

ecotale

EXTERNAL COSTS OF TRANSPORT AND LAND EQUALIZATION



GUIDELINES

**FOR A WIDER INTERNALIZATION PRACTICE
WITHIN THE TRANSPORT PLANNING AND POLICIES**





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INTRODUCTION – OBJECTIVES OF THE ECOTALE PROJECT

The reduction and/or internalization of the environmental, spatial and social costs caused by the transport sector are policy objectives that have been commonly assumed over the last decades (e.g. Directive 1999/62/EC, Directive 2006/38/EC). Within a market approach and according to the “polluter pays” principle, internalization is a way toward a comprehensive payment actually born by the transport users; in this “classic” vision, this is obtained by means of some additional/side pricing imposed to citizens/enterprises generating road traffic with private vehicles (e.g. road pricing: tolls, vignette, access fees; park pricing, vehicle/fuel taxation). However, incompleteness in the extent of the application of direct pricing and a missing or only partial link with modal policies, spatial planning and infrastructural decisions lead to failures of the internalization policies in terms of their ability to reach improvements of the sustainability of the transport systems over the time.

In the last years, in more occasions the European Union underlined the importance of considering transport external costs, providing directions for their calculation and tackling, issuing guidelines for better infrastructures tariff systems and stressing the relevance of handling externalities in relation with the peculiarities of the local contexts, such as for Alps pass or vast built-up areas.

External costs evaluation purposes are not only limited to interventions on the price system, but are also the base point of other possibilities of intervention such as damages prevention or optimization of the territorial planning solutions, provision of incentives to more sustainable modalities or measures of administrative regulation.

Furthermore, again in the EU sphere, several studies and policy papers have dealt with the topic of the integration between “land use” and transport systems, taking into account the environmental aspects and the urban sprawl.





Within this context, the ECOTALE project - developed within the INTERREG IVC programme - aimed at integrating the traditional approach based on the “economic” (or market-based) internalization of external costs (i.e. pricing measures) by introducing criteria and policies for a wider internalization approach considering land use and environmental planning as well.

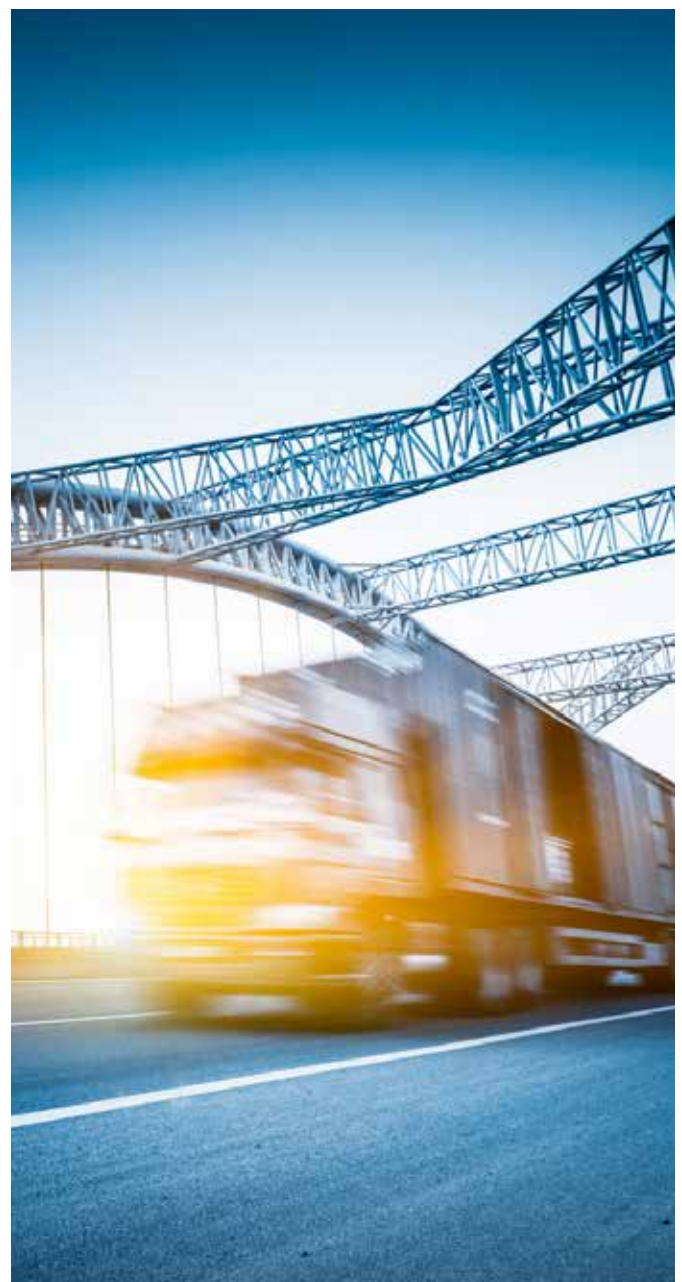
Building transport infrastructures produces diffused benefits (i.e. reduction of congestion, travel time, accidents, etc.) and concentrated costs (environmental costs, i.e. air pollution, noise, vibrations, and other costs, i.e. spatial exclusion, segregation, etc.). Costs and benefits have consequences on political, administrative, economic and financial aspects of the interested bodies, modifying policies, objectives and choices. Transport infrastructures are therefore a means of fiscal interdependencies and territorial externalities (environmental, clustering, planning) and of opportunities and threats for spatial development which are distributed unequally in space and which could irreversibly modify land patterns. Without policy intervention, these external costs are not taken into account by the transport users when they make a transport decision (the choice of a transport mode, whether to buy a car and which, how to use the car, which path to follow, where to park...) since they are facing incomplete prices and incorrect incentives: in a global economic and environmental accountancy, this leads to welfare losses and social costs unbalances.

Therefore, within the overall goal of a social, territorial and environmental sustainability of road transport and mobility systems, the ECOTALE project put focus and efforts to connect the challenges of internalizing external costs with those of integrating land use and transport planning and of having infrastructure decisions and investments consistent with clear and effective modal policies.

The internalization of external costs can be achieved when the account of all the social and environmental effects will be somehow made part of the transport-related decision making processes. That may lead to

a more efficient use of infrastructures and to a more sustainable split of trips among the alternative transport modes, thus reducing the negative side effects of the mobility systems.

A substantial amount of research projects, many of them supported by the UE, suggest that implementing market-based instruments inspired by the economic theoretical concept of marginal social cost pricing (Meade, 1952) could yield considerable benefits.





Fair and efficient transport pricing has also been advocated in a number of policy documents issued by the UE, notably the 2006 mid-term review of the White paper on the European Transport Policy. Internalization of external costs by market-based instruments is generally regarded as an efficient way to limit the negative side effects of transport.

Techniques for estimating transport externalities have reached a good level of maturity and availability; the EC commissioned "Handbook on estimation of external cost in the transport sector" (first edition in 2008, released under the IMPACT study, updated and reviewed edition in 2014) gives a useful review of such a state of the art.

However, also to foster a 'planning and investment approach' to transport internalization (i.e. reallocation of public resources in spatial planning, infrastructural decisions and modal policies) it has been felt necessary to provide Regions and Cities with concise and easily applicable guidelines, providing methodological and analytical advice and tips, quite based on real experiences, giving guidance for the main spectrum of sustainable mobility measures, in the perspective of the reduction of the global external costs of transport.

Therefore, based on the identification of reference modal policies and best practices analysis (both within and outside the project partnerships), methodological and applicative proposals have been formulated for the internalization of environmental and social costs of transport.

These guidelines reflect a spread and innovative perspective for transport costs internalization, with special focus on the relations between global transport costs and land use planning, with the aim of providing addresses to interested EU regional and local authorities to exploit into their local/regional policies the lessons learned from research and best available practices from.

With respect to the different policy topics, the methodological proposals have been formulated having regard to the following themes:

1. congestion charging
2. low emission zones / low traffic zones (lez/ltz)
3. parking regulations and pricing
4. road freight pricing
5. electromobility
6. speed limits
7. hov lanes
8. infrastructure funding with estate value capture
9. incentive-based measures
10. environmental taxes/charges
11. habitat & landscape protection
12. city logistics

For each of them, general definition and goals are outlined and the related policy topics and external costs are identified. A summary SWOT analysis highlights strength and weaknesses of each category, favourable possibilities and problems to be considered for the implementation of the actions. Some methodological suggestions out of the IMPACT handbook, elements derived from the good practices and other recommendations for the effective implementation of the action are provided as well.

In conclusion, some recommendations are provided for addressing planning and investment decisions based on global transport costs as a "preventive" and more strategic approach to internalization, besides transport pricing policies, aiming at improving equity and sustainability of the transport systems.



EXTERNAL COSTS RECALLS

Transport gives rise to side effects; these effects can become costs when they refer to congestion, accidents, air pollution, noise, impacts on climate change, natural fragmentation, etc.

The costs associates to these externalities are called external costs; they consist of costs to the society and, without policy intervention, they are not paid by transport users and are not taken into account by them when they make a transport decision.

As stated in the IMPACT Handbook (2008), it is important to distinguish between:

- social costs reflecting all costs occurring due to the provision and the use of transport infrastructure, such as wear and tear costs of infrastructure, capital costs, congestion costs, accident costs, environmental costs.

- private (or internal costs), directly borne by the transport user, such as wear and tear and energy cost of vehicle use, own time costs, transport fares and transport taxes and charges.

External costs refer to the difference between social costs and private costs. They are costs paid by others, i.e. neighbourhoods, the rest of the country, the world or the future generations.

Based on the economic welfare theory, transport users should pay all marginal social costs which are occurring due to a transport activity. According to the definition of marginal costs is given in the 1998 White Paper from the European Commission:

“Marginal costs are those variable costs that reflect the cost of an additional vehicle or transport unit using the infrastructure. Strictly speaking, they can vary every minute, with different transport users, at different times, in different conditions and in different places. Moreover for the last extra carriage on the train, car on the road, or ship at the sea, marginal costs can often be close to zero. Clearly such a strict definition is of no practical use, and like all other charging arrangements in the commercial world, a degree of approximation and averaging is





necessary to develop understandable, practical charging structures. Marginal costs may at times merely reflect an average of variable costs. More usefully, they should reflect infrastructure damage, congestion, and air pollution costs, and so would vary according to factors like unit weight or number of axles, peak times, urban travel, and engine emissions.”

Considering the private marginal costs (such as wear and tear costs of the each added vehicle and the related personal costs for the driver), optimal infrastructure charges should reflect the marginal external costs of using an infrastructure. These costs include wear and tear costs for the use of the infrastructure, congestion costs, accident costs and environmental costs. Parts of these costs are monetary relevant, while some parts (such as time losses, health damages, etc.) are social welfare losses.

Although the concept of externality plays a key role in the neoclassical microeconomic theory, in the theory of welfare economics and had been studied by a lot of influential authors (Marshall 1920, Pigou 1920, Scitovsky 1954, 1958 Bator, 1960 Coase, Buchanan and Stubblebine 1962, Arrow 1970, Meade 1973), the definition of this concept remains unclear.

According to the classification of Rothengatter (1994), a transport system generates three types of externalities: the first level of externalities is related to the interaction between transportation and non-renewable resources, the second layer to the inner interactions in the transport sector and the third level relates to the interaction between transport and other sectors of production and consumption. The third type of externality is mainly financial: it has an influence on the individual functions of production and consumption through prices and the private market. There is therefore an economic interdependence between transportation and the rest of the economic system: an improvement in the transport system has a variety of beneficial effects that result in better welfare, in an economic surplus in many markets and in a stimulus to growth and innovation (increase in

living standards, increase in the market size, better spatial distribution of industrial activities and services, etc..).

Air pollution and noise appear as actual phenomena of the transport system and users, though aware of producing them, consider them as secondary effects and do not know the actual amount of the cost arisen from them. Congestion is an inner externality of the target transport system; in fact, its gravity is determined by the number of users who decide to use the target infrastructure despite the limited capacity. Therefore it has a different nature from other externalities that and must be considered in order to make the decision process efficient. The economic quantification of external costs implies the determination of multiple variables such as the values of environmental quality, green and biodiversity, the value of human health, the value of time and the value of security.

In the ECOTALE, the external costs categories that have been considered, i.e. accidents, air pollution, noise, climate change, congestion, nature and landscape, infrastructure wear and tear.

CONGESTION

Traffic Congestion Costs consist of incremental delay, driver stress, vehicle costs, crash risk and pollution resulting from interference between vehicles in the traffic stream, particularly as a roadway system approaches its capacity. Each vehicle on a congested road system both imposes and bears congestion costs.

Costs related to congestion mainly consist of the cost of additional travel time plus some 10% for vehicle operations and have internal and external components. The cost of delays experienced by each individual traffic participant is internal and is part of his or her user costs.

Each additional vehicle in the traffic stream can interfere with other road users, which imposes an incremental delay and crash risk. The cost of delays imposed on other road users is external.



Congestion problems on the road can basically be split into two categories:

- congestion in urban areas.
- congestion at major corridors.

Congestion around urban areas may best be addressed by city (area) tolls (area licensing /cordon charge, e.g. London, Shanghai or Stockholm). Toll may be differentiated according to time of day (e.g. peak and off peak). To improve accessibility and provide alternatives, revenues may be earmarked for investments in the transport sector, including the financing of public transport alternatives.

The second type of congestion is related to congestion at major corridors outside of city centres. There are two possibilities for tackling congestion on corridors. The one is optimal capacity management by differentiating a congestion toll according to time of day, in order to guarantee optimal traffic flows with low congestion risk.

The second possibility for reducing congestion on corridors is increasing capacity. This increase can be a new lane (also priced with value pricing) or a new bypass.

NOISE

Noise can be defined as the unwanted sounds of duration, intensity, or other quality that causes physiological or psychological harm to humans. Noise costs consist of costs for annoyance and health:

- **costs of annoyance: transport noise imposes undesired social disturbances, which results in social and economic costs like any restrictions on enjoyment of desired leisure activities, discomfort or inconvenience (pain, suffering), etc.**
- **health costs: transport noise can also cause physical health damages. Hearing damages can be caused by noise levels above 85 dB(A),**



while lower levels above 60 dB(A) may result in nervous stress reactions, such as change of heart beat frequency, increase of blood pressure and hormonal changes.

The negative impacts of noise on human health result in various types of costs, like medical costs, costs of productivity loss, and the costs of increased mortality.

In road transport the sound emitted is mainly made up by the sound of the propulsion system and the sound of rolling. The ratio of both sources depends on the speed of the vehicle.

AIR POLLUTION

Air pollution costs are caused by the emission of air pollutants such as particulate matter (PM), NO_x, SO₂ and VOC and consist of health costs, building/material damages, crop losses and costs for further damages for the ecosystem (biosphere, soil, water). Health costs (mainly caused by PM, from exhaust emissions or transformation of other pollutants) are by far the most important cost category.

Transport related air pollution causes damages to humans, biosphere, soil, water, buildings and materials:

- **health costs:** Impacts on human health due to the aspiration of fine particles (PM_{2.5}/PM₁₀, other air pollutants). Exhaust emission particles are hereby considered as the most important pollutant. In addition Ozone (O₃) has impacts on human health.
- **building and material damages:** Impacts on buildings and materials from air pollutants. Mainly two effects are of importance: soiling of building surfaces/facades mainly through particles and dust. The second, more important impact on facades and materials is the

degradation through corrosive processes due to acid air pollutants like NO_x and SO₂.

- **crop losses in agriculture and impacts on the biosphere:** crops as well as forests and other ecosystems are damaged by acid deposition, ozone exposition and SO₂.
- **Impacts on biodiversity and ecosystems (soil and water/groundwater):** the impacts on soil and groundwater are mainly caused by eutrophication and acidification due to the deposition of nitrogen oxides as well as contamination with heavy metals (from tire wear and tear).

CLIMATE CHANGE

Transport is responsible for around a quarter of EU greenhouse gas emissions making it the second biggest greenhouse gas emitting sector after energy. While emissions from other sectors are generally falling, those from transport have increased 36% since 1990. This increase has happened despite improved vehicle





efficiency because the amount of personal and freight transport has increased.

Road transport alone contributes about one-fifth of the EU's total emissions of carbon dioxide (CO₂), the main greenhouse gas. More than two thirds of transport-related greenhouse gas emissions are from road transport (http://ec.europa.eu/clima/policies/transport/index_en.htm).

These emissions contribute to global warming resulting in various effects like sea level rise, agricultural impacts (due to changes in temperatures and rainfall), health impacts (increase in heat stress, reduction in cold stress, expansion of areas amenable to parasitic and vector borne disease burdens (e.g. malaria, etc.), ecosystems and biodiversity impacts, increase in extreme weather effects, etc.

The main greenhouse gases with respect to transport are carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄). To a smaller extent emissions of refrigerants (hydrofluorocarbons) from Mobile Air Conditioners also contribute to global warming.

ACCIDENTS

External accident costs are those social costs of traffic accidents which are not covered by risk oriented insurance premiums. Therefore the level of external costs does not only depend on the level of accidents, but also on the insurance system.

The most important accident cost categories are material damages, administrative costs, medical costs,





production losses and the so called risk- value as a proxy to estimate pain, grief and suffering caused by traffic accidents in monetary values. Mainly the latter is not covered properly by the private insurance systems.

NATURE AND LANDSCAPE

Three types of negative impacts are relevant (OSD, 2003): Habitat loss, habitat fragmentation and habitat quality loss due to destruction, fragmentation or degradation of the natural environment. Habitat destruction is currently ranked as the primary cause of species extinction worldwide.

The estimation procedures are:

- repair cost approach for ground sealing and other impacts on ecosystems (disturbance of animals and their biotopes by noise or barrier effects, visual disturbance, etc.) (INFRAS/IWW, 2000/2004).
- standard price approach for quantifying the negative effects of airborne emissions on ecosystems and biodiversity (through acidification and eutrophication) (Externe, 1999; NewExt, 2004).
- two-stage approach for quantifying biodiversity losses: a. repair costs for reduced species diversity due to land use change and b. repair costs for negative effects of airborne emissions on ecosystems and biodiversity (through acidification and eutrophication) (NEEDS, 2005a).
- two-stage approach for habitat loss and fragmentation:
 - a) compensation costs for habitat loss due to transport Infrastructure (creating compensatory ecosystem) and
 - b) compensation cost approach for habitat fragmentation (OSD, 2003).

INFRASTRUCTURES

Expenditure on new road infrastructure must be considered as an investment, because it creates benefits that last more than one year, and as such, the capital costs are generally not equal to the expenditure on capital. The total yearly operating and maintenance costs are taken directly from the accounts of the respective road authorities, assuming that these costs are strictly attributable to the traffic of the year where the expenditures are paid.

Studies distinguish between different cost categories:

INVESTMENT EXPENDITURES:

- 1 planning and surveying.
- 2 land purchase/right of way.
- 3 earthworks (ground preparation, drains, etc.).
- 4 substructures (base and frost protection course).
- 5 superstructures (binder and surface courses).
- 6 engineering works (bridges, tunnels, etc.)
- 7 equipment (traffic signs, etc.)
- 8 park and rest facilities

RUNNING COSTS

- 1 repair measures
- 2 operation (winter maintenance, green cutting, etc.)
- 3 traffic police
- 4 administration
- 5 toll collection



SHORTLY ABOUT INTERNALIZATION

Knowing transport external costs is a prerequisite to develop strategies for their internalisation, and thus to make progress towards sustainable transport, a key issue on the transport policy agenda.

The internalisation of these side effects means making them part of the decision making process of transport users. This can be done directly through regulation, i.e. command and control measures, or indirectly through providing better incentives to transport users, namely with market based instruments (e.g. taxes, charges, emission trading). Combinations of these basic types are possible: for example, existing taxes and charges may be differentiated, e.g. to Euro standards.

According to the welfare theory approach, internalisation of external costs by market based instruments leads to a more efficient use of infrastructures, reduces the negative side effects of transport activity and improves the fairness between transport users.

The purpose of internalisation of external costs is to make sure that the polluter and not the society pays. In other words, where market fails to ensure that the market price reflects the entire costs or benefits of certain activity, internalisation of such external costs/benefits serves to remedy the market.

The motives for internalisation and/or the introduction of pricing policies can be various (Impact Handbook, 2008, based on Verhoef, 2004).

Three motives for pricing policies can be distinguished (each with various possible policy aims):

influencing behaviour, to improve the efficiency of the transport system by:

- reducing environmental impacts of traffic
- allowing a freer flow of traffic (i.e. reducing congestion)

generating revenues, to:

- finance new, extended or modernised infrastructure (which may in turn be related to the aim of improving freer flow of traffic)
- cover costs of infrastructure management, operation and maintenance
- finance mitigation measures
- finance the general budget

increasing fairness, to:

- make the polluter/user pay (polluter pays principle)
- level out the income distribution or avoid overburdening of socially vulnerable groups
- prevent changes in income distribution
- level the playing field between transport modes.

The internalisation is meant to serve all these aims and to render operational the 'user pays' and 'polluter pays' principles.

When implementing pricing policies, a multitude of effects will occur, contributing to more than one potential aim.

The optimal internalisation strategy depends on the underlying aims and motifs behind pricing.



ELEMENTS & RECOMMENDATIONS OUT OF MAIN PREVIOUS EU STUDIES

Four out of the main reference studies performed at the EU level on the subjects of external costs and internalization in the transport sector have been reviewed and considered, to regain main summary

findings and policy recommendations, especially when in close relationship with the approach and main focus of the ECOTALE project.

1 “IMPACT – Handbook on estimation of external costs in the transport sector”

European Commission – DG TREN produced within the study

“Internalisation Measures and Policies for All external Costs of Transport (IMPACT)” - February 2008; updated January 2014)

- the project recommends differentiated charges with respect to vehicle characteristics, location and time of day;
- a distance-based charges for HGVs for the internalization of air pollution, noise and congestion costs is effective;
- a specific focus should be given to include additional measures in sensitive areas (e.g. Transalpine corridors);
- for climate change costs, CO₂-based taxes and emission trading systems are good options, particularly for maritime and aviation sub-sectors;
- it is recommended to make more explicit

- that the already allowed regulatory charges by Directive 2006/38/EC include additional urban congestion charges in urban areas and environmental charges in mountainous areas on top of the charges at average infrastructure cost and air pollution, noise and accidents costs;
- there is a strong case for applying more stringent legislation in cases where the gap between costs and charges is the largest, alternative modes of transport are available and where acceptability is already high;
- earmarking revenues enhances acceptability and related decisions should be left to Member States.

2 “External cost of transport” (INFRAS IWW)

International Union of Railways UIC
Zurich/Karlsruhe, October 2004

The project highlights the importance of considering internalization as part of a wider sustainability concept. In most cases, pricing measures are found to be the most cost-effective solutions but do not necessarily perform well with regards to effectiveness criteria. Overall effectiveness and efficiency can only be achieved through an optimal mix of pricing and non-economic measures. The following advices are thus provided:

- effectiveness of measures, in terms of impacts reduction,
- long term focus, considering the possibility of internalization measures as source to finance transport infrastructure;
- practicability and transparency for the users,
- special attention and specific measures for sensitive areas.



Such a wider concept has three pillars, which can be characterised as follows:

- an improved pricing system, which considers the different level of external costs between modes, as well in the price level and in the pricing structure;
- additional (non pricing) instruments which support the reduction of the level of environmental and accident costs;
- an institutional framework which allows sustainable decisions on infrastructure investment and financing.

The pricing instruments lead to steering and financing effects: crossmodal funds are especially useful to finance investments for areas or corridors, where the intermodal relation is rather strong (i.e. urban areas, sensitive regions, transalpine corridors, as it is applied in the Swiss approach).

3 “Study on Urban Aspects of the Internalisation of External Costs”

European Commission – DG MOVE
Rotterdam, November 2012

Starting from the evidence of considerable variations in the charging schemes according to the peculiarities of the local contexts, the project defines some lessons learned from past cases:

- congestion and air pollution are considered by cities and stakeholders as the most important negative externalities;
- to reduce such car traffic external costs, road users charges and parking policies are considered the most effective measure, the latter being the easier ones;
- charge levels are generally set pragmatically and not necessarily derived from estimated external costs
- it is recommended to introduce internalization measures as part of a package of complementary solutions aimed at improving overall transport services

- communication, public awareness and involvement are crucial, since the design phase of the policy;
- a trial case could be very effective: it helps to set an appropriate charge level, to test the impacts and to facilitate the acceptability of the charging scheme;
- earmarking and transparent use of revenues are key success factors, with public transport improvements being the preferred destination;
- the importance of monitoring is highlighted, for both raising acceptability and determining whether the initial policy objectives have been reached or not; in addition, it allows for the sharing of experience results between cities.



4 “An inventory of measures for internalising external costs in transport”

European Commission – DG MOVE
Supporting study for the EC internalisation strategy
Brussels, November 2012

- there is a need to further harmonise transport pricing across Member States, and particularly fuel taxes and infrastructure charging;
- it's recommended to develop policies that contribute to the implementation of kilometre charging on the entire road network and for both freight and passenger road transport.
- preferably, charge levels should be differentiated to key cost drivers such as emission class, location, time of the day (and/or congestion level) and axle load;
- differentiated vehicle registration charges/taxes related to specific CO2 emissions can provide a

- strong incentive to produce and consume more fuel efficient vehicles;
- fuel taxation, especially when related to carbon content, is an optimal instrument for internalising climate change costs (CO2), while its effectiveness with respect to other externalities (such as local air pollution or infrastructure costs) is disputed;
- evidence suggests that technological advances (e.g. vehicle tracking technology) has facilitated and encouraged the implementation of internalization measures such as distance-based charging and pay-as-you-drive policies.





GOOD PRACTICES – SUMMARY REVIEW OF THE REFERENCE SELECTION

During the mid part of the project, a specific search has been produced to identify policy cases of possible reference to render a picture of the state of application of the internalization principles and to provide empirical elements for the formulation of the ECOTALE guidelines.

The final collection counts some 50 considered and reviewed cases, out of which only a minority can be considered 'pure', explicit practices of transport internalization, following the established definition. Even if no assurance can be given about the comprehensiveness of the search, this can be most likely taken as a significant sample giving evidence of scarce actual practices of internalization when it is intended -in the strict sense- as some extra price directly charged to specific transport users as responsible of some given externalities (which could be clearly identified and measured).

However, in line with objectives and starting assumptions of the project, a more extended set of transport policy cases has allowed for consideration of potential or alternative level of internalization, when accepting to broaden its meaning, particularly in an applicability-oriented perspective.

Therefore, integrated and innovative planning approaches, funding and process schemes for infrastructure investments (for exclusive public transport developments or for optimized, mitigated and less-impacting road networks), road regulations (even when just in the form of some limitations) and other sustainable mobility measures have been included in the selection of cases and have been reviewed and discussed, with special regard to the attention paid to the externalities concerned, to their estimation and to their consideration in the policy definition and/or communication (policy acceptance issues).

On the other hand, even within the 'pure' pricing cases analysed (i.e. various kind of road access/transit charging and park pricing), evidence shows that

almost never the applied charges have been rigorously determined on the basis of the internalization economic theory (e.g. marginal cost as the sum of the external social costs -excluded congestion cost- produced by a virtual single additional vehicle at the congestion level corresponding to an equilibrium found iteratively as a result of the simulation of the effects of such a charging scheme...). This is not surprising at all to any planner or technician who -besides transport economic theory- is skilled on real policy processes as well.

Nonetheless, even in the real processes of the policy definition and verification, some good cases showed the usefulness and effectiveness of having -in the **ex-ante** phase- some estimates of local transport externalities and -in the **ex-post** phase- of having the opportunity to monitor and check the actual, quantitative effects on the modal shift (for instance) and thus to calculate the real modal elasticities in the system affected by the pricing measure (exemplar cases: London congestion charge and Oslo toll ring).

A distinctive mention is worthy with reference to road freight pricing experiences (see the Swiss and German cases), which seems conversely denoted by greater analytical formulation of the charging schemes, in terms of clear link with the externalities actually produced by heavy vehicles and a modulated application with respect to mass, emission standard and mileage.

The following paragraphs illustrate the methodology for the identification and the analysis and the complete collection of cases, with some summary statistics on the main classification criteria.

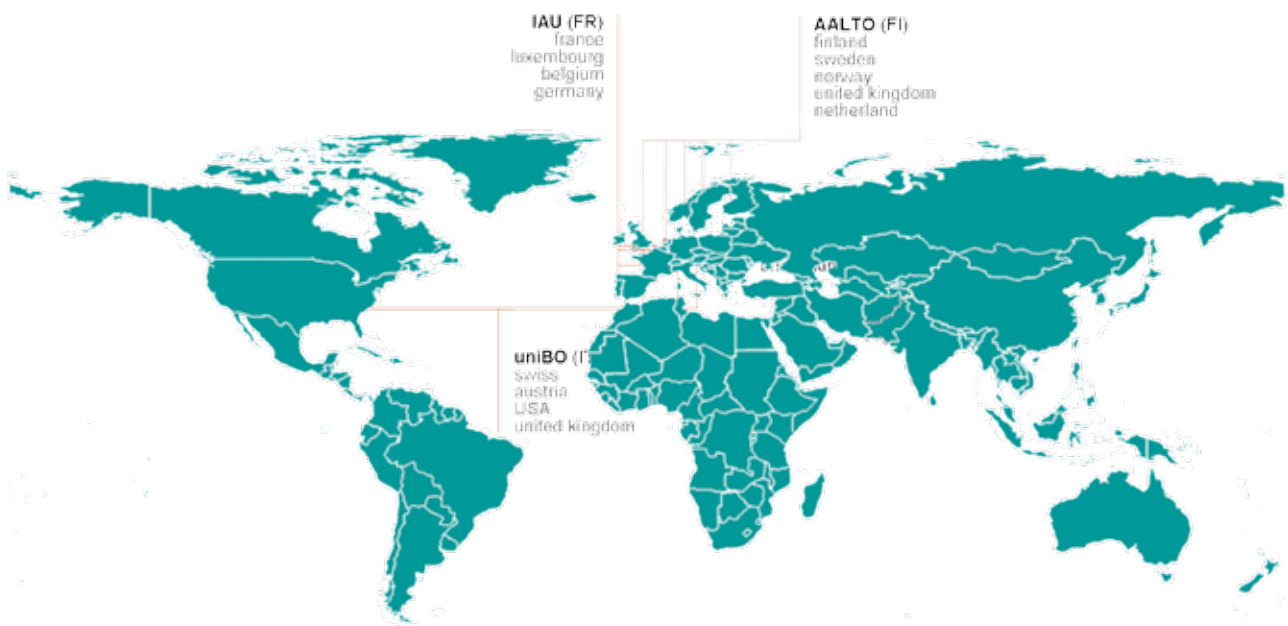
Within the extended collection, 15 cases have been selected to be mentioned and summarized within the Interreg 4C good practice common database (for programme capitalization purposes); several cases have then been utilized as source of good practice transfer -mostly pertaining to approach and methodology- for



the policy proposals formulated by the governmental partners of the ECOTALE consortium, through the 'implementation plans' developed for the respective local/regional contexts.

At the end of this chapter, a few summary consideration and conclusion are drafted as a result of

the overall view obtained with the empirical knowledge base offered by this good practice collection, also bridging to some of the propositions included in the guidelines and recommendations as well as in the main conclusions at the end of this volume.

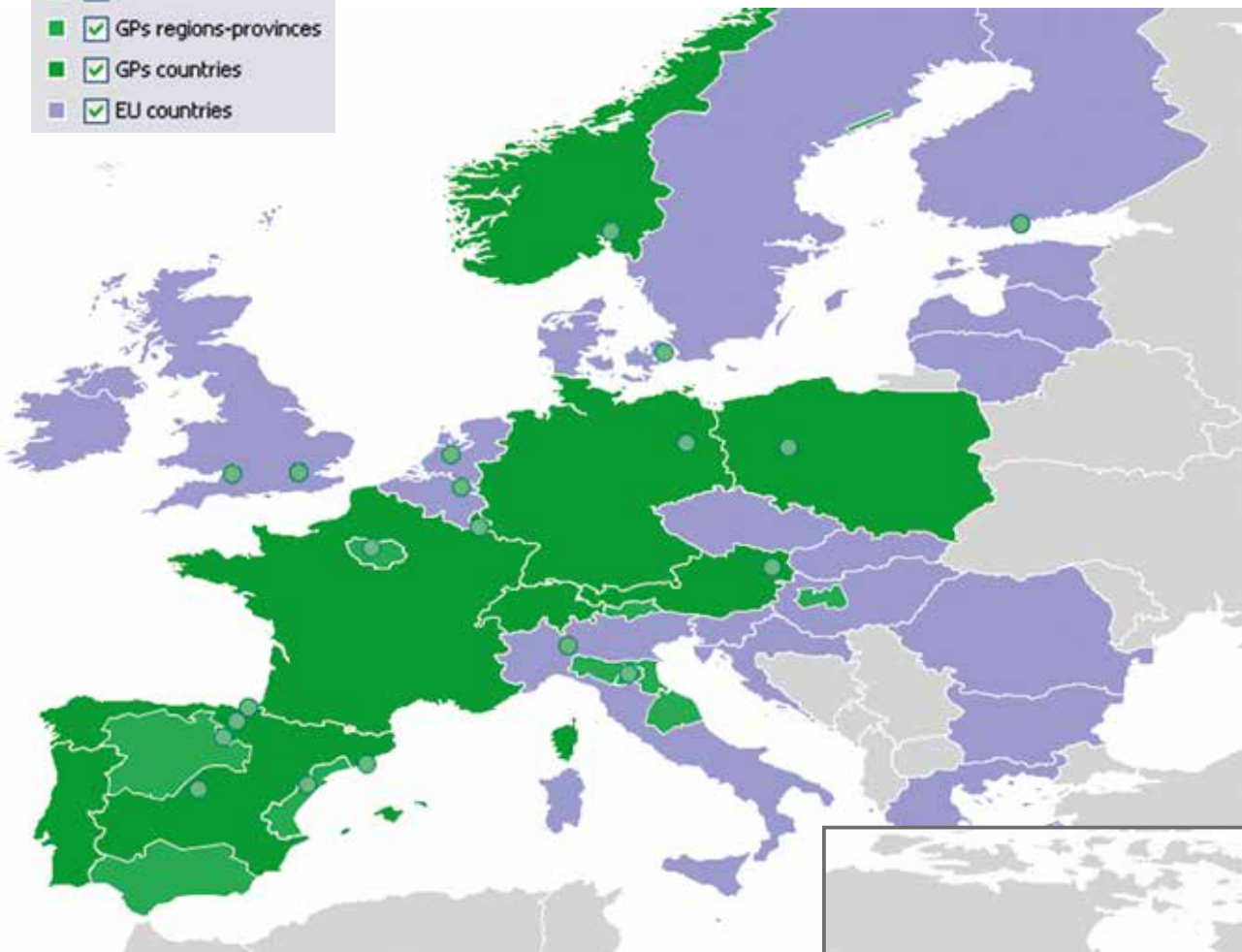


GEOGRAPHICAL COVERAGE OF THE SURVEY

geographical coverage of the survey followed an indicative definition of the search domains among the project partners; regional/local administrations addressed to respective countries, research bodies taking care of countries outside the consortium (see maps)



- GPs cities
- GPs regions-provinces
- GPs countries
- EU countries



COLLECTED CASES

map showing geographical distribution of the good practices identified, distinguished by territorial extent of the cases/policies (country wide, regional, urban/metropolitan)

<i>territorial extent of the policy case:</i>	<i>n. of cases</i>
country wide	10
regional/provincial	15
urban/metropolitan	24

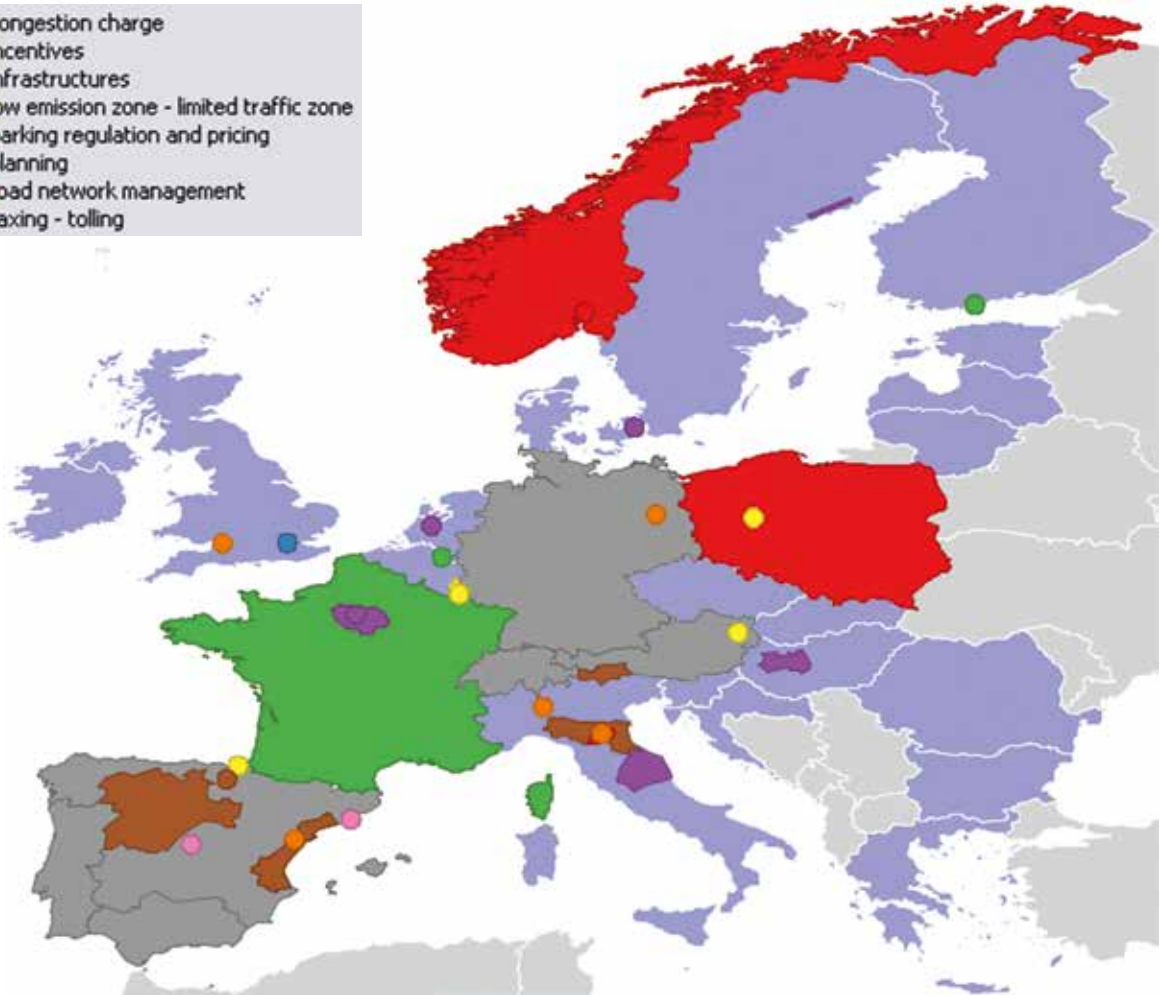


IDENTIFICATION AND RANKING CRITERIA

- as preliminary indication, the selection of good practice had been targeted at cases matching with the following (first instance) criteria, assumed as of high relevance within the scope of the project:
 - external costs: cases where an estimation of externalities is a determinant for the policy OR cases where the policy have been decided and introduced also referring to known/perceived external costs;
 - internalization: policies explicitly presented and introduced as internalization measures OR, though not explicitated, the policies act as an (implicit) internalization measure;
 - planning/policy process (in cases of pricing or subsidy measures): cases showing all or most part of the following planning/policy steps:
 - » the pricing scheme is introduced in the frame of a transport planning strategy;
 - » charges (tolls, fees, taxes,...) or subsidies are determined on an analytical base (statistics and/or accountancies and/or surveys and/or estimations; definition of specific parameters, demand-related values...);
 - » pricing incomes are destined and legally bound to specific actions in consistency with the transport strategy;
 - » monitoring and evaluation of the effects of the pricing measure are foreseen
- however, at least for the first selection, the scarcity of cases matching all the above criteria suggested to relax the selecting requirements; this decision was supported also by the peculiar perspective of the ECOTALE project, which aims at a broader proposal for internalization actions, especially by focusing on cost (re)allocations explicit or implicit in transport plans and policies and in infrastructural investments. The labelling categories used to group the cases in the synthetic cases description tables are to be intended only as main index entries, since some of those categories could be grouped in turn, under different perspectives, and since some of the cases present different features which could make them classified within more categories.



- congestion charge
- incentives
- infrastructures
- low emission zone - limited traffic zone
- parking regulation and pricing
- planning
- road network management
- taxing - tolling



POLICY CATEGORY
(categorization based on main policy field)

<i>categorization of case by main policy field:</i>	<i>n. of cases</i>
congestion charge	1
low emission zone - limited traffic zone	6
parking regulation and pricing	6
road freight pricing	3
e-mobility	2
road network management	2
infrastructures	9
incentives	3
planning	10
habitat - landscape	2
taxing - tolling	5



GOOD PRACTICE CASES SYNTHETIC DESCRIPTION

The labelling categories used to group the cases in the synthetic cases description tables are to be intended only as main index entries, since some of those categories could be grouped in turn, under different

perspectives, and since some of the cases present different features which could make them classified within more categories.

CONGESTION CHARGING					
BP id	case title	country	area	year of introd.	description
7	London Congestion Charge	UK	London	2003	The London congestion charge is a fee charged on most motor vehicles operating within the Congestion Charge Zone (CCZ) in central London between 07:00 and 18:00 Monday to Friday. It is not charged at weekends, public holidays or between Christmas Day and New Year's Day. The standard fee is £10 per day if paid by the day's midnight, £12 if paid by the end of the following day, or £9 if registered. The organisation responsible for the collection of the charge is Transport for London (TfL), with Capita Group operating the scheme under contract.

ELECTROMOBILITY					
BP id	case title	country	area	year of introd.	description
29	Autolib' Paris	FR	Paris + 46 surrounding cities	2011	Autolib' is a self-service electric car hire scheme launched on December 2011 in the Paris Region. Modelled on the success of the city's bike sharing scheme, it is the first of its kind to be implemented in a big European metropolis. The service operates on a 24/7 basis. The Autolib' stations can also be used for private electric vehicle users (cars or two-wheelers).
36	Network of electric charge points for e-cars	ES	Spain and Portugal	2009	The measure consists in a web platform with information provided about the electric charge points in both Spain and Portugal

HABITAT - LANDSCAPE PROTECTION					
BP id	case title	country	area	year of introd.	description
1	Habitat defragmentation program included in the highway maintenance program	CH	Switzerland	1998	the defragmentation program aims at building fauna overpasses and retrofitting infrastructure as part of highway widening schemes
42	LIFE LINCE project	ES	Andalucia	2002	The project aims at providing safe permeability of the roads for protected animals. It has permitted the construction of safe pass zones for animals like the "LINCE" (Spanish endemic endangered animal).



INCENTIVE BASED MEASURES

BP id	case title	country	area	year of introd.	description
16	Employer-subsidized commuter ticket	FI	Helsinki Metropolitan Region	2006	Employer tax-exempt fringe benefit for subsidized commuter tickets: if the share of the ticket paid by the employer exceeds € 600 but is less than € 3.400, the taxable value of the benefit is € 300. Also personal value tickets come under the benefit scheme (e.g. cycle to work can partly take advantage of the benefit).
23	Hasselt zero-fare public transport policy	BE	Hasselt	1997	An upgraded and free bus service. Local bus lines are free for everyone (including non-inhabitants, i.e. tourists and residents living in the region). As for regional buses, only the rides within the boundaries of the city are free for Hasselt's inhabitants.
28	French feebate programme or Bonus-Malus	FR	France	2008	The Bonus-Malus or feebate program was one of several measures comprised in the Grenelle green fiscality package. The programme paid buyers of new cars emitting a maximum of 130 gCO ₂ /km a bonus ranging from €200 to 5.000 depending on emissions levels and imposed a fee of €200 - 600 for the acquisition of cars emitting more than 160 gCO ₂ /km. A super-bonus is also attached to the programme for the purchase of a 'decarbonated' vehicle.

INCENTIVE BASED MEASURES

BP id	case title	country	area	year of introd.	description
5	Blueprint Sacramento	USA	California	2004	The Blueprint project is a regional vision planning process that addresses land use, transportation, air quality, housing, and other regional issues. The Blueprint is focused on sophisticated modeling and technical analysis of the linkages among transportation, land use, and air quality, as well as an extensive public engagement to help the public, planners, and other regional stakeholders.
6	I-405 Corridor Program	USA	Seattle - WA	1992	An upgraded and free bus service. Local bus lines are free for everyone (including non-inhabitants, i.e. tourists and residents living in the region). As for regional buses, only the rides within the boundaries of the city are free for Hasselt's inhabitants.
28	Crossrail London	UK	London, UK	2001	Crossrail is a joint venture between Transport for London and the Department for Transport to build a new railway linking Maidenhead and Heathrow in the west, to Shenfield and Abbey Wood in the east. Crossrail will provide high frequency, safe and comfortable journeys, carrying 72.000 passengers per hour in peak times along the central section. Construction has already started, with the central section expected to be completed by the end of 2018. Crossrail aims at generating £500 million in the region for the Crossrail funding package by maximising the property development opportunities above its stations and on land currently being used to support Crossrail's construction.

INFRASTRUCTURES

BP id	case title	country	area	year of introd.	description
9	Ørestad, Copenhagen Metro line	DK	Copenhagen	1992	<p>Ørestad is an area approximately 5km south of the city Centre of Copenhagen on the island of Amager. Despite being relatively close to downtown Copenhagen and Copenhagen Airport, it was relatively undeveloped until the 1990s. To develop this land, the Ørestad consortium (Ørestadssel-skabetl/S) was set up in 1992 with two main goals:</p> <ul style="list-style-type: none"> • to develop and sell the land for housing, offices, schools, etc; • to finance the building and operation of the Metro through the sale of land.
10	Quadrilatero delle Marche	IT	Marche Region - Umbria Region	2003	<p>The Marche- Umbria Progetto Quadrilatero involves the construction of road infrastructures (whose axes ideally represent the four sides of a quadrangle) through an innovative financing plan, the Area Vasta Plan. The innovation carried out by the Progetto Quadrilatero consists in the construction of road infrastructures using a particular form of Public Private Partnership (PPP) generated by the PAV (Area Vasta Plan) which is responsible for co-financing the works, reducing the economic outlay of State and Region. The co-financing mechanism - carried out and implemented by the PAV - is the " Value Capture". The PAV project is based on a basic assumption: upgrading and building road infrastructures, as well as improving the quality of life in the area, creates the conditions for an increase of economic development. Several elements have been provided and matched together to capture the value and find the co-financing necessary for the "Progetto Quadrilatero" realization</p>
51	Nottingham Express Transit LRT scheme	UK	Nottingham	2012	<p>Extension and improvement of the Nottingham Express Transit LRT system by a PPP model (complex build and operate concession, almost completely funding the LRT system investments and operation) encompassing construction of new lines and operation of the entire network, including park&ride sites.</p>
30	The Metro line 11 Charter	FR	France- Ile-de-France region	2008	<p>'The Metro line 11 Charter' is an experimental initiative launched by the Regional Council of Ile-de-France, IAU-îdf and the STIF (regional transport authority), based on the eastern extension project of the Paris Metro line 11. The project grew out of the concern of making the practice of integrated land use and transport planning more operational, notably along corridor projects. Following a 9 month negotiation process, all 13 stakeholders of the project approved a Charter which creates a decision-making partnership, states the overall objectives of the initiative and the responsibility of each entity.</p> <p>The project has not only addressed dense and mixed land use urban development around the future Metro stations. It also seizes the opportunity of the transport project to promote economic vitality and to enhance living conditions at the municipal scale by given specific attention to the integration of green networks, open spaces and soft modes.</p>



INFRASTRUCTURES

BP id	case title	country	area	year of introd.	description
31	T3 Tramway	FR	Paris		
49	Rehabilitation of the Budapest-Székesfehérvár railway line section	HU	Central Transdanubia Region	2007	The aim of the project is the central section's rehabilitation of the TEN-T railway line Budapest-Székesfehérvár-Nagykanizsa-(HR), through the building of a new second track between Budapest and Tárnok, the modernization of the double track line between Tárnok and Székesfehérvár, the building of a new signalling and catenary system and, finally, the modernization of the platforms in order to make it possible a train speed increase on the route.

LOW EMISSION ZONE - LIMITED TRAFFIC ZONE

BP id	case title	country	area	year of introd.	description
12	Area C – Limited Traffic Zone of Milan	IT	Milan	2012	Area C is the charge policy applied in the central limited traffic area.
14	Limited Traffic Zone in Bologna	IT	Bologna	2005	The present LTZ applied in the central area of Bologna is the result of the progressive introduction of traffic restrictions and road user charging according to the urban traffic master plan. Only authorized users (residents, mass transport vehicles, zero-emissions or car-sharing vehicles, etc.) are allowed to enter the LTZ from 7 am to 8 pm Monday to Friday. Not entitled users' vehicles are allowed occasionally and under the payment of a daily charge. As to freight transport vehicles, the access is subject to rules, time windows and fees directly related to their Euro emission standard.
21	Low Emission Zone in Berlin	DE	Berlin	2008	All diesel vehicles not meeting Euro 2 standards and petrol cars not meeting Euro 1 standards have been banned from driving within the zone. In January 2010 the criteria were tightened up to Euro 4. Alternatively, retrofit with particle filters is mandatory for diesel vehicles, including passenger cars and commercial vehicles.
44	Restriction on Private Car Access in Cities	ES	Morella and Vitoria, Spain - Region of Valencia and Basque Country	1994	the project aims at reducing the impact of the private vehicles in the cities through measures like total restricted access and superblocs
45	Urban consolidation centre	UK	Bristol	2004	The UCC was designed to serve the Broadmead shopping area, a major retail location in the centre of Bristol (about 350 retails and other commercial establishments and further development expected). The UCC is located on an established industrial estate, approximately 16 km Broamead with a typical journey time of 25 minutes.



LOW EMISSION ZONE - LIMITED TRAFFIC ZONE

BP id	case title	country	area	year of introd.	description
46	London LEZ	UK	London	2008	The Low Emission Zone (LEZ) was introduced in 2008 to encourage the most polluting heavy diesel vehicles driving in the Capital to become cleaner. The LEZ covers most of Greater London. To drive free of charge within the zone, exhausts produced by vehicles must meet strict particulate emissions standards. Despite significant improvements in recent years, London's air pollution is still a concern, therefore LEZ standards became more stringent in terms of both amount of vehicles affected and tightness of emission standards (3 January 2012).

PARKING REGULATION AND PRICING

BP id	case title	country	area	year of introd.	description
3	Urban Parking Area Policy	AT	Wien	1993	Co-operative Parking Space Management is a planning tool which was set up in 1995 to find partnership solutions to the problems of parked vehicles in the City of Vienna. Using a computer-controlled garage system, a monitoring platform was established for planning for stationary traffic. District parking management was introduced in the city centre in 1993 and in 1995 in the inner city districts as a short-term parking model. Parking charges were related to time and distance and they were included in a wide framework, "Park & Ride" facilities were installed at important transport axes, in order to encourage motorists to switch to public transport. Car-sharing, the fast suburban railway (S-Bahn) plan for Vienna and developing links to the TEN node development in the Vienna region are further projects designed to ease the burden on the traffic system. The parking space management scheme takes a guiding influence on motorized individual traffic at its source and in a targeted manner and makes an important contribution to preserving vital urban mobility needs.
20	Helsinki comprehensive parking policy	FI	Helsinki	2013	The current parking policy in Helsinki has been developing incrementally by the decades. The parking policy has never been analysed as a whole but only as the sum of separate decisions. The new comprehensive parking policy aims to analyse the core principles of parking policy holistically.
25	Parking policy in the city of Luxembourg	LU	Luxemburg	2008	The parking policy consists in a set of push-and-pull measures: parking facilities for residents through residential parking licenses; development of park-and-ride schemes to promote public transportation in combination with a fast and frequent public transport connection to the city centre; a clear system of parking zones with different restrictions or parking regimes adapted to specific districts and depending on local pressures; regulation of parking duration, parking prices, and parking prohibition.



PARKING REGULATION AND PRICING

BP id	case title	country	area	year of introd.	description
26	The Kyoto cent	LU	Luxemburg	2007	The Kyoto cent is a measure to reduce fuel consumption in the country through a tax of 2 cent on petrol and 1.25 cent on diesel. Per capita motor fuel sales in Luxembourg are currently very high with regards to international comparison. This is particularly due to cross-border purchase or "fuel tourism".
41	P&R network controlled by guidance system	ES	San Sebastian (Basque country)	2011	The idea is to relieve city center from private car traffic through the creation of remote park-and-ride areas where users would leave the private car and then take a public transport link to the city center.
47	Paid Parking Zone	PL	Poznan	1992	The Paid Parking Zone is a payment standing area in the wider part of the city centre. Side parking areas can be red (most expensive, located in the city centre), yellow or green (less expensive, located in more remote districts). The PPZ affects private cars and delivery cars. An exception is made for motorbikes and authorized vehicles.

PLANNING

BP id	case title	country	area	year of introd.	description
11	Bolzano-Alto Adige provincial Transport Plan	IT	Province of Bolzano	2003	Provincial Transport Plan - main planning instrument for the governance of the transport and mobility system
13	Guidelines for the improvement of the road network to improve the accessibility	IT	Emilia-Romagna Region		The guidelines define some criteria to analyse and design infrastructure investments in order to improve the accessibility of the region.
27	The Gustave Roussy Cancer Institut (GRI) travel plan in Villejuif	FR	Ile-de-france region	2002	In order to solve its access and parking problems, the GRI, the leading European centre for combating cancer, set up a company/site travel plan to accompany its business extension project. The main measures included in the plan are the creation of an express shuttle service linking the main regional train station to the site, a Transport Information Point (PIT) which provides information on travel options and promotes alternative modes and a Carsharing service (a dedicated space for car-poolers, a "good conduct charter" to be signed by the car-poolers, badge management, GRI software set up on the hospitals intranet).
33	Burgos car-pooling scheme	ES	Region of Castilla and Leon	2009	The measure aims at promoting car sharing in the industrial areas of Burgos
35	Efficient driving educational plan	ES	City-Region of Valencia	2011	The Valencian Regional Energy Agency develops training courses for efficient driving to private users in order to minimize pollutions effects of driving. The courses are free and addressed to all interested citizens. There is a calendar indicating days of courses



PLANNING

BP id	case title	country	area	year of introd.	description
37	Mobility study in the land-use urban plan of the city of Ermua	ES	Ermua (Basque Country)	2011	The mobility study intends to analyse the effects of traffic in Ermua city in order to update the new urban planning programme for the next period 2013
38	Mobility plan in Alzira for industrial sector	ES	Region of Valencia	2011	The Energy Agency of Ribera is carrying out a Transport plan for the industrial area 'Ctra Albalat - Tisneres' in the municipality of Alzira to solve all the concerns about mobility in the industrial area. The AER will consider the measures to implement in order to improve the accessibility of workers to their companies, encouraging users to use more sustainable transport systems, such as walking, cycling, using public transport or car sharing schemes.
39	Ribera Alta area sustainable mobility plan	ES	County of la Ribera Alta - Region of Valencia	2009	A plan to improve the sustainability of the mobility at inter-municipal level (not only at urban level).
40	New PT fleet management system in San Sebastian	ES	San Sebastian (Basque country)	2011	
43	Valencian mobility agency	ES	Valencia region	2009	The agency controls and coordinates all the sustainable mobility policies and activities in the region

ROAD FREIGHT PRICING

BP id	case title	country	area	year of introd.	description
2	Heavy vehicle charging system	CH	Switzerland	2001	All domestic and foreign heavy vehicles and trailers for goods transport with a gross total weight of more than 3,5 tonnes are subject to the distance-related heavy vehicle fee (HVF). The HVF calculation depends on the kilometres driven within the borders of Switzerland (on any road), the permissible Gross Total Weight (GTW) according to the registration documents of the vehicle and the emission standard of the vehicle.
4	Pricing system for road freight transport	AT	Austria	2004	Electronic toll collection has been operating since 01/01/2004; the fee levied is proportional to the distance travelled without obstruction of the traffic flow (free flow, multilane). All vehicles above a permissible gross weight of 3.5 tons are requested to pay a distance related toll. Vehicles under this threshold have still to pay a time related user fee by buying the Vignette. The whole system of motorways and express roads (2.000) is under the responsibility of a state owned Motorway Company and is subject to the new toll collection system.



ROAD FREIGHT PRICING

BP id	case title	country	area	year of introd.	description
22	Germany LKW-Maut (Lastkraftwagen-Maut) HGV tolling system	DE	Germany	2005	The LKW-Maut is a national distance-based tolling system for HGVs based on the 'polluter pays' principle. It affects HGVs > 12 tons. Charging principle is based on a multi-factor toll rate application based on the distance traveled, number of axles and emission class of the target vehicle. An empty vehicle costs as much as a fully loaded one.

ROAD NETWORK MANAGEMENT

BP id	case title	country	area	year of introd.	description
32	HOV lanes in the main access roads of Madrid	ES	Madrid	2001	Creation of HOV lanes to support the most efficient use of private cars (car pooling: 2 or more people inside)
34	Introduction of speed limit on the access roads to Barcelona	ES	Barcelona	2011	Introduction of maximum speed limits on the highways accessing Barcelona. The installation of speed meters is being carried out from 2011 until 2014 in different point of the road covering all ring exits of Barcelona City.

TAXING - TOLLING

BP id	case title	country	area	year of introd.	description
15	Road pricing on multi-modal corridors	IT	Province of Bologna	2009	The Provincial Mobility Plan, a specific plan concerned with transportation and mobility systems at a sub-regional level, provides for road pricing in an innovative approach, introducing the concept of multi-modal corridors: road pricing mechanisms are introduced where a public transport alternative is available. Moreover, part of the revenues collected from road pricing should be destined to support and improve the public transport on the same multi-modal corridor.
17	CO2 tax	NO	Norway	1991	The tax is currently the most important climate policy instrument and affects 64% of Norwegian CO2 emissions and 52% of total GHG emissions. Some industry sectors were granted exemptions from the tax to preserve their competitive position
24	Eco-tax on HGVs	FR	France	2013	The charge will apply to national motorways that are not under public management and currently free of charge, as well as to roads managed by departmental councils and municipalities. The ecotax will be calculated on the basis of distance traveled, number of axles, total weight and Euro emission class of the vehicle.

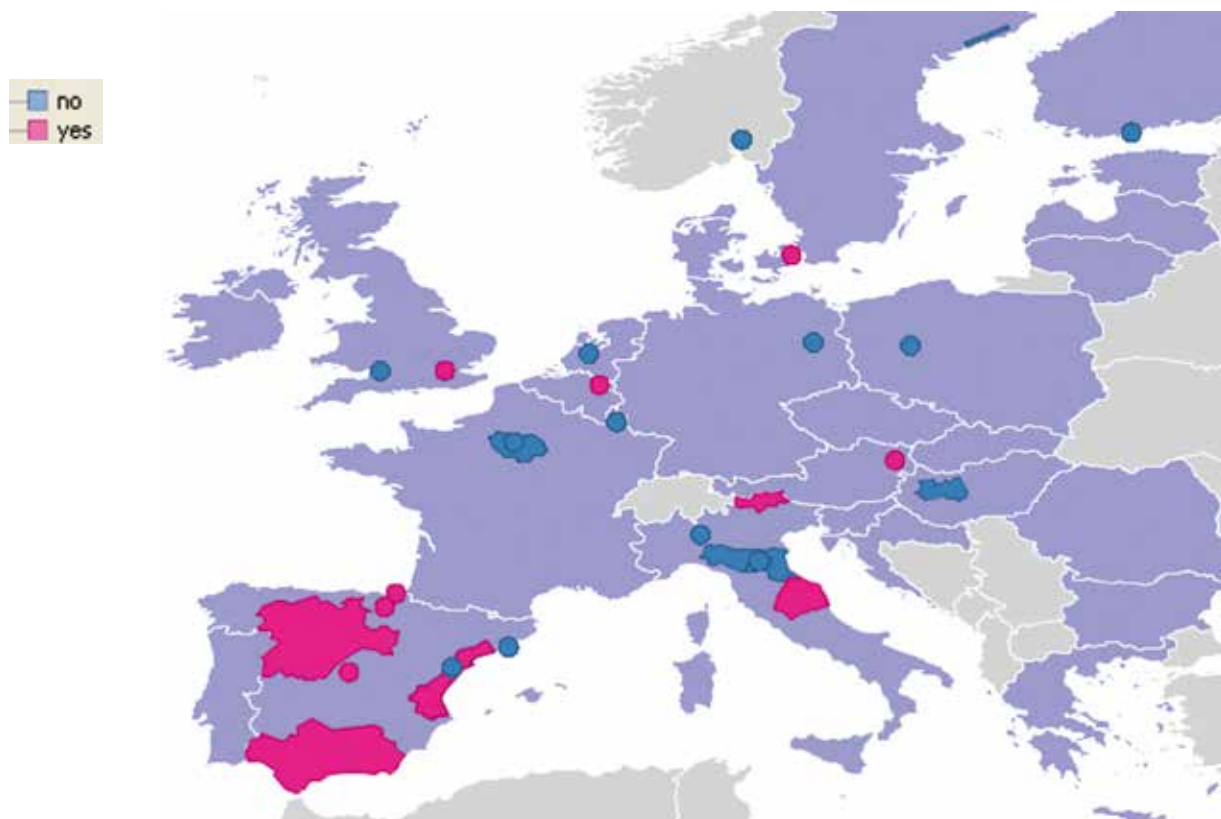
TAXING - TOLLING

BP id	case title	country	area	year of introd.	description
48	Vehicle tax	PL	Poland	1991	The vehicle tax is a local tax established by national law in general terms that affects the owners of vehicles above 3,5 tonnes except agricultural vehicles. The city council has a right to regulate this fee, establish exceptions, exemption and discounts; in any case the final amount has to be lower than the higher limit foreseen by the government. In 2011 reduction for vehicles meeting EURO 4-5 standards was approved. In 2013 lower fees have been planned for vehicles meeting EURO 5-6 standards.
50	Oslo-Akershus toll ring	NO	Oslo	1990	A tolling ring, based on electronic barriers on all roads accessing the Oslo city centre, collects charges on every entering motor vehicles, excluded motorbikes and electric cars. Vehicles up to 3,5 tons pay 30 NOK (2013, around € 3,60), heavy vehicles 90NOK (€10,80), regardless of their emissions standard, 24 hours a day, 365 days a year. The toll is in fact not intended as a congestion or environmental charging but as a generalized road user charge to fund new road infrastructures and public transport in Oslo and the Akershus county.



ESTIMATION OF TRANSPORT EXTERNALITIES

[country wide cases excluded in map]

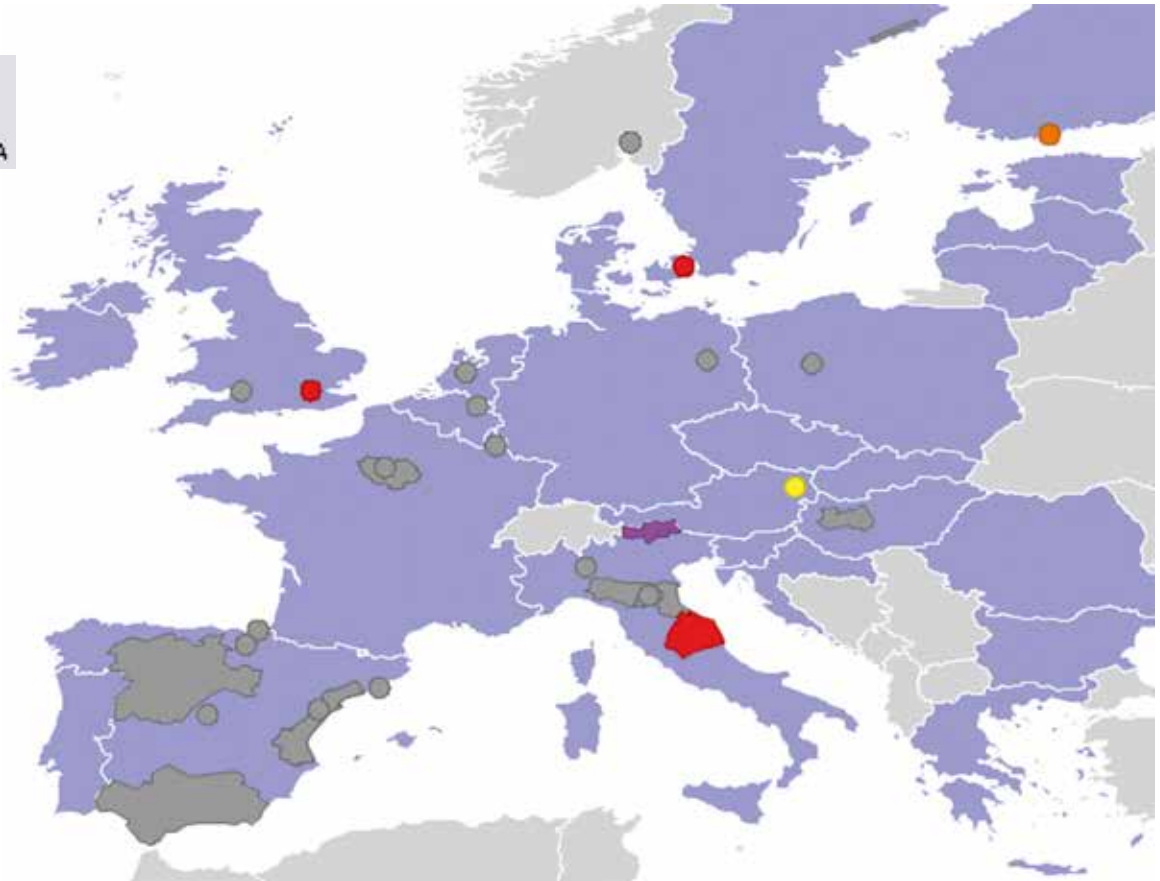


<i>role of transport externalities in the cases:</i>	n. of cases
estimated to define the policy	20
referred to in the policy definition	25
(other)	4



EXTERNALITIES METHODOLOGY OF ESTIMATION

[provisional map] [country wide cases excluded in map]

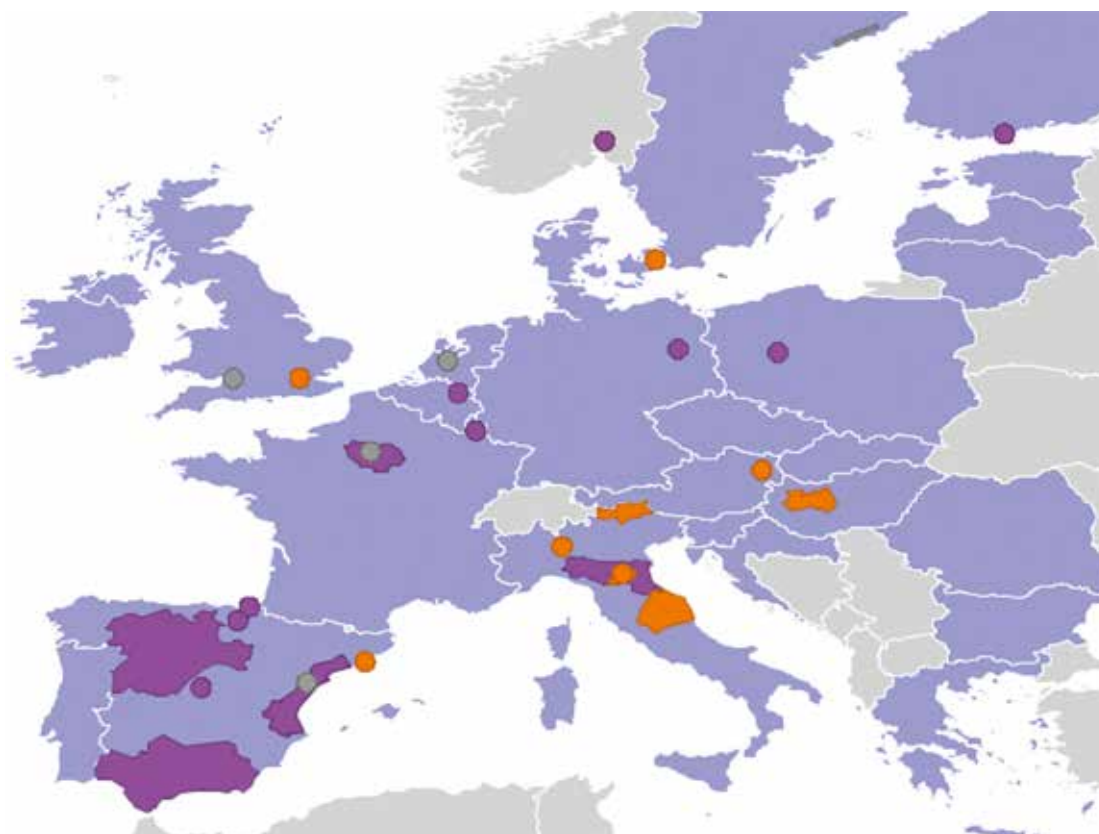


<i>reference to internalization in the policy measures:</i>	<i>n. of cases</i>
explicit	18
implicit	23
(other)	8



KIND OF INTERNALIZATION

(explicit/implicit, where the case) [country wide cases excluded in map]

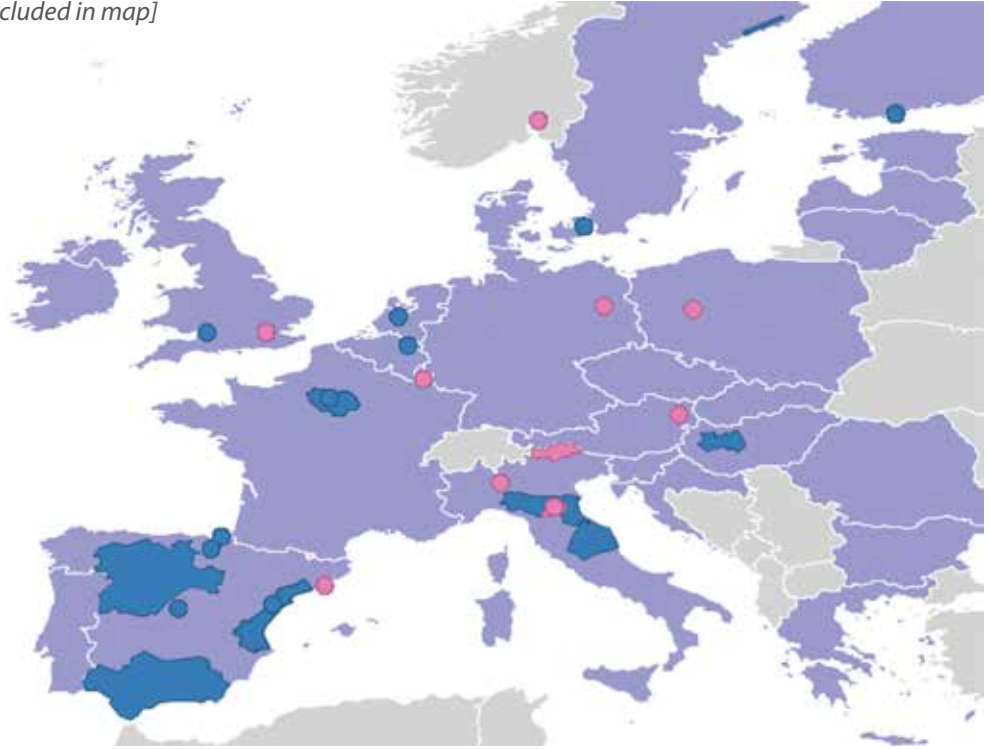


<i>financial means adopted within the cases:</i>	<i>n. of cases</i>
financial mean	
finance (funding)	23
subsidies	1
taxes	5
tolls - user fees	18
customs duties	0
reductions/exemptions/differentiations	14
(others)	4



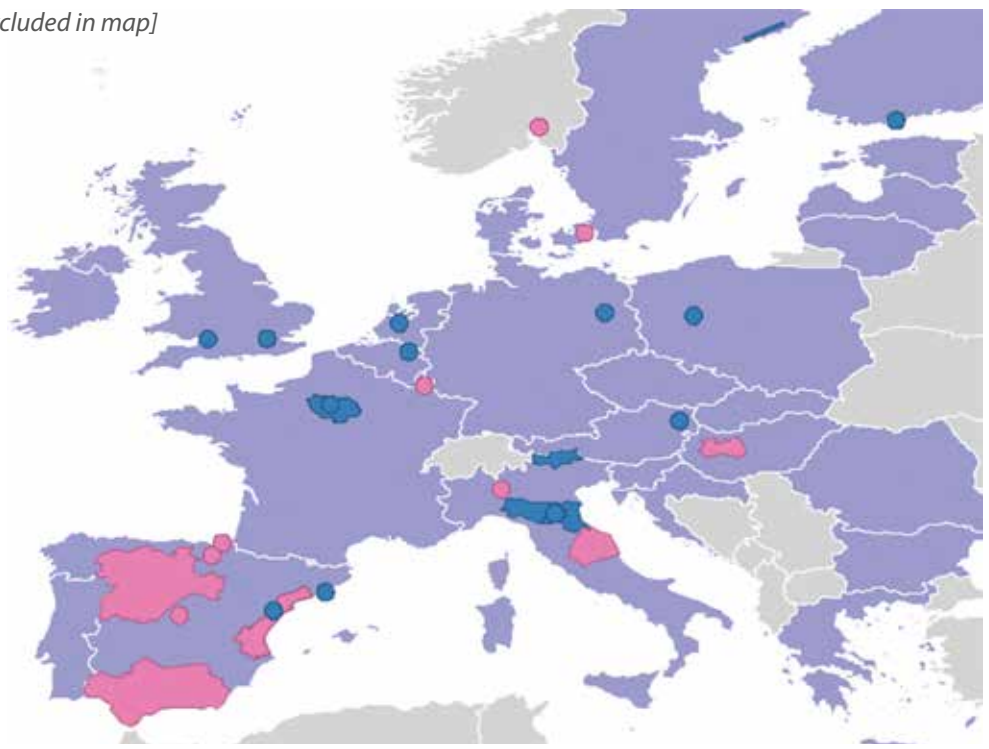
PRICING (APPLICATION OF TOLLS / USER FEES)

cases in pink [country wide cases excluded in map]



TRANSPORT FINANCE (FUNDING) SCHEMES

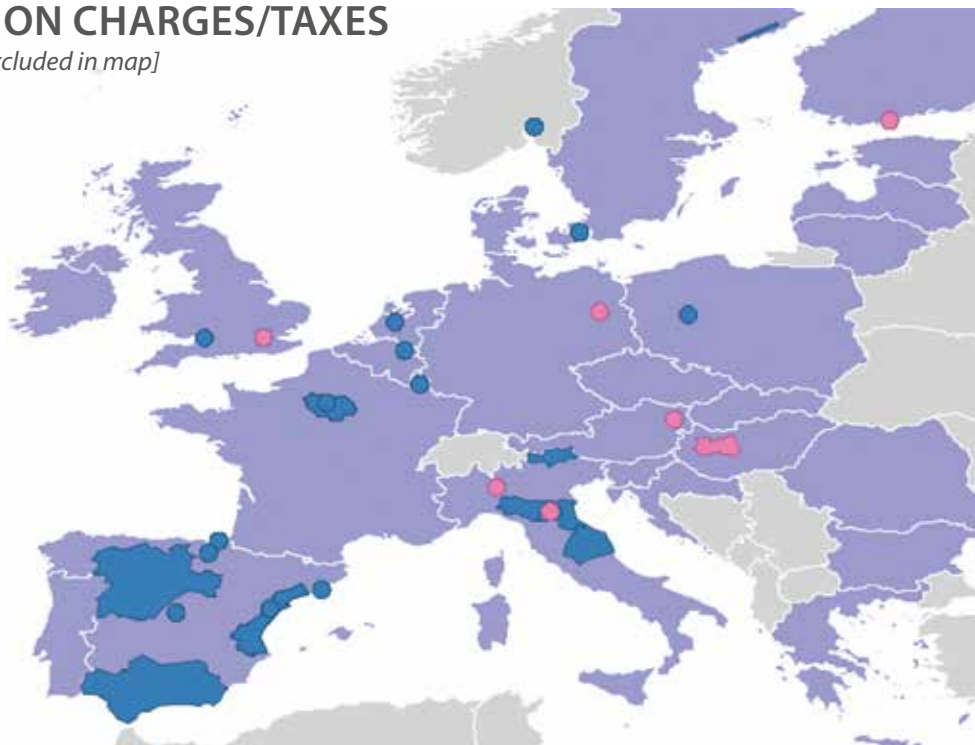
cases in pink [country wide cases excluded in map]





CASES WITH REDUCTIONS/EXEMPTIONS DIFFERENTIATIONS ON CHARGES/TAXES

cases in pink [country wide cases excluded in map]





SUMMARY CONSIDERATIONS OUT OF THE GOOD PRACTICES REVIEW

As briefly recalled also in previous sections of this volume, the ECOTALE project prospected a cooperative work (research centres acting together with local governmental bodies) aimed at depicting some progress state of the internalization approach to transport planning, with special focus on real practices and in view of formulating widely applicable guidelines. Practical feasibility, in terms of relatively easy definition, communication and acceptability of 'traditional' internalization measures, was in fact the main project perspective, together with a widened scope and formulation of its concept, to encompass possible planning approaches, where external costs and a social accountancy of the modal alternatives could be governed and balanced through territorial compensations, public capture of accessibility related estate values, infrastructure investments allocations and innovative funding schemes.

Having all of these possible policies and practices a clear consistency with the overall objectives of improving the modal splits and the sustainability of the transport systems as a prerequisite and logical foundation.

Principles and theory at the basis of the internalization proposals were and are well known, at least within the community of researchers and transport planners: "polluter pays", optimal 'regulation' of the transport demand through the application of the right price, which is the one including -for any different modal user- all the costs actually caused. In other words, the theoretical focus seemed to be addressed to the determination and application of costs without 'social discounts', neither explicit (subsidies, reductions) nor implicit (neglected external costs).

These assumptions and theory should therefore always lead to the proposition of an additional pricing, wherever the cost currently born by the user does not cover all the social and environmental costs.

But the empirical evidence out of the real cases collected confirmed the project hypothesis that these

principles and propositions appeared to be not as much known or not so applicable to regional/local politicians and technicians working in the public administrations. And this of course reflects on similar lack of knowledge and awareness by the wider user community.

Related to that, one of the ECOTALE messages stresses the importance of revealing the internalization meanings or values often implicit in many transport policies, at least where the structure of costs, particularly the relative modal costs, are altered in consistency with sustainability related objectives (i.e modal policies and/or environmental measures). Transport planning and integrated land- and transport planning could have implicit internalization values as well, provided that they allocate resources again in compliance with desired improvements in the sustainability of the affected mobility systems.

However, given the low popularity of internalization arguments, revealing its implicit presence in some transport policy could be not effective without associating estimates of actual externalities in the local contexts: communication of the extent of damages and costs justifying modification of users costs or of public funds allocations should be seen as a promising public acceptance factor, as much as planners and politicians will be able to show social unfairness of present conditions (before-policy). The second message is therefore a call to estimate and communicate transport externalities in order to raise consensus in favour of 'transport system determinant' plans, road users sourced infrastructure funding schemes, modal policies, road and parking regulations, be them or not direct user pricing measures (land or public fund allocations could for instance be seen as a sort of 'social pricing', which can be suitably connected to fiscal policies or other instruments able to bring the final costs and benefits to the right transport users, according to the social impacts respectively produced).



As stated in the introduction of this chapter, the analysed 'pure' road pricing schemes did not show amounts of charges rigorously determined on the basis of the marginal social costs, as postulated by the internalization theory. Most likely, such charges have been assessed through negotiated policy processes which have been rather driven by public acceptance challenges. This brings again to the crucial role of letting available -and widely communicating- estimates of the externalities concerned by each single policy proposal: in this way, the determination and acceptance of pricing charges could be eased and at least qualitatively connected to the real extent of actual external costs.

Moreover, remarkable differences in policy specifications and implications showed up for road pricing cases apparently associable in general terms: London congestion charge, Milan 'eco-pass', Bologna LTZ access fee and Oslo toll ring indubitably are schemes promoted, defined and communicated with some differences. Primary stated objective and nature of the charge are in fact determinant to some diversities in the way the charge is applied and differentiated (or not) among the various users categories (along the vehicle types, trip purposes, time of the day, day of the week...). If there is no doubt that a clear consistency between the (main) stated policy objective and the consequent charge determination and application is an important acceptability factor, it seems as well confirmable the common nature of internalization of such measures and some evident correlation among the different targeted (main) objectives (e.g. vehicle emissions are related to traffic levels and thus to congestion).

A special attention -in the general context of internalization potential- has been given to parking policies, where the pricing practice can be clearly connected to more general modal policies for the government of the mobility in urban areas. As well as for the mentioned cases of road pricing (access/transit related charges), also the parking fees seem rarely connected to some determination following the internalization

principles and theory: quite commonly accepted so far in every urban context with evident unbalances between available spaces and parking demand, the parking charge is rather intended as a sort of empirical multiplier of parking offer, due to its turn over effect. In a modal policy and urban mobility framework, then, parking tariffs are rather used as a lever to discourage private car access to inner city areas, to influence the parking durations, and to promote the use of parking lots or park and ride facilities as alternative to central on-street parking.

Specific road network regulations have then been considered as possible cases of implicit internalization measures: HOV reserved lanes and speed limit schemes (both completed with adequate enforcing measures) can in fact be seen also as policies for the governance of externalities as they produce cost effects, by means of the value of time (significant part of the generalized travel cost) for the differently affected users, and they can reduce external cost factors, such as for accident risk and dangerousness or for emissions. The internalization theoretical frame is therefore in place even for this kind of measures, as soon as they reduce externalities while raising the costs for specific users mainly responsible for them. Again, the challenge should be to introduce clear estimations and communication to justify and support such measures even under this perspective.

Finally, it has been decided to include among the reference practice also the case of the free public transport service offered in Hasselt (BE), even if the experience has ended in 2013. The 16 years operation of this policy (which has been recently started in Tallin, after a referendum approving it by 2/3 of the electors) could still provide another possible internalization scheme as soon as it implies a public cost (thus imposed to all the citizens, pro-quota) to support a less impacting transport mode. By benefiting of the free transport service, public transport users are somehow gaining refund of such a fiscal cost, which conversely remain born by private cars users (as tax payer not benefiting of the free service).



CONCLUSIONS

These guidelines have been produced in order to provide a concentrated view on transport externalities and the most relevant means of internalizing the detrimental effects of transport. True internalization is often a theoretical possibility only, and most applications only partially achieve internalization on a system level. However, this project has found solutions that provide – for the partners’ practices – the best fit for both political and public acceptability and effectiveness of application.

The selection of especially Good Practices must be seen as an extension of the combined “wisdom” of the project partners, and also as the answer to their most pressing need for curbing unwanted externalities. There is also a fundamental question of how to fund needed transport projects. One partial answer, and one that should satisfy, in financial terms, even the most critical opponent is “internalization” of the costs.

The conclusions deal with the overall “lessons” learned from the good practices, case studies, as well as the transfer/implementation processes within the project.

cultural effects and the “trickling down” of benefits or costs

- **The institutional component deals with the legal frameworks, the role of policy environments, and partnerships vital to application**

Policy packaging for synergies

Policy packaging is arguably the most important outcome of the experiences and evidence gathered throughout the project. The Good Practices show that only in very few cases has a single policy measure been successful to the degree of actually internalizing the perceived externalities. Most often a combination of measures is needed for creating the desired effect. Often there is a complex set of existing policies and measures that need to be taken into account.

The package should aim at producing either synergic or additive effects: synergic effects mean that the effects of the package exceed the sum of the effects of the individual policies, and additive effects equal the sum of individual effects. This could be achieved by combining measures that either make evasion difficult or make conformance easy, or both. The former is present in most restrictive measures, e.g. the Austrian pricing that targets all vehicles – in contrast to the LKW-Maut that only concerns vehicles over 12 tons, which could under some circumstances or in some locations result in evasion by acquisition of a larger number of lighter vehicles, thus maybe even increasing net emissions; the latter is visible in e.g. the Luxembourg and GRI packages that attempt to provide a consumer-centered system that supports mobility decisions that produce positive net effects. Care should be taken to ensure that the measures at least complement each other, so that each part of the package contributes to the net effects. One should avoid situations

Consistent integration within transport planning strategy and process

The previous studies and the Good Practices alike show the importance of aligning the desired measures with existing and future transport planning strategies. A clear indication of the underlying rationale(s) for the need to utilize a measure is the starting point for this alignment. There are three intertwined components that must all be satisfied for a viable integration:

- **The financial component deals with pricing, subsidies and financing issues**
- **The economic component deals with the wider effects of a measure, such as the societal and**



where measures substitute each others, e.g. that the effect of one policy is diminished with the application of the other.

Many policy/measure packages might not achieve synergic or additive effects yet their simultaneous application is seen to be beneficial. Especially in large projects where a wide variety of externalities need to be addressed, it may be necessary to introduce measures that fit the policy package or are politically needed, even if their net effect cannot be ensured. Such examples might be reptile and rodent escapes in inspection wells – whether they will e.g. improve, or stop degrading of biodiversity, or aid endangered species protection, is a question that most likely cannot be answered. However, from a political or acceptability point of view such a measure might be vital as a part of a policy/measure package on habitat protection. In addition, such measures could be necessary from the point of view of addressing uncertainties in relation to habitat loss and degradation.

Systemic understanding

Systemic understanding of both externalities and their internalization possibilities is the starting point for utilizing any measures such as the ones portrayed in these guidelines. Systemic understanding refers to the need to see the transport issues as systems that have their own operational logic, functional boundaries and territories. However, these sub-systems also operate within, along and in reciprocal relation to other transport sub-systems, land use systems, economic, social and even cultural systems. For example, a congestion zone must necessarily be delimited to a certain geographical area, but it forms a part of a wider functional transport network. It functions in relation to other urban systems - infrastructure, land use, retail, manufacturing, education, health care - that all have their own logics that may or may not interact with the (sub)system that is targeted with this specific measure.

The systemic approach makes the need for considerations of collaboration between the systems visible. This provides viewpoints for the needed and desired breadth of partnerships, their roles and interests in both participating in addressing the issue and anticipating the direct and multiplied effects of applying the measure.

The systems also have their own qualities that likely produce complexity in and through this interaction, be it challenges in interlacing restrictive parking regulations with perceived small retail needs or clashing of organizational cultures. These complexities tend to obscure the causalities that are targeted through the application of the measure, and this means it will be more difficult to see e.g. the real effects of the measure. However, as many of the Good Practices show, successful implementation is about finding a balance in both systemic inclusivity – which translates to e.g. technical rigor of implementation and operation – and collaborative scope – which in its turn creates communicational and political inclusiveness that affects acceptability and implementability.

Getting the price right for achieving the desired effect

There are volumes dedicated to how the prices should be calculated, estimated, researched and optimized, and while such methods can be the most important starting point for calculations, there are also other considerations that cannot be overlooked. Setting the price level from both system perspective (acceptable revenue base to provide needed levels of effectiveness and efficiency) and user perspective (acceptable payments for different user groups) often creates a window that is not optimal but possible. Earlier studies show that getting the price right is also a matter of distributional justice, social equity and public acceptance. The effects generally don't treat different



social groups similarly. It is important to note the need for additional, complementary measures can alleviate the situation, e.g. combination (packaging) that introduces non-pricing measures together with pricing measures, such as public transport improvements together with cordon tolls.

Careful consideration of “earmarking” revenues for both system expenses and redistributive actions – within or outside the policy package – is usually seen to improve the acceptability of schemes that often leave all social groups worse off than before. In most studies, earmarking is said to be a preferred option, but even more important is a clear indication of how the revenue is spent, irrespective of the spending model.

Early adoption of policies

The timing of the policy is often as important as its implementation. Early adopters face issues that relate to the

development of the measure itself and to its acceptability in the face of lacking precedents, but may in return enjoy the effects and related savings/internalization as early as possible. On the other hand, as measures need to be adopted to local circumstances in any case, development costs will always incur. Hence, the acceptability dimension is often more important to overcome.

Another challenge in timing is the adaptation to changing local frameworks, e.g. changes in legislation, regional governance or private sector restructuring. Phasing and coupling measures with urban development may produce economic synergies.

Early adopters also face the challenge of availability of supporting technologies. For the first adopters, technology is often experimental. Earlier studies have noted that small-scale trials may be the preferred option in these cases. Often the adopters can also share some of the costs with equipment/service providers due to the experimental nature.



LAND USE-TRANSPORT INTERACTION AND EXTERNALITIES

The land use effects of transport sector are well known and yet, despite a long-term commitment to land use-transport integration in policy and planning, they are still relatively rarely discussed in a satisfactory manner. One reason for this is the current practice of cost-benefit calculation of transport projects that practically prevents land use effects from being taken into consideration, due to fear of multiple accounting and uncertainty of outcomes. However, the EU guidance also gives advice on how to account for impacts that do not fall into the traditional externality categories. However, such calculations on e.g. impact on the economic development are not encouraged to be included in the cost-benefit analysis.

Land use elements of transport externalities

This project has specifically chosen to include land use effects as one of its focal points when discussing externalities. Several land use effects are visible in the previous studies and the Good Practices. Overall, a transport measure may affect the internal connectivity of the area where it is applied, or the effect may be in the external connectivity/accessibility. The location of future urban activities will thus be affected, as well as the mobility choices of urban residents and businesses, thereby affecting individual health and economic viability and efficiency. Preconditions for more efficient land use may be created, or sprawl may be promoted in the opposite instance.

There are strong land use elements to many externalities. The loss or improvement of urban quality, and/or livability, is the most often occurring effect that has land use and urban design dimension. Congestion makes urban environments less enjoyable, as does transport noise. Localized pollution may prevent not only street life but also create places that are not healthy to inhabit. Accident-prone transport environments are often perceived as dangerous and therefore avoided, which makes them less

desirable. Congestion, noise and pollution tend to produce land use patterns that are motivated by abatement rather than finding optimal locations for each activity.

This can happen through planning or voluntary selective processes. All externalities that have detrimental local effects to any of these dimensions may hamper economic activity, which may lead to relocations of businesses. Land values are affected by especially congestion, noise and degrading landscapes, and to some extent by extensive transport infrastructure, with strong parallels to urban quality and perceived effects to economic activity. Congestion is also a major factor in urban accessibility.

Whereas real barrier effects are created by congestion and transport infrastructure in general, also noise and pollution from transport may require use restrictions in affected urban environments. Noise may also increase the total area needed for development since noise abatement often cannot absorb all of the effect, thereby leaving some buffer zones that cannot be reasonably utilized. This may also lead to a need for compensating land use by provision of purpose-planned quiet zones. Also climate change effects may be manifested in land use through extra buffer zones for streams and coastline, and related compensatory land use elsewhere.

Integration of and use and transport aspects

As seen in some of the Good Practices, the coupling of land development and transport investment can produce a LUT system that can internalize its construction costs by creating an attractive interconnected set of development in both land use and transport, thereby increasing land values and thus enabling funding to be directly related to the benefits of the scheme. For this to function as true internalization, however, the approach needs a robust



framework that includes both a well-defined systemic definition (that there is an otherwise-unattainable causal and reciprocal connection between the investment and increased values) and an institutional partnership that is able to capture this value increase (land use planning powers, land ownership, development capabilities). Many of the Good Practices point at the benefits of an integrated LUT perspective, even if direct value capture schemes are not envisaged.

The spatial extent of land use effects can be difficult to determine. Modeling may provide good estimations to at least the scale of effects at different distances (either Euclidean, relative or relational distance) in theory, but often it is impossible to provide reliable real-life predictions, partially since the relevant spatial connections are so complex and effects are, at a distance, combinations of different diffuse processes where causality cannot be determined with ease. Also, especially urban areas have too many independent actors for them to be accounted for at the level of their transport and land use decisions.

However, the spatial extent of the measures should be specified accurately when possible, in order to account for the abovementioned issues of implementability, effectiveness, internalization and partnership. This is related to the systemic approach but bears also an independent land use component. The functional areas of land use, urban functions and everyday life (e.g. extent of planned development, service provision zones, retail hierarchies, travel-to-work areas) in and around the location of measure application should also be accounted for. This results in better “fit” between transport and land use policies, which often also translates to a perceived integration that in turn leads to better acceptability.

Adoption of ecosystem services approach

As most of the land use effects of transport deal with the physical, economic and natural environments and ecosystems, the abovementioned views on systems and integration seem to have resemblance with the now popular thinking of “ecosystem services”. In this approach, the ecosystem is seen to provide “services” of different kinds, and different measures (human activities, e.g. transport projects) have impacts on the ability of the ecosystem to provide those services (to the humans). In relation to transport, two main drivers of change are the changes in land use resulting from transport (projects) and the effect of pollution on the ecosystem.

Ecosystem services are divided into provisional, cultural and regulating services, where the first refers to those services that produce tangible products, the second to non-material or culturally important benefits, and the third to the benefits from regulating the balances that result in production being able to take place, cultural values being preserved and livability sustained. A fourth category is supporting services, those that ensure the provision of all other ecosystem services.

Ecosystem services point of view may be directly beneficial in evaluating the relation between transport and natural habitats, and it can provide answers left unanswered in the traditional assessments. However, it can also benefit the assessment of land use and urban impacts, through its existing methodology of framing for comprehensive inclusion of material and non-material costs and benefits.



MONITORING THE EFFECTS AND POLICY REVIEW

Monitoring the application of any measure is essential for being able to assess the true effects. While monitoring is a complex issue, not least because even understanding what can and is being monitored in reality can be difficult to grasp. However, there are certain preconditions that enable successful monitoring, evaluation and subsequent policy review.

First and the most important aspect is a clear definition of what the project aims to achieve. Setting goals that can be measured or otherwise evaluated in a consistent way means that not only eventual success, but also the effectiveness and efficiency of measures can be assessed. However, it is important to note that it is often necessary to include, or even start from, goals that are based on e.g. values that cannot be quantified, with the effects being visible only in the long term. Also these goals may often be broken to parts that have some measurable aspects.

The main challenges for monitoring include technical issues such as monitoring system qualities and technological reliability, data quality and the cost of monitoring. Often data needs to be collected from different sources. With increased complexity of the integrated system that is being affected by the measure comes increased complexity of data systems. Interpretation and calculation of effects and efficiency should be made for the same systemic composition as the original assumptions.

Anticipation and interpretation of unexpected results is however an integral part of monitoring as well. Furthermore, especially when effects are more diffuse in nature, as in e.g. economic development of a region, it may be difficult to isolate the effect of a measure from the effects of other simultaneous developments. What generally should be avoided in assessing effectiveness and efficiency is multiplying of results by assigning same effects to all simultaneous measures. However, since often singular measures are necessary from the point of view of a larger system, if not very effective or efficient in their immediate field of application, care should be taken to position such measures within the whole system that they benefit. This also emphasizes the importance of integrative approaches and the systemic view.

Monitoring provides the basis for policy review. This also needs clear and robust rules for assessing success and failure. Resilient strategies need to be built for sustained application, but a balance between creating flexibility for local adaptations and providing strategically sound long-term framing must be achieved. Another balancing act is that between promoting, supporting, regulating and controlling aspects in order to achieve desired effects with reasonable costs for both application and monitoring.



	Consistent integration within transport planning strategy and process	Land use-transport integration	Monitoring of the effects and policy review
Congestion charge	Supporting measures such as public transport connections and LEZ crucial	Geographical extent and supporting measures should be directed to counteract negative land use effects	The expensive technical equipment might do the monitoring easy, but the system should also be flexible to eg. enlarge or diminish the charge area
	Income from the charge should be used into the supporting measures	The land use inside the charge zone must support the goals of the congestion charge policy	
	The fiscal balance of the charge might surprise but the charge should never become just another tax to fund the general budget	Efficient land use policies needed outside the zone, so that congestion outside the charge zone is not induced	
Low Emission Zones / Limited Traffic Zones (LEZ/LTZ)	The other externalities and areas must be taken into account, not only suboptimizing the central area local emissions	Do the exceptions for locals and actors, perceived as vital, influence the land use within the zone?	Registering the vehicles crucial, but how to determine the link between the single vehicle and the real emissions produced?
		How will the freed street space be used? Uses that improve urban spaces and create revenue should be investigated	Difficulties to take into account weather, changes in the land use (such as sensitive facilities), changes in the general fleet and fuels
Parking regulation and pricing	Parking price is a cornerstone of an integrated transport policy, free parking should be a specifically justified exception, not the default	Parking policy and land use have a close two-way relationship	Without effective control the parking policy can easily be evaded
	The spatial extent of the policy must be wide enough	Parking regulation should be tied to land use regulations, e.g. by encouraging the separation of the parking place cost from apartment cost in residential areas	
	Parking fees should be directed to supporting measures	Land use policies, zoning and building control should encourage creation of Transit Oriented Developments	
	Physical planning crucial to enforce the policy		
Pricing for road freight	The territorial extent is usually very large and all the stakeholders (eg. railway companies, different municipalities) must be tied to the policy	Locations of big facilities and logistics centres are more easily controlled than those of smaller actors, huge impact to the potentials for multimodality and reducing the mileages	The changes in the economic situation influence the effectiveness and acceptance of the policy and it should be flexible enough to adjust
E-mobility	The current challenges in the spread of electronic cars can be a possibility to couple it with other policies such as LEZ and car share	Land use changes influence the potential and limitations for e-mobility infrastructure	The industry is developing rapidly, so there is risk of expensive investments becoming outdated fast
	Important not to concentrate to the local emission reduction only, the other externalities must be kept in mind	Facilities for E-mobility should be privileged in detailed planning and design	
Management of road network: speed limit	Territorial extent of the speed limit policy and the relative competitiveness of the different modes should be analysed	Potential for land use change must be taken into account when calculating the profitability of speed limit reduction	Monitoring should be real-time to achieve best results
	Different tools should be combined, such as education, physical planning and control	Changes in accessibility and capacity affect land values and induce changes in land use	system-level changes must be accounted for



	Consistent integration within transport planning strategy and process	Land use-transport integration	Monitoring of the effects and policy review
High Occupancy Vehicles (HOV) lanes	The continuity and connectiveness of the lanes, the total and used capacity during different times of the day should be analysed	Should not be too easy excuse to widen the road corridor	Control and preventing misuse is difficult, clear and robust rules may be easier to follow than theoretically optimal classifications
Infrastructure funding	Estimating the effects, introducing the policy early enough and securing the political commitment are crucial	Cornerstone for the integrated land use-transportation planning, needs good organizing	The mechanism must be delicate and sensitive enough for the market changes
		Land use impacts should be approached on the corridor level	
		added land values should be integrated into funding schemes where applicable	
Incentive-based measures	The incentives should closely enough resemble the real externalities of a modal change	Incentives for a land use change reducing the travel need can be an alternative	The policy should take into account the actual sensitivity for a modal change to be effective
	The transportation economics must be taken into account in an optimal way, not overemphasize either savings by reduction or modal change by excess service	The effect of land use changes on incentive levels should be looked at in the long term	
Market-based measures	The large scale measures fuzz the causalities	Local flexibility may be beneficial for integrating the land use effects	Local flexibility may be beneficial for monitoring
	Many stakeholders are introduced and the exceptions may counteract the policy goal		
Habitat/landscape	Timing of the measure is important, avoiding the problematic projects and routes is more effective than countermeasures or compensations	Valuating the natural landscape as "ecosystem services" may support the policy	Multidisciplinary and continuous monitoring is crucial

