (Andersen et al., 2010) reviewed EC policy documents related to interfaces between short and long-distance transport networks. These documents were:

- The Transport White Paper European transport policy for 2010: time to decide (European Commission, 2001), which set out an ambitious action programme comprising 60 or so objectives for the transport policy until 2010.
- The mid-term review (European Commission, 2006) of the Transport White paper, which confirmed that the objective of the European transport policy is to ensure sustainable mobility in Europe. It was stated that all modes must become more environmentally friendly, safe and energy efficient. Co-modality, i.e. the efficient use of different modes on their own and in combination, will result in an optimal and sustainable utilisation of resources.
- The “Freight Transport Logistics Action Plan” (Commission of The European Communities, 2007 (COM(2007) 607 final).
- The Green Paper Towards a new culture for urban mobility (European Commission, 2007), which highlighted the importance of the urban dimension of freight transport, and the need for efficient interfaces between long and short-distance freight transport.
- The Action Plan on Urban Mobility (Commission of The European Communities, 2009 (COM(2009) 490 final).

Since then, The European Commission has launched a new white paper on transport *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* (Commission of the European Communities, 2011). The new white paper set out ten ambitious goals for a competitive and resource-efficient transport system, grouped into three categories<sup>1</sup>:

### **Developing and deploying new and sustainable fuels and propulsion systems**

1. Halve the use of ‘conventionally fuelled’ cars in urban transport by 2030 and phase them out in cities by 2050 to achieve essentially CO<sub>2</sub>-free city logistics in major urban centres by 2030

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<sup>1</sup> The text is extracted from an illustrated brochure that comprises the text of (Commission of the European Communities, 2011)

2. Low-carbon sustainable fuels in aviation to reach 40 % by 2050 and reduce EU CO<sub>2</sub> emissions from maritime bunker fuels by 40 % (if feasible 50 %).

**Optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes**

3. Thirty per cent of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030 and more than 50 % by 2050.

4. A complete European high-speed rail network by 2050, tripling the length of the existing high-speed rail network by 2030.

5. A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services.

6. Connect all core network airports to the rail network by 2050, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.

**Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives**

7. Deployment of the modernised air traffic management infrastructure in Europe by 2020 and completion of the European common aviation area. Deployment of equivalent land and waterborne transport management systems and deployment of the European global navigation satellite system (Galileo).

8. Establish the framework for a European multimodal transport information, management and payment system by 2020.

9. Move close to zero fatalities in road transport by 2050. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.

10. Move towards full application of 'user pays' and 'polluter pays' principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.

Among the ten goals, there are several points related to the long/short-distance interfaces that are addressed in this deliverable. Indicators for long/short-distance interfaces are related to the EC transport policy goals in Section 4.6.

## 1.3 Contributions

In addition to the authors of this document, the following people from the CLOSER members have contributed with input material for the deliverable:

- Ingrid Nagel, FhG-IVI:
- Alain l'Hostis and Corinne Blanquart, IFSTTAR
- Jon Martin Denstadli, TOI
- Jenni Eckhardt and Tuuli Järvi, VTT
- Zuzana Svedova, CDV
- Giannis Adamos and Konstantinos Papoutsis, CERTH/HIT
- Andrius Jarzemskis, VGTU-TMI

## 1.4 Document organisation

The rest of this document is organised as follows: In Chapter 2 definitions are provided and typologies for interfaces between long and short-distance freight and passenger transport are defined. Chapter 3 elaborates on the use of indicators in transport, and analyses potential core indicators for interfaces between long and short-distance freight and passenger transport. The proposed core indicators are presented and discussed in Chapter 4, whereas recommendations and concluding remarks are given in Chapter 5.

## 2 Typologies for interfaces between long and short-distance transport networks

### 2.1 Definitions and inputs from CLOSER Deliverable 3.1

The CLOSER project considers *interfaces* and *interconnections* between long distance transport and local/regional transport. Interfaces and interconnections are considered to represent the same topic, which is the transfer of goods and people between long and short-distance transport, or in other words where long and short-distance transport interact. All aspects of such transfers are considered, including institutional, legal, design, planning, technical, and deployment aspects.

The distinction between short- and long-distance transport is often based on distance band considerations. For instance, long-distance transport is sometimes defined as trips or transport longer than 100 km. CLOSER Deliverable 3.1 (Andersen et al., 2010) proposed a different definition for the CLOSER project, based on the different spatial scales:

- Urban level
- Regional level
- National level
- International level

Interfaces between long and short-distance transport can be defined as interfaces between transport legs of different spatial scale. These interfaces are referred to as *long/short-distance interfaces*. This definition emphasises the role that the legs of a transport chain play more than their actual distance, a *transport leg* is a part of a passenger's door-to-door trip (passenger transport) or part of a shipment's door-to-door transport (freight transport).

There will be challenges classifying marginal cases, but this definition has the advantage of including long/short-distance interfaces that may be difficult to capture with definitions based on given distance bands. A transport leg of 200 km may serve as a long-distance mode in one setting and as a short-distance mode in a different setting.

CLOSER Deliverable 3.1 defined a set of interface characteristics as part of the work of structuring long/short-distance interfaces. The interface characteristics were divided into five groups:

1. **Policy objectives and measures** that affect the transport system, including objectives connected to modal split, environmental effects, efficiency and safety, as well as measures that initially can be divided into broad categories such as economic/financial, legal and physical/infrastructure

2. **Organisational and institutional structure** refers to the role of and relations between organisations (stakeholders), e.g. ownership, responsibility for infrastructure and operation, and the institutions that affect these organisations, such as regulations and financial structure. These issues apply throughout the transport chain, concerning all stages: access/egress, long-distance and interfaces/terminals.
3. **Supply side performance** is connected to energy use, investments, performance and efficiency in the utilisation of resources, financial performance, social standards and actual transport volumes/flows achieved. Also these issues may be relevant throughout the transport chain.
4. **Terminal properties** are aspects of the specific terminal or long/short-distance interface, capturing design, location and accessibility, scope of services offered, signage, space and capacity offered, as well as the technology and equipment possessed.
5. **Level of service** represents the quality and cost that is delivered to the customers, including classical concepts as relations with customers, comfort, cost, flexibility, frequency of services, information delivered, shipment losses and damages, reliability of service, safety and security issues, integration of services, integration of fares/tickets, as well as time use and efficiency in the operations. Level of service may be considered at different assessment levels and on different legs within a transport chain.

As far as possible, characteristics are common for passenger and freight transport, but additional categories only applicable to one of them are introduced when needed.

## 2.2 Inputs from CLOSER Workshop in Lille

A CLOSER WP3 Workshop took place in Lille, France on May 24, 2011. The workshop was set to discuss indicators and structuring of interfaces. The workshop contained plenary sessions with presentations from the CLOSER consortium and from invited stakeholders. In addition, there were divided sessions (passenger and freight transport), where the following issues were discussed:

- Selection criteria for indicators
- Specific indicators
- Typologies for interfaces

Specific inputs from these sessions are discussed in the relevant parts of this deliverable.

In the passenger transport context, Goudeau (2011) labelled four dimensions of interfaces between transport systems meeting in stations:

- Physical interface
- Information interface
- Fare interface
- Institutional interface

Compared to the interface characteristics listed in Section 2.1, physical interface is very closely related to the terminal properties. The institutional dimension of the interface is closely related to Organisational and institutional structure in Figure 1. Information interface and fare interface are closest related to the information and ticket integration parts of Level of service in Section 2.1.

### 2.3 Typologies and types

A typology is a taxonomic classification of a phenomenon, where a set of important characteristics (the types) are used to create a structured representation. A wide variety of typologies exist for freight terminals and public transport stations, some of them are presented in this section. Many more exist in the literature, but the point is to show that different typologies arise based on different emphasis and purpose of making the classification.

CLOSER Deliverable 3.1 (Andersen et al., 2010) introduced a set of dimensions that could be interesting for structuring of long/short-distance interfaces:

- Terminal type (modal combinations)
- The main spatial scale (International / National / Regional / Local) of the long-distance mode, which to some degree is related to the terminal type
- Ownership and independence of terminal
- Terminal operating entity (public body or entity, a private company, or some sort of public-private partnership)
- Level of integration (integration of services and ticket/fare integration)

IMONODE (2005) presented a typology of freight platform types and their characteristics, taken from the Final Report of REFORM project. This typology is quoted in Table 1.

Table 1. Freight platform types and characteristics.

<b>Category</b>	<b>City Terminal</b>	<b>Freight village</b>	<b>Industrial and logistic park</b>	<b>Special logistic area</b>
Transport modes	Road-road Road-rail	Road-rail (barge)	Road-road Road-rail	Road-sea/air Road-rail- sea/air

<b>Category</b>	<b>City Terminal</b>	<b>Freight village</b>	<b>Industrial and logistic park</b>	<b>Special logistic area</b>
Main aims	Traffic reduction in the city	Modal shift and urban traffic reduction	Regional economic growth and modal shift	Regional economic growth
Operator	Huge forwarder or retailer	Operating company (public influence)	No operator	Airport or harbour authorities
Company structure	Huge forwarder or retailer	Small companies, also large transport companies	Large industrial companies and transport companies	Large companies
Land use	Small areas in the city	Large areas in the outskirts	Large areas in the outskirts or at old industrial areas	Extension to existing sites in the city or in the outskirts
Land price	Very high price	Relatively low	Relatively low	High
Quality of infrastructure	Good access to the city	Direct links to main infrastructure and access to the city	Direct connections to main infrastructure	Very good access to the international infrastructure
Orientation	City	Regional / interregional	Regional / interregional	International / intercontinental

Source: The Final Report of REFORM project

The freight platform types quoted in Table 1 were discussed in the CLOSER WP3 Workshop (see Section 2.2). It was agreed that the REFORM typology contained many good ideas and appears useful in several contexts. In the workshop it was agreed that it would be useful to extend the typology with one more category by splitting the city terminal category into city terminal and rural terminal, capturing that there may also be smaller terminals serving smaller communities and regions outside urban areas.

Eckhardt and Rantala (2011) proposed a classification of logistics centres into six categories:

- Logistics zone, which is a zone formed by logistics concentration, areas and centres, located along the main transport infrastructure
- Logistics concentration, which is a spontaneously formed compact group of logistics centres and areas with several management organizations, operators and industries.
- Logistics area, which is an organised area for logistics operations, freight village or business park. Such areas may include several logistics centres,



warehouses and terminals with logistics services, and there are several actors involved.

- Logistics service centre; these are open logistics centres with one specific management, but possibly several actors.
- Logistics centre; this is a closed logistics centre with operations for specific trade or industrial companies' needs.
- Warehouse, Terminal; these are private warehouses and terminals, surface area under 10,000 m<sup>2</sup>.

In Denver, US, a transit oriented development plan (Denver, 2006) included a typology of station areas based on the following types:

- Land Use Mix
- Desired Housing Types
- Commercial/Employment Types
- Proposed Scale
- Transit System Function

They end up with the following categories in the typology:

- Downtown
- Major Urban Centre
- Urban Centre
- Urban Neighbourhood
- Commuter Town Centre
- Main Street
- Campus/ Special Events Station

Simpler typologies exist, for instance, based on size and the role of a terminal in the transport system . For example, railway stations in the UK are categorised into six categories as shown in Table 2.

**Table 2. Categories of UK railway stations. Source: Wikipedia.**

Category	Number (2009)	Description	Trips per annum
A	25	National hub	over 2 million
B	66	Regional interchange	over 2 million
C	275	Important feeder	0.5–2 million
D	302	Medium staffed	0.25–0.5 million

Category	Number (2009)	Description	Trips per annum
E	675	Small staffed	under 0.25 million
F	1,192	Small unstaffed	under 0.25 million

## 2.4 Typologies in CLOSER

A range of different typologies for terminals and other entities and aspects of the freight and passenger sectors exist. Some of these have been presented in the previous section. The typologies presented above show that there are many ways to establish typologies. What is important for CLOSER is to capture aspects of long/short-distance interfaces, and differences between such interfaces.

In this section typologies that are relevant for long/short-distance interfaces are proposed, one for freight transport and one for passenger transport. Due to the differences in organisation of passenger and freight transport, somewhat different typologies are proposed. The proposed typology for freight transport is presented in Section 2.4.1, while typology for passenger transport is presented in Section 2.4.2.

The purpose of introducing these typologies is to facilitate future comparison and analysis of long/short-distance interfaces. They are a supplement to the structure of interfaces (Section 2.1). Indicators are organised along the structure of Section 2.1, but the typologies can be used for further explanation of results or for grouping of long/short-distance interfaces for benchmarking purposes.

### 2.4.1 Freight transport

For freight transport, we propose a simpler (fewer characteristics) version of the REFORM typology, the typology is presented in Table 3. The reason for this selection is that the REFORM typology thematically is very relevant for the long/short-distance interfaces.

**Table 3. Freight transport typology.**

Characteristics	Special logistic area	Industrial and logistic park	Freight village	City terminal	Rural terminal
Transport modes	Road-sea/air Road-rail-sea/air	Road-road Road-rail	Road-rail (barge)	Road-road Road-rail	Road-road (Road-rail)
Main aims	Regional economic	Regional economic	Modal shift and urban	Traffic reduction in	Regional economic

Characteristics	Special logistic area	Industrial and logistic park	Freight village	City terminal	Rural terminal
	growth	growth and modal shift	traffic reduction	the city	growth
Operator	Airport or port authorities	No operator	Operating company (public influence)	Huge forwarder or retailer	Huge or small forwarder or retailer
Company structure	Large companies	Large industrial companies and transport companies	Small companies, also large transport companies	Huge forwarder or retailer	Huge or small forwarder or retailer
Land use	Extension to existing sites in the city or in the outskirts	Large areas in the outskirts or at old industrial areas	Large areas in the outskirts	Small areas in the city	Small areas
Orientation	National/ international	Regional / national	Regional / national	City	Small city/region

*Special logistic areas* are ports or airports with a national or international orientation, operated by airport or maritime port authorities.

*Industrial and logistical parks* are large areas with large industrial and transport companies and a regional or national orientation, typically located in the outskirts of cities or in old industrial areas; there is not necessarily a specific “terminal operator”.

*Freight villages* are usually established with larger public influence or assistance, and there is often public influence on the operational side. These are often located in outskirts of cities, and like industrial and logistical parks, the orientation is regional or national.

*City terminals* are typically operated by forwarders and retailers, located in or in close vicinities to the cities. There are numerous such terminals, often operated by competing companies.

*Rural terminals* play a similar role as city terminals, but are sometimes controlled by smaller local companies.

## 2.4.2 Passenger transport

In passenger transport, a typology which focuses on spatial range and orientation of long/short-distance interfaces is proposed. The proposed typology is presented in Table 4.

**Table 4. Passenger transport typology.**

Characteristics	National hub: Airports and passenger/ferry ports	National city terminal	Other city or local terminals
<b>Long-distance modes</b>	Air, high-speed rail, conventional rail, interurban bus, ferry	High-speed rail, conventional rail, interurban bus	Conventional rail, interurban bus, ferry
<b>Main authority levels</b>	National/regional	National/regional/local	Local/regional
<b>Orientation</b>	National/international	Regional/local/city	City
<b>Type (level) of interconnection</b>	International/national <-> Local/regional/national	National/regional <-> Regional/local	Regional <-> local
<b>Ownership</b>	National authorities or their representatives, varying private influence	National/regional/local authorities or their representatives, sometimes private influence	Usually local/regional authorities but also national, not much private influence

A *national hub* may be an airport, a rail station (high-speed/conventional), a bus station or a ferry terminal which connects with other terminals at national/international level. They are often located outside the core centre of a city and the connection is not directly to the local city network, but rather in terms of airport express trains and/or buses. National authorities have in some sense interest in and influence on the terminal, and it is affected by national policies. Depending on the circumstances, private actors may be involved in the terminal, but usually governmental companies or administrative bodies own and or/operate national hubs.



A *national city terminal* may have more or less the same long-distance modes as a national hub, but it is located closer to a city centre and with more direct access to local city network of public transport. Its orientation is mainly at regional and national (interregional level), but international connections may also be offered. National authorities often have a role connected to the terminal organisation and investments, but the regional influence is stronger than for national hubs.

*Other city or local terminals* are oriented towards a city or local community/smaller region. Local or regional authorities are usually involved in the organisation of the terminal, but also national authorities can be involved.

## 3 Indicator analysis

### 3.1 Use of indicators in transport

An *indicator* can be defined as “a parameter, or a value derived from parameters, which points to, provides information about, describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value” (OECD, 2003). Alternatively, an indicator can be defined as “the measurement of an objective to be met, a resource mobilised, an effect obtained, a gauge of quality or a context variable. An indicator produces quantified information with the view of helping actors concerned with public [and private] interventions to communicate, negotiate or make decisions” (Macário, 2005).

Indicators may be qualitative or quantitative, and they may be defined at aggregated or detailed level. For policy analysis it might be appropriate to use relative indicators for benchmarking and evaluation. It may for instance be more relevant to compare vehicle kilometres per capita in different countries than just the total number of vehicle kilometres.

There is extensive literature on the use of indicators in transport. COST action 356 (Joumard and Gudmundsson, 2010) reviewed indicators for environmental sustainability in transport, while the European Environment Agency produce annual reports with indicators for transport and environment in the European Union (EEA, 2010). Among EC-financed projects, projects discussing and developing indicators include PROMIT (2007) for benchmarking of intermodal freight transport, BESTUFS (2006) for urban freight transport, TOOLQIT (2007) for level of service and quality in passenger and freight transport, and REFIT (2007) for transport sustainability.

In many cases the terms performance indicators and Key Performance Indicators (KPIs) are used. We interpret these terms as “indicators” and “core indicators”, respectively.

### 3.2 Purpose of indicators and selection criteria

#### 3.2.1 Purpose and role of indicators

The purpose of developing indicators in CLOSER is to facilitate characterisation of long/short-distance interfaces. In the discussions of the CLOSER WP3 Workshop in Lille in May 2011, the role of the CLOSER indicators was further detailed: Core indicators for long/short-distance interfaces should facilitate:

- Description of the functioning of interfaces (good/bad)
- Recommendations for improving the interfaces

- Global assessment: prioritisation of actions (what is important to work on)
- Benchmarking of long/short-distance interfaces

In the CLOSER description of work, it is stated that the indicator review at least should cover

- Organisational and institutional aspects
- Users' aspects – including level of service (LoS) and quality issues
- Environmental and “Greening of transport” aspects

As part of the indicator review, we have tested different approaches for indicator organisation. As it is necessary to be able to address indicators at different assessment levels, we concluded to group indicators according to the interface structure that was presented in Section 2.1.

### 3.2.2 Indicator selection criteria

Indicators are applied in a wide variety of sectors and settings, and there exist many different opinions on characteristics of good indicators, and consequently a wide variety of indicator selection criteria appear in the literature.

In the TRANSFORUM project (TRANSFORUM, 2006), it was suggested that in a policy context, indicators should:

- Be representative of policy objectives, policy measures and external factors
- Together cover all relevant policy objectives and policy measures
- Be relevant for all stages of a policy process (preparation, assessment, implementation, evaluation)
- Facilitate strategic analysis or evaluation of all components of transport policy?
- Be clear and understandable for policy-makers, interest groups, researchers and other stakeholders
- Be measured in an empirical way (assessable data) and be suitable for forecasting

TOOLQIT (2007) discussed these criteria further, and suggested that the following criteria should be applied for selecting core indicators in the context of level of service and quality in freight and passenger transport. Indicators should:

- *Reflect consistency between different decision levels*
- *Address strategic, tactical and operational decision levels*
- *Secure that all variables are well defined*
- *Reflect any kind of accessible information/data as far as it concerns transport*
- *Take regional differences in account*

- *Not restrict the indicators to be used in transport models*
- *Assess the variables to specific policies*

TOOLQIT (2007) suggested that lack of the existence of data or lack of access to data should not necessarily restrict the selection of core indicators, because the data access may change over time. This issue will however depend on the context, the time-horizon for the use of indicators, and the priorities of those responsible for indicator development.

Indicator selection criteria were discussed in the CLOSER WP3 Workshop that took place in Lille on May 24, 2011. As a basis for the discussion, the following indicator selection criteria were listed: The indicators should:

- *Be possible to measure*
- *Be possible to forecast*
- *Be in a format that allows for benchmarking*
- *Be clear (understandable, one-dimensional)*
- *Be assigned to specific policies*
- *Be easily surveyed*
- *Cover strategic, tactical and operational decisions*

The conclusions from the Workshop discussions were that the most important criteria are that:

1. Indicators should be possible to measure.
2. Indicators should be clear and well defined (but indicators can be complex as long as they are clear and well defined).

It was however also said that all the listed criteria are important.

For some issues, it is crucial to have indicators defined, and in these cases, a more pragmatic approach must be chosen, and that the most appropriate indicators will be included even if there may be a need for case-specific precision and delimitation of the indicators.

### 3.3 Summary of previous indicator review

To assess the current status of relevant indicators, a broad approach was chosen, involving all partners in the project. A range of data bases, research projects, and consultancy reports were screened for indicators. Indicators were registered by use of a web-based data collection database set up by Fraunhofer Institute.

For each indicator, the following information was collected:

- Name of indicator, a brief description and unit of measurement



- Segment: Whether the indicator applies to passenger transport, freight or both
- Assessment level; access/egress, long-distance, terminal or other
- Applicable long-distance and access/egress modes, type of terminal/station, spatial scale
- Type of concept; policy, institutional, legal, users' level.

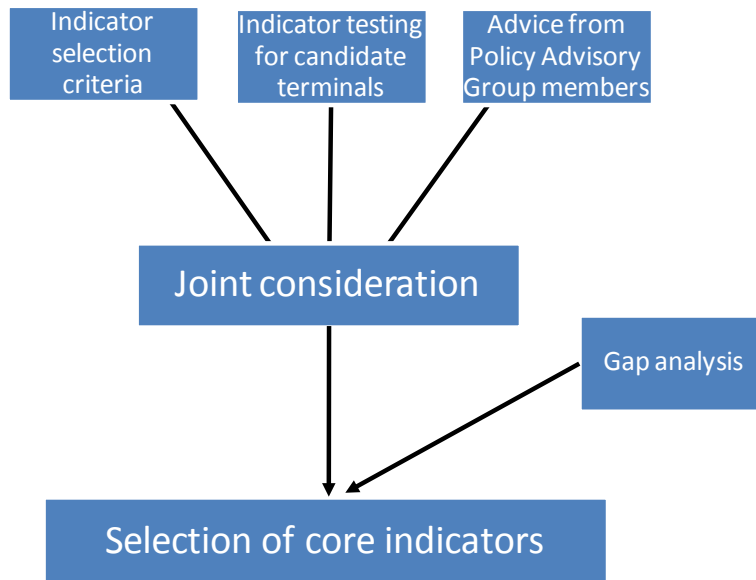
The indicator review was presented in Andersen et al. (2010). More than 250 indicators were collected in the review, covering passenger transport, freight transport, or both passenger and freight transport.

### 3.4 Selection process

From the large quantity of indicators reviewed in CLOSER Deliverable 3.1, a set of core indicator for long/short-distance interfaces has to be made.

The selection process contains several inputs. First of all, selection criteria for indicators are used; these were discussed in Section 3.2.2. Secondly, in a testing phase, a set of indicators have been tested on specific candidate terminals by the CLOSER partners, this approach is described in Section 3.5. Indicators for this part of the analysis were selected from the initial list by use of the criteria listed in Section 3.2.2 combined with a need to cover a wide variety of issues. The purpose of this activity was to learn about the usefulness of each indicator by trying to use them in practice. Thirdly, the members of the Policy Advisory Group, which is the CLOSER expert panel, have indicated their priorities of specific indicators. This activity is discussed in Section 3.7.

The final selection of core indicators is then made by considering the results of the three stages of the indicator selection process, combined with additional inputs where gaps are identified. The indicator selection process is illustrated in Figure 1.



**Figure 1. Indicator selection process.**

### 3.5 Indicator testing for candidate terminals

CLOSER WP3 has utilised a set of *candidate terminals* in order to utilise hands-on information from a set of specific long/short-distance interfaces. Information about the CLOSER candidate terminals can be found in CLOSER Deliverable 3.1 (Andersen et al., 2010).

As part of the indicator testing, indicators were tested for a set of candidate terminals. This analysis was made to have an impression of how different indicators would work in practice if we tried to quantify them for specific long/short-distance interfaces. A set of indicators were selected from the initial list of indicators in CLOSER Deliverable 3.1. The selected indicators represent some of the most interesting ones from the initial list in terms of the selection criteria described in Section 3.2.2, but at the same time with an emphasis on covering a broad set of issues.

The testing of indicators was performed by the CLOSER partners, in many cases supported by interviews with stakeholders in the specific terminals or interconnections. The testing considered both the clearness of the indicators, as well their usability for analysis of short long/short-distance interfaces.

It was decided to use three templates were developed for the indicator quantification; there was one template for freight transport interfaces, a second template<sup>1</sup> for air passenger interfaces, and a third template for passenger transport interfaces that are not airports. This latter distinction was made to allow the study of some airport-specific indicators. The templates are presented in Annex A. Indicators are organised by the

interface characteristics categories that were displayed in Section 2.1. The candidate terminals that were used for indicator testing are shown in Table 5.

**Table 5. Candidate terminals used for indicator testing.**

Name of terminal	Freight	Passenger airport	Other passenger	Country	Terminal type
GVZ Dresden Friedrichstadt		x		Germany	City logistics centre
Flughafen Leipzig	x	x		Germany	Airport
The logistics platform of Zaragoza (PLAZA)		x		Spain	Logistics platform
Oslo Airport Gardermoen		x		Norway	Airport
Alnabru rail terminal	x			Norway	Rail terminal / dry port
PROODOS S.A. Freight terminal	x			Greece	Rail - truck terminal
Thessaloniki Port Authority S.A.	x		x	Greece	Port
Constantza Port	x			Romania	Port
Port Edouard Herriott / Lyon terminal	x			France	Multimodal terminal
Paris Charles de Gaulle airport		x		France	Airport
Armentières railway station			x	France	Rail station
Prague Airport Ruzyne		x		Czech Republic	Airport
Brno bus station			x	Czech Republic	Bus station
Port of Helsinki, Vuosaari Harbour	x			Finland	Port
Port of Kotka, Mussalo Harbour	x			Finland	Port
Port of Klaipeda	x			Lithuania	Port
Vilnius airport		x		Lithuania	Airport

Table 5 shows which templates have been used for each terminal, as well as country information and type of terminal.

Below we summarise the most important inputs that we obtained for each of the tested indicators. The indicator analysis is described in three subsections referring to the three templates that were used.

### 3.5.1 Freight transport indicators

The indicators that were tested for freight transport interfaces are summarised in Table 6.

**Table 6. Freight transport indicators tested for candidate terminals.**

Category	ID	Name of indicator and unit of measurement (if applicable)
Policy	F1	Percentage of intermodal versus unimodal chains door-to-door
Organisational and institutional structure	F2	Number of institutional levels involved in the multimodal supply
	F3	Independence of the node management from transport operators and local actors
	F4	Transport interchange stations investment - Average investments in freight terminal in the period 2005-2010 in €/TEU throughput and year.
	F5	Fair and equal access to terminal/station
Supply side performance	F6	Number of TEU handled per employee
	F7	Ratio between volume and facilities (TEU/crane, etc)
	F8	Ratio between lowest monthly throughput (volume) and highest monthly throughput
Terminal properties	F9	Distance from nearest highway (km)
	F10	Distance from city centre (km)
	F11	Expandability of terminal
	F12	Complementary activities in surrounding area.
Level of service	F13	Handling cost (Euro/TEU)
	F14	Terminal working (opening) hours
	F15	Safety and security of transfer (% of shipments with loss or damage)
	F16	Origin-destination speed based on total door-to-door transshipment time (km/h)
	F17	Average transshipment time in terminal (without planned storage) (hours)
	F18	Non-movement time as share of total origin-destination shipment or travel time (%) - typical route
	F19	Punctuality - % of shipments arriving on time (<30 min delay)

### Policy

Testing of the indicator **Percentage of intermodal versus unimodal chains door-to-door** reveals some difficulties with the indicator. For GVZ Dresden, it was commented

that since there are multiple companies in the terminal, it is difficult to assess the indicator. The indicator is tested at terminal level, but is obviously more appropriate at a more general level like for a region or a country. At this level, it will be very useful if appropriate data are available, and it is therefore a good candidate for being a core indicator. One possible data source is commodity flow surveys that have been conducted in countries like the United States, France Sweden and Norway.

## Organisational and institutional structure

The indicator **Number of institutional levels involved in the multimodal supply** is intended to reflect the complexity of planning and decision process. One good comment that we received for the indicator is that it depends on the transport chains. This highlights the need to specify that the indicator is related to planning and decision processes, not individual shipments. There were also other comments stating that the indicator was not very clearly defined, while in some cases the indicator was quantified without any reported problems.

**Independence of the node management from transport operators and local actors** is related to organisation and indirectly also access conditions. If the answer is “No”, there can potentially be problems with access conditions and efficiency of the transport system. However, it is commented that independence need not imply efficiency. In almost all terminals studied, the indicator is set to “Yes”. One exception is Klaipeda port where the national railway company is strongly involved. It is nevertheless challenging to capture informal dependencies between actors. This has for instance been experienced in the rail freight sector where the EC railway packages formed a legal basis for splitting infrastructure management from operations, facilitating fair and equal competition. Experience has shown that even if the EC directives have been implemented in national legislation, other mechanisms have prevented competition. Ownership of terminals has been particularly important in this context, because in some countries terminals have not been comprised by the independence requirements. The emphasis on this issue in policy contexts makes it an interesting core indicator.

**Transport interchange stations investment - Average investments in freight terminal in the period 2005-2010 in €/TEU throughput and year** was included in order to capture investments, which is one important parameter for the developments of long/short-distance interfaces. The indicator testing revealed problems connected how the terminal should be delimited; another challenge is proprietary information in the case of private terminals. Despite the importance of the investment issue, the lack of possibilities for clear use of the indicator weakens its candidacy as a core indicator.

**Fair and equal access to terminal/station** - Indicates whether all companies have access to a terminal on equal conditions (time, cost, flexibility, etc) independent of ownership. This indicator is related to the independence of the node management

(indicator F3), but is focusing specifically on the access conditions. For Flughafen Leipzig, it was stated that “terminals will always claim to have fair access”. Like for the independence of node management (F3) there may be differences between formal rules and real-life practice. It should nevertheless be possible to work with this indicator, and again the policy importance of this indicator makes it interesting.

## Supply-side performance

Two of the supply-side performance indicators tested are related to the efficiency of the operations. The indicator **Number of TEU handled per employee** links the total throughput to the number of employees. One challenge that was identified in the indicator testing was the delimitation of which employees to consider, this was reported for Alnabru rail freight terminal and the Port of Helsinki, Vuosaari Harbour. This is partly related to the delimitation of a terminal, but also to the role of auxiliary services, etc. For the majority of terminals, this was not considered to be a problem, and it should be possible to make assumptions in specific analyses that should allow the use of the indicator.

**Ratio between volume and facilities (TEU/crane, etc)** relates yearly throughput to the facilities. In one case TEU per berth was quantified. For the Port of Helsinki, Vuosaari Harbour, an alternative for lifting capacity (TEU/hr) of a terminal was suggested. In other cases the indicator was considered clear and representative for productivity considerations. To summarise, the indicator is considered important, but there may be reasons to differentiate the type of facility depending on the specific objects of study.

**Ratio between lowest monthly throughput (volume) and highest monthly throughput** reflects seasonal changes in demand, which may be a critical factor for the profitability of a terminal. In one of the Finnish ports a strike had almost stopped a port for a month, which strongly affected the indicator value. For several terminals, the indicator was rated as not very relevant, and it is therefore not recommended to include it as a core indicator.

## Terminal properties

**Distance from nearest highway (km)** is included to reflect the attractiveness of a terminal area. No particular problems have been reported for the indicator, and it was in general considered relevant.

**Distance from city centre (km)** is an important indicator for the last-mile operations. Large distance between terminals and city centres increases the total number of truck-kilometres for last mile deliveries. The only observed difficulty is that more than one city

may be relevant, but that should not constitute a big problem, and the indicator should be included as core indicator.

**Expandability of terminal** reflects the possibilities for terminal extension in the future. The indicator can also be related to possibility for increasing the efficiency of a terminal. The testing of the indicator reveals that it is not sufficiently clear without further explanation. It could be a yes/no indicator, size of extra area that can be acquired relative to existing area, or a qualitative description, and it is considered so important that it is a potential core indicator.

The indicator **Complementary activities in surrounding area** refers to what additional services apart from freight transfer and storage a terminal area has. The testing of indicators for candidate terminals revealed that a more detailed definition is necessary. One question is how the indicator could be better defined. It could either be an index of quality, or qualitative containing a description of the complementary activities. Delimitation of surrounding area is also an issue, it could be within a given distance (for instance 10 km), or within the same industrial area. The latter alternative may be difficult to define. The relevance of the indicator can also be debated, it depends on the scope of a study and the types of interfaces considered. With this in mind, the problems with definition weaken the candidacy of this indicator.

## Level of service

**Handling cost (Euro/TEU)** is used to reflect the price that customers of the terminal have to pay for the services. With cost it is meant the cost paid by those who use the terminal (price of terminal services). Prices are often negotiable depending on volumes, relations, etc. The definition of “handling” can be different depending on local conditions, loading unit, etc. Therefore, this indicator is challenging to define in an unambiguous way. Nevertheless, this topic is so important that it has to be included in an indicator set.

**Terminal working (opening) hours** specifies the availability of a terminal. For the port of Klaipeda it was commented that extended opening hours may be possible in critical situations. The

**Safety and security of transfer (% of shipments with loss or damage).** In one case it is claimed that the information will be difficult to obtain, in another case that more precision is needed. We suggest including an indicator for Loss and damage (percentage of shipments lost or damaged in terminal).

**Origin-destination speed based on total door-to-door transshipment time (km/h).** One challenge with this indicator is which segments or shipments to consider. One comment that we received was that the value of the indicator depends on the ratio between road transport and other modes of transport. Another comment stated that this

information is very difficult to calculate. On the other hand, the indicator seems more appropriate at a more aggregated level.

**Average transshipment time in terminal (without planned storage) (hours)** is often registered by terminal, but the representativeness of the indicator could be debated.

**Non-movement time as share of total origin-destination shipment or travel time (%) - typical route.** Routes of transport vary a lot and this can affect the result. In fact, the indicator is related to the Origin-destination speed indicator (F16), and has the same challenges as that indicator, but also the non-movement time can give important signals on the efficiency of long/short-distance interfaces. It can be used to compare alternative door-to-door transport solutions (for instance unimodal freight versus multimodal transport).

**Punctuality - % of shipments arriving on time (<30 min delay).** The indicator quantification revealed that the indicator is not equally important for all segments, and that the 30 minutes indicated are way too strict for ships. Another feedback was that punctuality is registered at shipment level, not at terminal level. That points at a need for context-specific definitions depending on the circumstances when the indicator is used.

### 3.5.2 Airport indicators

The indicators that were tested for airports using candidate terminals are presented in Table 7.

**Table 7. Airport indicators tested for candidate terminals.**

	ID	Name of indicator and unit of measurement (if applicable)
Policy	A1	Modal split in access/egress (% of trips)
Organisational and institutional structure	A2	Number of decision levels required for investments in or construction of infrastructure (give number and additional explanation)
	A3	Transport interchange stations investment - Average investments in interchange stations in the period 2005-2010 in €/passenger and year
Supply side performance	A4	Number of passengers/number of TEU handled per employee
	A5	Ratio between volume and facilities (passengers/check-in machine)
	A6	Relative market share in catchment area
	A7	Ratio between access/egress cost by car vs public transport
Terminal properties	A8	Ratio between access/egress time by car vs public transport
	A9	Distance from nearest highway (km)
	A10	Distance from city centre (km)
	A11	Expandability of terminal
	A12	Average (walking) distance from air to rail/bus within terminal (metres)
	A13	Ratio between access/egress transport time and long-distance transport time (Calculate based on most frequent flight route for long-distance and trip from



	ID	Name of indicator and unit of measurement (if applicable)
		city centre for access/egress)
	A14	Ratio between access/egress transport cost and long-distance transport cost (Calculate based on most frequent flight route for long-distance and trip from city centre for access/egress)
Level of service	A15	Minimum required transfer time between flights (minutes)
	A16	Overall quality (with components like physical effort needed, personal comfort, crowded or not, information level,...)
	A17	Price of taxi from city centre to airport (Euro)
	A18	Cost of parking in airport terminal (daily fee, Euro)
	A19	Required check-in time prior to departure - how long before departure is required (minutes)
	A20	Number of destinations served
	A21	Departure frequency of access/egress modes (typical no of departures/hour)
	A22	Ticket integration - are integrated tickets between long-distance and access/egress modes available?
	A23	Quality monitoring program (capturing customer satisfaction)
	A24	Safety and security of transfer
	A25	Quality of information (signing, real-time information)
	A26	Non-movement time as share of total origin-destination shipment or travel time (%) - typical route
	A27	Punctuality - % of departures arriving on time (<10 min delay)

## Policy

The indicator for **Modal split in access/egress** (% of trips) seems much more appropriate than the analysis of modal split for freight transport. This indicator also points to the need for improved connections with public transport, etc. It is however suggested that the modes of transport to be considered should be specified in the indicator definition, and we will do that.

## Organisational and institutional structure

**Number of decision levels required for investments in or construction of infrastructure** (give number and additional explanation). For Prague airport the importance of the indicator was questioned. In most cases it seems possible to identify the number of involved decision levels, but for Vilnius airport it was questioned how EU institutions should be considered, many infrastructure projects are funded by EU money. These should be treated as a separate level.

**Transport interchange stations investment - Average investments in interchange stations in the period 2005-2010 in €/passenger and year.** This indicator requires a more precise definition of interchange station. Like for freight transport, there are so

many pitfalls related to this indicator that it is not qualified to be a core indicator at this stage.

## Supply-side performance

**Number of passengers/number of TEU handled per employee.** In the same way as for freight transport, this indicator has problems with how to calculate the number of employees. In particular because airports have so many different additional services like shops, restaurants and hotels, it is difficult to define which categories should be included. The Air Transport Research Society (ATRS)<sup>2</sup> uses this indicator for ranking of airports worldwide, and it is therefore assumed that it will be possible to make reasonably fit-for-purpose calculations.

**Ratio between volume and facilities (passengers/check-in machine)** can be interpreted in two different ways; in a productivity perspective it is good to have as many passengers as possible per check-in machine. However, from a level-of-service perspective, it is good to have a good capacity of check-in machines. It can in any case be debated whether the indicator is representative for any of these purposes, as check-in also can be done at check-in desks and on the web. We will therefore not consider this indicator as a core indicator for airports (or passenger transport in general).

**Relative market share in catchment area** represents the share of the total market that is captured by the airport. The indicator lacks a definition of the total market; is it share of air traffic to and from a city/region, or is it share of long-distance travel? Another issue is whether the indicator says something useful for long/short-distance interfaces, in our view it does not. In a city with two or more airports, the market share for each of them will be quite low compared to a city with one airport only, but that does not necessarily imply that one solution works better than another.

**Ratio between access/egress cost by car vs public transport.** This indicator should be considered in relation to information on modal split in access/egress (indicator A1). For Oslo airport it was reported that it was not clear if parking costs should be included for cars. Parking costs is a separate indicator (A18), and the use of car can either be for passenger pick-ups/drop-offs where the time spent in the airport is short, or air passengers bringing their car to the airport while travelling. Because the parking cost component will be very different in these cases, we find it most reasonable to exclude parking costs from this indicator. The importance of the indicator related to modal split makes it an interesting indicator in the selection process for core indicators.

The indicator **Ratio between access/egress time by car vs public transport** is related to the cost indicator (A13) and the modal split in access/egress indicator (A1). The quantification process revealed a need for precision of the indicator, for instance

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<sup>2</sup> <http://www.atrsworld.org/>

related to which locations to consider, whether scheduled or actual travel times should be used, and whether walking from parking lot or public transport station to terminal should be included. The indicator is however considered important, which points at a need to include it as a core indicator. It might be necessary to consider local possibilities when it comes to data, but travel surveys seem to be appropriate data sources. In that case actual travel times will be more relevant than scheduled ones, but local solutions must be found as to how origins and destinations of trips are selected. One possibility using a travel survey is to select pairs of trips with similar origins and destinations (starting or ending at the airport), and then calculate an average among the ratios that are obtained. Like the cost ratio indicator, the indicator is a potential core indicator.

### Terminal properties

Indicators **Distance from nearest highway (km)** and **Distance from city centre (km)** were positively described in the indicator quantification process, and no specific problems were identified for these indicators. The indicators are also considered to be important.

The indicator **Expandability of terminal** was considered clear in the sense that it represents potential for future expansion. But like for indicator F11 Expandability of terminal there is a question of unit of measurement. But it becomes obvious that the indicator should be used together with an indicator for *saturation ratio* of terminal, meaning percentage of total capacity that is utilised.

**Average (walking) distance from air to rail/bus within terminal (metres)** is connected to the design and physical interface of airports. A short distance facilitates easy transfer between air and public transport. The indicator was well received in the quantification exercise, and no specific problems were reported for the indicator. The indicator could however be labelled Airport transfer distance to make it more precise.

**Ratio between access/egress transport time and long-distance transport time** and **Ratio between access/egress transport cost and long-distance transport cost** are related indicators, and both calculated based on most frequent flight route for long-distance and trip from city centre for access/egress. These indicators are quite challenging, and the testing revealed some uncertainties, including; 1) where does the trip start and end; 2) which mode is used for access/egress; and 3) which activities should be included (i.e. where do we change from access/egress to long-distance). However, the indicator was expressed to be meaningful for describing appropriateness of airport *locations*. Nevertheless, these indicators will not be given priority in the selection of core indicators.

### Level of service

**Minimum required transfer time between flights** (minutes) is an indication of the efficiency of an airport, but also the attractiveness of the airport as transfer point. The indicator does however not seem to be sufficiently important for consideration as a core indicator.

**Overall quality** (with components like physical effort needed, personal comfort, crowded or not, information level,...) is a crucial indicator, yet still with some difficulties. The challenge in a nutshell is that overall quality is maybe the most important indicator, but at the same time very difficult to quantify, because it has many components that in themselves are difficult to quantify. One solution in such cases is to define an index capturing several quality aspects. The Airports Council International publishes an “Airport Service Quality” index, capturing issues such as overall satisfaction, access, passport/ID-control, security, finding the way and airport facilities. Access to data is however very restricted, and it is not clear whether this can be a useful data source. Because of the importance of quality, it nevertheless has to be considered as a core indicator.

**Price of taxi from city centre to airport** (Euro) and **Cost of parking in airport terminal** (daily fee, Euro) are part of the cost picture that travellers meet. No particular problems were indicated for these indicators, and they seem to be appropriate in the locations tested. For the cost of parking it should be specified if it is the parking option closest to the building, or the most frequently used one, as well as the distance from the selected parking place to the entrance of the terminal building. The detailed character of these indicators is however a reason to not include them as core indicators.

The indicator **Required check-in time prior to departure - how long before departure is required** (minutes) is an indicator that clearly is a part of the disadvantage of transferring between modes. However, there may be differences between airlines and ticket classes.

**Number of destinations served** was reported as a reasonable indicator with no particular problems, while it for the indicator **Departure frequency of access/egress modes** (typical no of departures/hour) was commented that the most typical ones should be selected (airport bus, airport express train, etc). The importance of these indicators could however be debated. For Charles de Gaulle airport it was stated that for high-speed rail as access/egress mode, this indicator was not important because of too low frequencies.

**Ticket integration - are integrated tickets between long-distance and access/egress modes available?** In the indicator testing it was suggested that for this indicator it should be specified that the integration relates to integration of access/egress mode to and from the considered terminal, but it clearly is an important topic for a core indicator.

The existence of a **Quality monitoring program** (capturing customer satisfaction) has been suggested as an indicator for airports. It can be understood as a Yes/No indicator, but we consider it less useful than most other that have been tested.

**Safety and security of transfer** is clearly important for airports as for other terminals. But it is difficult to find appropriate specific indicators like number of people killed and injured, as such events are rare in airports. The efforts put into safety and security procedures, security control, and terminal design are clearly important, but finding an appropriate measure is difficult. One alternative is to include an indicator for number of injuries, which is a safety measure.

**Quality of information** (signing, real-time information) is an important indicator, but measurement is again a challenge. It is suggested to consider this indicator in relation to the overall quality indicator (A16).

**Non-movement time as share of total origin-destination shipment or travel time (%) - typical route** is again an interesting indicator, but the definition is challenging at terminal level. It should rather be used at a more aggregated level based on travel surveys, and could then be a very interesting indicator.

The indicator **Punctuality - % of departures arriving on time** (<10 min delay) was reported to be important. It is however questioned if this information will be accessible from all airports. It was also proposed to change the definition of punctual departures from 10 to 15 minutes. The name of the indicator should be changed from departures *arriving* to departures *departing*.

### 3.5.3 Other passenger transport interface indicators

The indicators that were tested for passenger transport terminals other than airports are presented in Table 8.

**Table 8. Indicators tested for other passenger transport candidate terminals.**

	ID	Name of indicator and unit of measurement (if applicable)
Policy	OP1	Percentage of intermodal versus unimodal chains door-to-door
Organisational and institutional structure	OP2	Number of institutional levels involved in the multimodal supply
	OP3	Independence of the node management from transport operators and local actors
	OP4	Number of decision levels required for investments in or construction of infrastructure (give number and additional explanation)
	OP5	Transport interchange stations investment - Average investments in interchange stations in the period 2005-2010 in €/passenger and year
Terminal properties	OP6	Distance from city centre
	OP7	Average (walking) distance from station entrance to vehicle (at platform) (metres)
	OP8	Complementary activities in the surrounding area

	ID	Name of indicator and unit of measurement (if applicable)
	OP9	Ratio between access/egress transport time and long-distance transport time (Calculate based on most frequent used destination for long-distance and trip from ultimate origin for access/egress)
	OP10	Ratio between access/egress transport cost and long-distance transport cost (Calculate based on most frequent used destination for long-distance and trip from ultimate origin for access/egress)
Level of service	OP11	Average interchange time (minutes)
	OP12	Standard deviation of interchange time (minutes)
	OP13	Overall quality (with components like physical effort needed, personal comfort, crowded or not, information level,...)
	OP14	Terminal comfort
	OP15	Terminal opening hours
	OP16	Ticket integration - are integrated tickets between long-distance and access/egress modes available?
	OP17	Integration of information - is information for access/egress modes and long-distance modes available in the same place/format, e.g. joint route planner? Explain.
	OP18	Intermodal timetable coordination
	OP19	Safety and security of transfer
	OP20	Quality of information (signing, real-time information)
	OP21	Quality monitoring program (capturing customer satisfaction)
	OP22	Non-movement time as share of total origin-destination shipment or travel time (%) - typical route
	OP23	Punctuality - % of departures arriving on time (<10 min delay)

## Policy

**Percentage of intermodal versus unimodal chains door-to-door** is difficult at terminal level, but makes sense at a more general geographical level. The indicator could be divided into sub-indicators by distance bands. The indicator would in some settings be more useful if the definition was changed so that a bicycle ride was not put in the same category as private car (both can be unimodal door-to-door). The categories could be:

- Slow modes door-to-door
- Car door-to-door
- Intermodal trips including at least one means of public transport

## Organisational and institutional structure

No critical comments were received for the indicator **Number of institutional levels involved in the multimodal supply**, and it appears to be a representative and

appropriate indicator related to institutional structure. The same was the case with the indicator **Independence of the node management from transport operators and local actors**. It should however be noted that the importance of independence of node management is context-specific.

The indicator **Number of decision levels required for investments in or construction of infrastructure** is related to indicator OP2 (Number of institutional levels involved in the multimodal supply). For Armentières railway station there was a question on the difference between decision levels and institutional levels that were used in indicator OP2. Obviously the terminology of these indicators should be harmonised, but the topic is important.

**Transport interchange stations investment - Average investments in interchange stations in the period 2005-2010 in €/passenger and year** is an indicator that also was tested for freight transport and for airports. Testing of the indicator revealed uncertainties connected to public spending in spaces next to the station that also improved the pedestrian experience. Another uncertainty was connected to the definition of “investment”. The indicator is difficult and will not be included.

## Terminal properties

The indicators **Distance from city centre** and **Average (walking) distance from station entrance to vehicle (at platform) (metres)** were tested without any reported problems, and the indicators were said to be representative and important terminal properties. The indicator **Complementary activities in the surrounding area** was also reported to work well, but the definition of *complementary activities* is not clear. It could be an alternative to instead use *attractiveness of terminal surroundings* as an indicator, even though such an indicator also lacks some specification. We therefore conclude that this indicator should not be considered as a core indicator.

**Ratio between access/egress transport time and long-distance transport time** and **Ratio between access/egress transport cost and long-distance transport cost** (both indicators calculated based on most frequent used destination for long-distance and trip from ultimate origin for access/egress) are related indicators. In the same way as for airports, the indicators are very difficult to define.

## Level of service

**Average interchange time** (minutes) and **Standard deviation of interchange time** (minutes) are important descriptions of how an interchange actually performs. It was reported that in some cases data are not available, while in other cases data are not

available. It should however be feasible to establish this kind of data through surveys, and the indicators are considered to be very important.

**Overall quality (with components like physical effort needed, personal comfort, crowded or not, information level,...)** is an important indicator, but the challenging part is to define categories or values. The indicator was nevertheless reported to be representative and good. We propose introducing a five-level scale (Very good / Good / Average / Bad / Very bad), where local adaptations will need to be done for use of the indicator.

The indicator **Terminal comfort** was used without any reported problems, but the results were based on empirical assessment and not any specific criteria. **Terminal opening hours** was also easily assessed, but there may be some local differences within a terminal or other circumstances that make it difficult to just indicate a starting time and an ending time. We propose to let the overall quality represent the terminal comfort indicator, and to not include opening hours in itself as a core indicator.

**Ticket integration - are integrated tickets between long-distance and access/egress modes available?** is an indicator that reflects an important aspect of long/short-distance interfaces. We have received answers that are yes, no, and "partly". Ideally such answers could be supported by intermodal surveys that can assist in a quantification of how large share of the passengers that use such tickets. The importance of the topic points at a need for including the indicator as a core indicator.

A related indicator is **Integration of information - is information for access/egress modes and long-distance modes available in the same place/format, e.g. joint route planner? Explain.** For this indicator, a verbal description will be needed to fully explain the status of an interchange. It is nevertheless considered to be an important indicator for long/short-distance interfaces and should be considered in the selection of core indicators.

The indicator **Intermodal timetable coordination** reflects whether there is a synchronisation of departure and arrival times in order to reduce transfer times for travellers. The indicator is more relevant in some contexts than other. With low departure frequencies, the timetable coordination is more important than in the case of high frequencies. The coordination is also more important when there are particular inbound and outbound streams that can be matched in a terminal. To conclude, the indicator is not sufficiently important in general to be included as a core indicator.

**Safety and security of transfer** is an indicator that requires judgment, as it is difficult to identify clear quantitative indicators that cover these aspects well. The topic is particularly complex because passengers' *perceived* risk for safety or security-related accidents is a part of the total safety and security picture. Number of injuries by category per year could be a more specific indicator, where the categories are staff, passengers, and other.



**Quality of information (signing, real-time information)** is related to the indicator covering “Overall quality” (OP-13). In the indicator quantification for candidate terminals, judgments were made. We do not suggest to include it as a separate indicator, but rather to use an indicator for “clarity of ways” within terminals.

The indicator **Quality monitoring program (capturing customer satisfaction)** is intended to reflect focus on quality and customers’ satisfaction in transport interchanges. In itself this indicator need not mean much for the level of service offered, but as part of the total picture, the indicator can say something about quality management. For this role, it should however be moved to the category “Supply side performance”, but it is still doubted if it is sufficiently important to be defined as a core indicator.

An indicator that has also been tested for freight transport and for airport interchanges is **Non-movement time as share of total origin-destination shipment or travel time (%) - typical route**. Also in this case, the testing revealed problems with estimating values for this indicator, but that is partly because it is tested at terminal level, but in fact is more applicable at a more generic level. This indicator was also considered important for freight transport and for airports, and it is then also reasonable to include it for passenger transport in general.

Finally, the indicator **Punctuality - % of departures arriving on time (<10 min delay)** was tested. For Armentières railway station, it was reported that punctuality information is available at regional level, not in individual interchanges.

### 3.6 Inputs from members of the CLOSER Policy Advisory Group

The members of the CLOSER Policy Advisory Group (PAG) have been involved in the discussions of core indicators and indicator selection. In the PAG meeting in Lille on May 25<sup>th</sup>, the overall approach was presented to the PAG members. Then, each PAG member received an indicator list that they were given the chance to comment on and give their advice on individual indicators. The lists that were distributed to the PAG members contained more indicators than what was tested for the candidate terminals.

The PAG members are experts in different fields, some in freight transport and some in passenger transport. Each PAG member has sent us feedback based on their priorities. Recommendations are therefore varying, but we have tried to include a balanced representation of each PAG member’s feedback.

Table 9 shows examples of indicators that have been particularly highlighted by one or more PAG member. Some of these were included in the indicator list that they received, while others were not. In the discussion of core indicators in Section 4 we point to specific indicators that have been included based on the inputs from the PAG members.

**Table 9. Indicators that have been highlighted by Policy Advisory Group members.**

Indicator	Indicator explanation	Unit of measurement
Clarity of the ways from and to the platforms	Defines the overall satisfaction of the clarity of the ways from and to the platforms at a terminal.	
Latest check-in time	How close to the flight departure time check-in is possible	Minutes
Size	The indicator defines the percentage of the anticipated demand in the freight terminal's catchment area that may be accommodated by the terminal in the referred time horizon (note: this indicates the market share).	Percentage (%)
Logical integration	% of network integrated (timetables, information)	%
Property status and availability	The indicator defines the property status and availability of a terminal (usually), whether it is public or private, if there are one or more owners and the feasibility of the implementation.	
Flows	The indicator defines the flows (long haulage/and/or distribution)	tons per year
Present saturation ratio of the freight terminal	The indicator defines the present saturation ration of the freight ratio; present flows serviced by the terminal / capacity of the terminal.	Percentage (%)
Handling cost	Average handling cost per TEU in a terminal	Euro/TEU
Origin - destination speed	Average speed from origin to destination including waiting and time needed for transfer between modes	km/h
Settlement character	Type of the settlement under service	compact city or rural or mixed or national
Regional importance	Number of municipalities covered by transport services being provided in the node	number
Terminal availability	Availability of the terminal depending on the ownership	privately or publicly available
Real time information for management	Number of existing Real-Time Information ( RTI) systems which are	?

Indicator	Indicator explanation	Unit of measurement
	based on ETSI, ISO and CEN standards, and national guidelines.	
Electronic documentation of procedures	Existence of electronic form of documents; electronic signature possibility	yes/no
Contactless smartcard ticketing	Existence of electronic ticketing based on a contactless smartcard in the node	yes/no
SMS payment/ confirmation	Existence of electronic ticketing based on SMS payment/ confirmation in the node	yes/no

### 3.7 INTERCONNECT indicators

CLOSER has two “sister” projects covering similar issues, these are HERMES and INTERCONNECT. One significant difference between HERMES and INTERCONNECT at one hand and CLOSER on the other hand, is that HERMES and INTERCONNECT focus on passenger transport only.

Deliverables of HERMES and INTERCONNECT were studied for the indicator review in CLOSER Deliverable 3.1 (Andersen et al., 2010). However, Since the CLOSER indicator review was performed in Deliverable 3.1, the INTERCONNECT project has presented indicators in their Deliverable 5.2 (Ulled, 2011). They define three types of indicators, namely modal share indicators, interconnection rate indicators and travel cost and interconnection cost indicators (passenger transport only). In total they define 15 indicators (Ulled, 2011), many of them related to percentage of unimodal and multi-modal itineraries. In addition there are indicators for multi-modality rate - *the number of different modes used in an itinerary*, and inter-modality rate - *the number of shifts between different modes in an itinerary*. In addition, there are indicators for interconnectivity rate - *number of shifts between different modes or between different services in the same mode*, and diversity rate - *the total length of road, rail and air used in an itinerary aggregated according to an entropy formulation*. Finally, there are indicators for travel cost - *the cost in Euros of an itinerary*, and for *percentage of travel cost spent in interconnections (city connectors and network connectors) with respect to total travel cost*.

The INTERCONNECT indicators are defined in a somewhat different context than the CLOSER indicators, and are tested at aggregated geographical level by use of models like TRANS-TOOLS. We therefore do not include these INTERCONNECT indicators in the selection of CLOSER core indicators.

### 3.8 Gaps in the data collection and the analysis of the material

In the CLOSER Description of Work (DOW), it is specified that WP3 indicators should cover the following issues:

- Organisational and institutional aspects
- Users' aspects – including level of service (LoS) and quality issues
- Environmental and “Greening of transport” aspects

The analysis of indicators above covers organisational and institutional aspects as well as users' aspects well. It is however few indicators directly related to environmental and “Greening of transport” aspects in the studied material. The reason for this is not a lack of interest for these issues, but rather the difficulty of finding good indicators that are also focusing on the long/short-distance interfaces. However, indicators related to modal split and unimodal versus intermodal itineraries are indirectly related to environmental issues.

In order to strengthen the emphasis of environmental issues, we see a need for including more specific core indicators related to environment. Such indicators can either be connected to activities in the terminals, or at a more aggregated level concerning the transport system. To cover this, we suggest including one indicator for Greenhouse gas emissions at an aggregated level, and one indicator at interchanges/terminal level. Due to the relation between energy use and emissions, we propose including an indicator connected to energy use at the interchange level.

## 4 Core indicators for long/short-distance interfaces

The main output of CLOSER WP3 is a selection of core indicators for long/short-distance interfaces. The suggested core indicators are presented in Table 10. There are in total 30 indicators, these are grouped by the five-level structure that was illustrated in Section 2.1. For each indicator, we present ID in the first column of Table 10 (the indicators are numbered from C1-C30, where C stands for Core). Then there are columns for indicator name and description, respectively. We also define which segments of transport each indicator applies to. Some indicators are related to all segments, meaning all long/short-distance interfaces in passenger and freight transport. Other indicators apply to either passenger or freight transport, while there also are indicators that are applicable for specific interchange types (e.g. passenger transport airports).

A general challenge for the indicators is that it is difficult to establish a general rule for determining the object of study. In some cases it is most appropriate to consider a city, region or country, in particular for the policy-oriented indicators. In other cases indicators should be applied at terminal level. In passenger transport, a terminal refers to a railway station, bus station, or an airport. Some complexity arise for instance because an airport also may have the functions of a rail station and/or a bus terminal. For each indicator that is included, we define its scope as broad as possible where this is appropriate. For example, even if an indicator has only been tested for airports in the candidate terminals-based indicator evaluation, we define the scope of the indicator broader if that seems to be possible. This is to have a set of core indicators that is as uniform and complete as possible across different long/short-distance interfaces.

In the last two columns, we indicate by “x” if the indicator is applicable at interchange level (for specific terminals/interchanges), at more aggregated level (typically for a city, region or country), or both. Each indicator is discussed below Table 10. There we also refer to whether the indicator was evaluated for candidate terminals through the indicator ID’s used in Tables 6, 7 and 8.

**Table 10. Suggested core indicators for long/short-distance interfaces.**

ID	Indicator name	Description and unit of measurement	Segment	Interchange level	Aggregated level
<b>Policy</b>					
C1	Multimodality rate	Percentage of multimodal versus unimodal shipments or itineraries	All		x
C2	Modal split in access/egress	Percentage of trips, road, rail, bus, taxi, slow modes	Passenger	x	x
C3	GHG emissions	GHG emissions, grams per passenger km and grams per tonne km	All		x
<b>Organisational and institutional structure</b>					
C4	Independence of terminal/interchange management	Independence from transport operators and local actors	All	x	
C5	Fair and equal access	Whether all companies have access to a terminal/interchange on equal conditions (yes/no/partial)	All	x	x
C6	Institutional complexity	Number of institutional levels involved in a) interchange planning b) interchange investments	All	x	
<b>Supply side performance</b>					
C7	Employee productivity	Ratio between flows and inputs, TEU transhipped per employee and year and passengers per employee and year			
C8	Equipment productivity	TEU lifted per year and per crane	Freight	x	
C9	Flows	Number of TEUs or number of passengers per year, respectively	All	x	
C10	Energy productivity	Interchange/terminal energy use per year and TEU transhipped or passenger (kWh)	All	x	
<b>Terminal properties</b>					
C11	Saturation ratio	Ratio between actual volumes and maximum capacity (daily average, %)	All	x	
C12	Expandability	Potential for expandability of interchange/terminal (% increase compared to today's transshipment capacity)	All	x	
C13	Distance from city centre	Number of kilometres from city centre to	All	x	x

ID	Indicator name	Description and unit of measurement	Segment	Interchange level	Aggregated level
		interchange/terminal			
C14	Distance from nearest highway	Number of kilometres from interchange/terminal to nearest highway	All	x	
C15	Platform access distance	Average walking distance from entrance to platform/gate	Passenger	x	
C16	Airport transfer distance	Average walking distance from arrivals hall to main public transport modes (bus, rail and metro)	Passenger airports	x	
C17	Access/egress cost ratio	Ratio between access/egress cost by car vs public transport (%)	Passenger airports	x	x
C18	Access/egress time ratio	Ratio between access/egress time by car vs public transport (%)	Passenger airports	x	x
C19	Clarity of ways	Clarity of ways within interchange/terminal	Passenger	x	
<b>Level of service</b>					
C20	Handling cost	Average price paid per TEU transhipped through the terminal (Euro)	Freight	x	
C21	Overall quality	Needs to be defined as an index in passenger transport with components physical effort needed, personal comfort, information, perceived safety/security and facilities	Passenger	x	
C22	Ticket integration	Availability of integrated tickets between long and short-distance modes (Yes/No/partial)	Passenger	x	x
C23	Information integration	Common information for long and short-distance modes (Yes/No/partial)	Passenger	x	x
C24	Average interchange time	Average time for transfer between modes (minutes)	Passenger	x	
C25	Variability of interchange time	Standard deviation of transfer time between modes (minutes)	Passenger	x	
C26	Punctuality	Percentage of arrivals within defined tolerance for delay	All	x	x
C27	Non-movement factor	Non-movement time as share of total origin-destination shipment or travel time	All		x
C28	Origin-destination speed	Average speed from origin to destination	Freight		x
C29	Interchange injuries	Number of persons killed or seriously injured in interchange/terminal per year by category (staff, passengers, and other)	Passenger	x	X
C30	Loss and damage	Percentage of shipments with loss or damage	Freight	x	

ID	Indicator name	Description and unit of measurement	Segment	Interchange level	Aggregated level
		at interchange/terminal including loading and unloading			

In sections 5.1 to 5.5 we discuss each indicator and recommended values (desired direction of indicators). In Section 5.6 we relate the indicators to the policy goals of the most recent White paper on transport *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* (Commission of the European Communities, 2011).

#### 4.1 Policy indicators

The following three indicators are defined for policy-related issues:

- **C1 Multimodality rate:** Represents the degree of multimodality at an aggregated level (typically for a region) and facilitates comparison of different regions, which again may point at need for policy actions. The indicator is a renaming of the indicator Percentage of intermodal versus unimodal chains door-to-door that was tested for freight transport and other passenger transport terminals. Even though some questions were raised in the testing process, we have concluded to include it because of its importance and also feedback from Policy Advisory Group (PAG) members. For environmental purposes, the indicator value should be as high as possible. For consideration of the competitiveness of intermodal solutions, a low indicator value may reveal that intermodal transfers are not sufficiently competitive. In some passenger transport contexts, it may might sense to differentiate between slow modes door-to-door, car door-to-door, and intermodal trips including at least one means of public transport. The indicator corresponds to indicators F1 and OP1.
- **C2 Modal split in access/egress:** This indicator was reported to be important for airports, but it can also be extended to other passenger transport contexts. The indicator facilitates comparison for both at interchange level and more general level. In an environmental perspective, the modal share of private cars and taxis should be as low as possible. The indicator corresponds to indicator A1.
- **C3 GHG emissions:** Intended for use at aggregated level, and can for instance be used for comparison of unimodal versus multimodal itineraries. GHG emissions should be as low as possible. The indicator has been included to serve the need for covering environmental aspects.
-



## 4.2 Organisational and institutional structure

Core indicators related to organisational and institutional structure are:

- **C4 Independence of terminal/interchange management:** This indicator requires description if there are dependencies (formal or informal). Often (but not always), independence is desired. The indicator corresponds to F3 and OP3.
- **C5 Fair and equal access:** Defines whether all actors have access to an interchange/terminal at equal conditions (Yes/no/partial). Indicator value “Yes” is desirable, the indicator corresponds to previously discussed indicator F5.
- **C6 Institutional complexity:** This is a two-level indicator reflecting number of governmental levels involved in a) planning and b) investments. For efficiency purposes and implementation ability, a low number is desired. This indicator captures earlier discussed indicators F2, A2 and OP4

## 4.3 Supply-side performance

We define four core indicators covering supply-side performance:

- **C7 Employee productivity:** This indicator relates terminal throughput to staff. The indicator testing for candidate terminals revealed some problems with definition, but this must be defined for the particular studies where the indicators are used. Desirable level is as high as possible, and the indicator is based on F6 and A4
- **C8 Equipment productivity:** Relates terminal throughput to equipment. Also here, depending on the context, the appropriate definition of equipment must be selected. The indicator value should be as high as possible. This indicator is based on F7 and A5
- **C9 Flows:** This indicator maps the size of the terminal in terms of volume. High value might be good if large volumes are desired, but this depends on context. The indicator has been based on PAG members recommendations.
- **C10 Energy productivity:** Energy use in interchange/terminal related to the production in terms of TEU (freight transport) or passengers (passenger transport). The lower energy use, the better. The indicator has been included to serve the need for covering aspects related to environmental performance.

## 4.4 Terminal properties

The following indicators have been included to represent terminal properties:

- **C11 Saturation ratio:** This indicator represents how much of the terminal/interchange capacity is utilised (based on a daily average if applicable). A too low saturation ratio calls for increased volumes in order to promote effectiveness, while a too high saturation ratio calls for expansions of terminals

other measures. The discussion of the freight indicators revealed a need for this indicator, and it was also recommended from PAG.

- **C12 Expandability:** The testing for candidate terminals revealed some difficulties with this indicator, but it is nevertheless included because it has been considered important by PAG members and consortium members. It should be calculated as % increase potential from today's transshipment capacity. Depending on data access and appropriateness, the calculations can be based on daily or annual capacity. A high expandability potential is considered to be good. Indicators F11 and A11 formed the basis for this indicator.
- **C13 Distance from city centre:** The importance of this indicator has been highlighted by PAG members and through testing of candidate terminals. A short distance reduces last mile costs and external effects. This indicator was tested through indicators F10, A10 and OP6
- **C14 Distance from nearest highway:** This indicator is considered important in particular for freight transport, but in some cases also in passenger transport. The indicator value should be as low as possible. It was tested as indicator F9 and A9.
- **C15 Platform access distance:** Average walking distance from entrance to platform/gate, should be as short as possible. For terminals with heterogeneous values, the "typical" distance can be used. The distance should be as short as possible, the indicator was tested as indicator OP7.
- **C16 Airport transfer distance:** Average walking distance from arrivals hall to main public transport modes (bus, rail and metro) represents ease of transfer between air and public transport in airports, which is an important determinant of access/egress modal split. The distance should be as short as possible. This indicator was tested as indicator A12.
- **C17 Access/egress cost ratio** and **C18 Access/egress time ratio.** Ratio between access/egress cost and time by car vs public transport (%). Parking costs for an average stay in airport parking areas should be included. This indicator needs case-specific specification, but is considered important for modal split in access/egress. For both indicators, the value should be as high as possible for the use of presumably environmentally friendly modes. These indicators were tested for airports with IDs A7 and A8, but have been regrouped from supply side performance to terminal properties.
- **C19 Clarity of ways:** This is a indicator specific for passenger terminals and their design/signage, it must be measured on a scale (for instance 1-5). It has some connection with indicator OP20, and has also been emphasised by PAG members.

## 4.5 Level of service

As much as eleven Level of service indicators have been included, reflecting the importance and variety of such issues.

- **C20 Handling cost:** Testing of this indicator revealed some problems with definitions, but it is considered so important that it should be included with some

specifications. The indicator should be used for a typical transfer operation at an interchange/terminal, and should if possible be selected for the “typical customer”. A low cost is considered good for the competitiveness; the indicator is based on indicator F13.

- **C21 Overall quality:** This is an important indicator, and the main question is how it can be operationalised. Context-dependent studies will be needed for the use of the indicator, and such studies do exist (for instance the Airport Service Quality index). In the candidate terminals-based testing, this indicator corresponds to indicators A16 and OP13.
- **C22 Ticket integration:** This is an important interchange indicator, as also highlighted by Goudeau (2011). Availability of integrated tickets between long and short-distance modes eases transfer between modes. The area is however challenging, with several technological, fiscal and legal dimensions. Indicator values can be Yes/No/partial, but additional explanations should also be given. The indicator was tested with ID A22 and OP16
- **C23 Information integration:** The indicator reflects whether common information is available for long and short-distance modes, for instance in terms of a joint route planner. Typical values can be Yes/No/partial (with additional explanation), “Yes” is the desirable value. This indicator was tested with ID OP17.
- **C24 Average interchange time:** Average time for transfer between modes (minutes). Intermodal travel surveys or terminal surveys can give the necessary data. The interchange time should be as low as possible, feasible values depend on mode of transport and context. The indicator was tested as OP11 and emphasised by PAG members.
- **C25 Variability of interchange time:** Standard deviation of transfer time between modes (minutes). Intermodal travel surveys or terminal surveys can give the necessary data. The variability should be as low as possible. In the indicator testing for candidate terminals, this indicator was labelled OP12.
- **C26 Punctuality:** This is the percentage of arrival within defined tolerance for delay, which may depend on local conditions, modes involved, etc. Local adaptations will thus need to be done, also with respect to what a punctual arrival is (10 minute, 15 minutes,...). The punctuality indicator should be as high as possible. Different companies have different targets, typically between 90% and 99%/100 %. Punctuality was tested by indicators F19, A27 and OP23.
- **C27 Non-movement factor:** This indicator represents the share of the origin-destination time that a shipment or a passenger is not moving. The indicator points at the efficiency of terminal/interchange operations in a region, and the indicator value should be as low as possible. The indicator was tested with IDs F18, A26 and OP23.
- **C28 Origin-destination speed:** This is the average speed from origin to destination including non-movement time. It may in some cases require some work to calculate the indicator, but it can give important signals on the competitiveness of alternative transport chains or itineraries. A higher speed is better than a lower. The indicator was tested through ID F16.
- **C29 Interchange injuries:** The indicator captures Number of persons killed or seriously injured in interchange/terminal per year by category (staff,

passengers, and other). The value should be as low as possible, with 0 as target value. This indicator was not specifically tested for candidate terminals, but arose in the discussion of the results.

- **C30 Loss and damage:** This indicator refers to operations at interchanges/terminals, and relates to percentage of shipments with loss or damage. The indicator value should be as low as possible. The indicator is connected to the tested indicator F15.

## 4.6 Relation to EC policy goals

As stated in Section 1.2, the new white paper on transport set out ten ambitious goals for a competitive and resource-efficient transport system. Indicators could be used to measure level of achievement of such policy goals, but also developments in the efforts to reach the aims for a resource-efficient transport system. Achievement of policy goals could be measured through the use of indicators measuring the policy goal directly by a dedicated indicator, or by measuring associated properties that are otherwise relevant for the policy goals. In this way both direct and indirect indicators are valuable for use in evaluation of policy goal achievements.

In Table 11 we present the most relevant indicators from Table 10 that could be used for evaluation of EC transport policy goals by connecting the indicators to the ten EC transport policy goals. We differentiate between “direct” indicators, marked in red, as core indicators to be used for measuring achievements of different policy goals. On the other hand, indicators marked in green are assumed to be “indirect” indicators in the sense that they don’t give direct measurement of achievement of the EC policy goals, but nevertheless are relevant for the analysis of these goals.

**Table 11. Coverage of EC transport policy goals by core indicators.**

Policy goals	Indicators
<b>Developing and deploying new and sustainable fuels and propulsion systems</b>	
1. Halve the use of ‘conventionally fuelled’ cars in urban transport by 2030 and phase them out in cities by 2050 to achieve essentially CO2-free city logistics in major urban centres by 2030	<p>C2 Modal split in access/egress</p> <p>C3 GHG emissions</p> <p>C10 Energy productivity</p> <p>C13 Distance from city centre</p> <p>C17 Access/egress cost ratio</p> <p>C18 Access/egress time ratio</p>

<p>2. Low-carbon sustainable fuels in aviation to reach 40 % by 2050 and reduce EU CO2 emissions from maritime bunker fuels by 40 % (if feasible 50 %)</p>	<p>C3 GHG emissions C10 Energy productivity</p>
<p><b>Optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes</b></p>	
<p>3. Thirty per cent of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030 and more than 50 % by 2050</p>	<p>C1 Multimodality rate C3 GHG emissions C9 Flows C11 Saturation ratio C12 Expandability</p>
<p>4. A complete European high-speed rail network by 2050, tripling the length of the existing high-speed rail network by 2030</p>	<p>C1 Multimodality rate C28 Origin-destination speed</p>
<p>5. A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services.</p>	<p>C1 Multimodality rate C21 Overall quality C23 Information integration C24 Average interchange time C25 Variability of interchange time C26 Punctuality C27 Non-movement factor</p>
<p>6. Connect all core network airports to the rail network by 2050, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.</p>	<p>C2 Modal split in access/egress C16 Airport transfer distance C28 Origin-destination speed</p>
<p><b>Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives</b></p>	
<p>7. Deployment of the modernised air traffic management infrastructure (SESAR) (12) in Europe by 2020 and completion of the European</p>	<p>C1 Multimodality rate C26 Punctuality</p>

common aviation area. Deployment of equivalent land and waterborne transport management systems and deployment of the European global navigation satellite system (Galileo).	C23 Information integration
8. Establish the framework for a European multimodal transport information, management and payment system by 2020.	C6 Institutional complexity C22 Ticket integration C23 Information integration
9. Move close to zero fatalities in road transport by 2050. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.	C1 Multimodality rate C2 Modal split in access/egress C29 Interchange injuries
10. Move towards full application of 'user pays' and 'polluter pays' principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.	C3 GHG emissions C20 Handling cost

The analysis of EC transport policy goals suggests that some goals are better covered than others by the indicators. On the other hand, some indicators are more relevant for the specific policy goals than others. It should however be noted that the indicators are defined at different levels, and some of the more micro-oriented indicators may represent aspects that are highly policy-relevant, although indirectly. Therefore we cannot say at an indicator that is not directly connected to one of the policy goals is a bad indicator. Nevertheless, Table 11 suggests that the following policy goals are most well covered by indicators:

- 1. Halve the use of 'conventionally fuelled' cars in urban transport by 2030 and phase them out in cities by 2050 to achieve essentially CO<sub>2</sub>-free city logistics in major urban centres by 2030
- 3. Thirty per cent of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030 and more than 50 % by 2050
- 5. A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services.

On the other hand, fewest indicators were directly related to the following policy goals:

- 2. Low-carbon sustainable fuels in aviation to reach 40 % by 2050 and reduce EU CO<sub>2</sub> emissions from maritime bunker fuels by 40 % (if feasible 50 %)
- 4. A complete European high-speed rail network by 2050, tripling the length of the existing high-speed rail network by 2030

- 10. Move towards full application of ‘user pays’ and ‘polluter pays’ principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.

Taking into account our division of indicators into “direct” or core ones (marked red) and “indirect” ones marked green we find that the policy goals most well covered are:

- 5. A fully functional and EU-wide multimodal TEN-T ‘core network’ by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services. This EC policy goal are covered by six “direct” or core indicators (C1 Multimodality rate, C21 Overall quality rate, C23 Information integration, C24 Average interchange time, C25 Variability of interchange and C 26 Punctuality).
- 7. Deployment of the modernised air traffic management infrastructure (SESAR) (12) in Europe by 2020 and completion of the European common aviation area. Deployment of equivalent land and waterborne transport management systems and deployment of the European global navigation satellite system (Galileo).
- 9. Move close to zero fatalities in road transport by 2050. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport. These EC policy goals are covered by three “direct” or core indicators (C1 Multimodality rate, C2 Modal split in access/egress and C29 Interchange injuries).

Similarly, the following policy goals are connected to fewest “direct” indicators:

- 3. Thirty per cent of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030 and more than 50 % by 2050. One “direct” indicator: C1 Multimodality rate.
- 4. A complete European high-speed rail network by 2050, tripling the length of the existing high-speed rail network by 2030. One “direct” indicator: C28 Origin-destination speed.

From the analysis we see that the indicators seem to give good information for evaluation of EC policy goals achievements. The quantitative analysis does not give a complete picture of the coverage of policy goals, but it nevertheless points out that there is a wide range of the CLOSER core indicators that are highly relevant for evaluation of EC transport policy. Some of the indicators are connected as an indicator in multiple policy goals and will give valuable information for assessment of the achievements for many EC policy goals. Even though some indicators are not listed in Table 11, they are relevant for study and evaluation of policy-related aspects more indirectly.

## 5 Conclusions and recommendations

CLOSER WP3 deals with structure of interconnections between long-distance transport and short-distance transport, referred to as long/short-distance interfaces. The main outcome of WP3 is a set of suggested core indicators for long/short-distance interfaces. Topics for this deliverable have been:

- Establishment of selection criteria to choose core indicators.
- Selection and validation of core indicators and new indicators.
- Discussion of typologies of interfaces
- Presentation of results of the WP3 workshop arranged in Lille on May 24, 2011.

A set of 30 core indicators have been proposed, some of them covering all long/short-distance interfaces (freight and passengers), while other indicators cover more specific segments. The selection of core indicators has been based on a multiple inputs, where the most extensive approach has been testing of potential core indicators for a specific set of terminals and interchanges that have been selected for such analyses in the CLOSER project. In addition, the CLOSER expert panel *Policy Advisory Group* has been consulted, and we have reviewed and discussed general *indicator selection criteria*.

Core indicators for long/short-distance interfaces should facilitate:

- Description of the functioning of interfaces (good/bad)
- Recommendations for improving the interfaces
- Global assessment: prioritisation of actions (what is important to work on)
- Benchmarking of interconnections

The indicators cover a range of issues including organisational and institutional aspects, users' aspects including level of service (LoS) and quality issues, as well as environmental and "Greening of transport" aspects.

The ten outlined policy goals of the most recent EC white paper on transport *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* (Commission of the European Communities, 2011) were discussed in light of the suggested core indicators for interfaces between long-distance and short-distance transport. The assignment of indicators to policy goals suggests that the following policy goals are most well covered by indicators:

- Halve the use of 'conventionally fuelled' cars in urban transport by 2030 and phase them out in cities by 2050 to achieve essentially CO<sub>2</sub>-free city logistics in major urban centres by 2030
- Thirty per cent of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030 and more than 50 % by 2050
- A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services.

On the other hand, fewest indicators were directly related to the following policy goals:

- Low-carbon sustainable fuels in aviation to reach 40 % by 2050 and reduce EU



- CO2 emissions from maritime bunker fuels by 40 % (if feasible 50 %)
- A complete European high-speed rail network by 2050, tripling the length of the existing high-speed rail network by 2030
- Move towards full application of ‘user pays’ and ‘polluter pays’ principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues add ensure financing for future transport investment

If we differentiate between “indirect” and “direct” indicators to be used for evaluating achievement of EC policy goals, we find that the EC policy goals most well covered by “direct” core indicators are:

- A fully functional and EU-wide multimodal TEN-T ‘core network’ by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services.
- Thirty per cent of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030 and more than 50 % by 2050.
- Move close to zero fatalities in road transport by 2050. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.

The assignment of indicators to policy goals points out that many CLOSER core indicators are highly relevant for evaluation of EC transport policy.

A final recommendation is that the indicators should be tested on a group of in depth case studies covering long-distance and short-distance freight and passenger transport networks to validate our findings. The case studies should also be tested against the outlined EC policy goals in the latest White Paper (Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system) using indicators assessed in this deliverable to be valuable for this purpose.

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## Appendix A. Templates for indicator testing for candidate terminals.

### Freight transport

Candidate terminal:				
Responsible partner:				
Responsible person:				
Last update:				
<b>For each indicator the following information is needed:</b>				
- Value: Calculated or estimated value of the indicator for the specific terminal/interconnection				
- Data access; is information easily available?				
- Representativeness; does the indicator tell us something useful and does it represent the phenomenon in a good way?				
- Do you see problems with the definition and use of this indicator? Add here also information if you know other indicators that would work better.				
Indicator	Value	Data access	Representativeness	Problems with definition and/or use?
Percentage of intermodal versus unimodal chains door-to-door				
Number of institutional levels involved in the multimodal supply				
Independence of the node management from transport operators and local actors				
Transport interchange stations investment - Average investments in freight terminal in the period 2005-2010 in €/TEU throughput and year.				
Fair and equal access to terminal/station - Indicates whether all companies have access to a terminal on equal conditions (time, cost, flexibility, etc) independent of ownership				
Number of TEU handled per employee				
Ratio between volume and facilities (TEU/crane, etc)				
Ratio between lowest monthly throughput (volume) and highest monthly throughput				
Distance from nearest highway (km)				
Distance from city centre (km)				
Expandability of terminal				
Complementary activities in surrounding area.				
Handling cost (Euro/TEU)				
Terminal working (opening) hours				
Safety and security of transfer (% of shipments with loss or damage)				
Origin-destination speed based on total door-to-door transshipment time (km/h)				
Average transshipment time in terminal (without planned storage) (hours)				
Non-movement time as share of total origin-destination shipment or travel time (%) - typical route				
Punctuality - % of shipments arriving on time (<30 min delay)				

## Airports

Responsible partner:				
Responsible person:				
Last update:				
<b>For each indicator the following information is needed:</b>				
- Value: Calculated or estimated value of the indicator for the specific terminal/interconnection				
- Data access; is information easily available?				
- Representativeness; does the indicator tell us something useful and does it represent the phenomenon in a good way?				
- Do you see problems with the definition and use of this indicator? Add here also information if you know other indicators that would work better.				
Indicator	Value	Data access	Representativeness	Problems with definition and/or use?
Modal split in access/egress (% of trips)				
Number of decision levels required for investments in or construction of infrastructure (give number and additional explanation)				
Transport interchange stations investment - Average investments in interchange stations in the period 2005-2010 in €/passenger and year				
Number of passengers/number of TEU handled per employee				
Ratio between volume and facilities (passengers/check-in machine)				
Relative market share in catchment area				
Ratio between access/egress cost by car vs public transport				
Ratio between access/egress time by car vs public transport				
Distance from nearest highway (km)				
Distance from city centre (km)				
Expandability of terminal				
Average (walking) distance from air to rail/bus within terminal (metres)				
Ratio between access/egress transport time and long-distance transport time (Calculate based on most frequent flight route for long-distance and trip from city centre for access/egress)				
Ratio between access/egress transport cost and long-distance transport cost (Calculate based on most frequent flight route for long-distance and trip from city centre for access/egress)				
Minimum required transfer time between flights (minutes)				
Overall quality (with components like physical effort needed, personal comfort, crowded or not, information level,...)				
Price of taxi from city center to airport (Euro)				
Cost of parking in airport terminal (daily fee, Euro)				
Required check-in time prior to departure - how long before departure is required (minutes)				
Number of destinations served				
Departure frequency of access/egress modes (typical no of departures/hour)				
Ticket integration - are integrated tickets between long-distance and access/egress modes available?				
Quality monitoring program (capturing customer satisfaction)				
Safety and security of transfer				
Quality of information (signing, real-time information)				
Non-movement time as share of total origin-destination shipment or travel time (%) - typical route				
Punctuality - % of departures arriving on time (<10 min delay)				

## Other passenger transport terminals

Candidate terminal:				
Responsible partner:				
Responsible person:				
Last update:				
<b>For each indicator the following information is needed:</b>				
- Value: Calculated or estimated value of the indicator for the specific terminal/interconnection				
- Data access; is information easily available?				
- Representativeness; does the indicator tell us something useful and does it represent the phenomenon in a good way?				
- Do you see problems with the definition and use of this indicator? Add here also information if you know other indicators that would work better.				
Indicator	Value	Data access	Representativeness	Problems with definition and/or use?
Percentage of intermodal versus unimodal chains door-to-door				
Number of institutional levels involved in the multimodal supply				
Independence of the node management from transport operators and local actors				
Number of decision levels required for investments in or construction of infrastructure (give number and additional explanation)				
Transport interchange stations investment - Average investments in interchange stations in the period 2005-2010 in €/passenger and year				
Distance from city centre				
Average (walking) distance from station entrance to vehicle (at platform) (metres)				
Complementary activities in the surrounding area				
Ratio between access/egress transport time and long-distance transport time (Calculate based on most frequent used destination for long-distance and trip from ultimate origin for access/egress)				
Ratio between access/egress transport cost and long-distance transport cost (Calculate based on most frequent used destination for long-distance and trip from ultimate origin for access/egress)				
Average interchange time (minutes)				
Standard deviation of interchange time (minutes)				
Overall quality (with components like physical effort needed, personal comfort, crowded or not, information level,...)				
Terminal comfort				
Terminal opening hours				
Ticket integration - are integrated tickets between long-distance and access/egress modes available?				
Integration of information - is information for access/egress modes and long-distance modes available in the same place/format, e.g. joint route planner? Explain.				
Intermodal timetable coordination				
Safety and security of transfer				
Quality of information (signing, real-time information)				
Safety and security of transfer				
Quality monitoring program (capturing customer satisfaction)				
Non-movement time as share of total origin-destination shipment or travel time (%) - typical route				
Punctuality - % of departures arriving on time (<10 min delay)				